

**THE TEXT IS FLY
WITHIN THE BOOK
ONLY**

TEXT CUT BOOK



ENCYCLOPÆDIA BRITANNICA

NINTH EDITION

THE
ENCYCLOPÆDIA BRITANNICA

A
DICTIONARY

OF
ARTS, SCIENCES, AND GENERAL LITERATURE

NINTH EDITION

VOLUME XIV

NEW YORK: CHARLES SCRIBNER'S SONS
MDCCLXXXII

[*All Rights reserved.*]

The following Articles are copyrighted in the United States of America, and permission to print them in this volume has been granted exclusively to A. & C. BLACK, Edinburgh :—

KENTUCKY. Copyright, 1882, by JOHN R. PROCTER

LA FAYETTE. Copyright, 1882, by JOHN BIGELOW.

ABRAHAM LINCOLN. Copyright, 1882, by JOHN G. NICOLAY.

HENRY WADSWORTH LONGFELLOW. Copyright, 1882, by THOMAS DAVIDSON

ENCYCLOPÆDIA BRITANNICA.

KAOLIN

KAOLIN, a name applied to the pure white clay which forms an important ingredient in the manufacture of porcelain, and which is, therefore, known also as *china clay*. Large quantities are raised in Cornwall, whence it is frequently termed *Cornish clay*. The name *kaolin* is said to be derived from a hill near King-tih-chin, in China, named Kao-ling or "lofty ridge." The clay from this locality was first sent to Europe, under the name of kaolin, by the Père d'Entrecolles, a Jesuit missionary who resided at King-tih-chin in the early part of the last century. A similar white clay was soon afterwards found at Aue, near Schneeberg in Saxony, and was used by Böttcher in the manufacture of porcelain, thus laying the foundation of the factory at Meissen for producing the famous Dresden china. In England kaolin was first detected in Cornwall by William Cookworthy of Plymouth about 1755, a discovery which resulted in the manufacture of hard paste china at Plymouth and Bristol. In Cookworthy's writings the clay is called "caulin." Kaolin is found in Nebraska, and in several of the eastern States of the American Union.

Certain clays, when examined under the microscope, are seen to contain crystalline pearly scales of a mineral which Messrs Johnson and Blake have described as *kaolinite* (*American Journal of Science*, ser. ii. vol. xliii., 1867, p. 351). They regard this crystalline substance as a distinct mineral species, a hydrated silicate of aluminium, forming the basis of pure kaolin. Its composition appears to agree with Forchhammer's formula for true kaolin, viz., $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 + 2\text{H}_2\text{O}$. Mr J. H. Collins regards the crystalline scales which are associated with the Cornish kaolin, not as kaolinite, but as a white lithia-mica or lepidolite.

Kaolin is almost invariably a product of the alteration of felspar, and is therefore always found in association with felspathic rocks, usually granite. The china-clay rocks of Cornwall and Devon are simply granites in which the orthoclase-felspar has become decomposed or kaolinized. Such rocks are termed by Mr Collins *cardianite*, after the Cardlake mine, near St Anstell, where typical varieties occur. The production of kaolin from felspar is rather difficult to explain, inasmuch as the alteration is sometimes observed under conditions which appear to preclude the operation of atmospheric agencies. It is not simply the effect of water charged with carbonic acid, whereby the

felspar might be decomposed and its alkaline silicate removed as a soluble carbonate, while the silicate of aluminium remained behind, in a hydrated condition, as kaolin or china clay. Many chemists have been inclined to attribute the decomposition to the effect of water or watery vapour at a high temperature, charged with hydrofluoric and boric acids. It is certain that minerals containing fluorine and boron—such as fluor spar, lepidolite, and schorl—are common associates of kaolin.

The localities from which kaolin is obtained in Britain are all situated in Cornwall and Devon; in the former county the workings are principally in the neighbourhood of St Anstell, St Stephen's, and Breaugue, while in Devon they are situated at Lee Moor and Meary, on the south of Dartmoor. In working the clay the "overburden" or superficial deposit is first removed, in order to reach the clay-bearing rock. The rock is broken up by the pick, and water is introduced to wash out the clay. A quantity of sand is left behind, and requires to be constantly removed. The water containing the clay in suspension is either pumped to the surface up a shaft, or, if the working be upon a hill-side, is run out at an adit level. This clay-water is led into channels called "drags," where the sand and coarser flakes of mica are deposited. From the drags the liquid passes into another set of channels called "micas," in which further deposition of suspended matter occurs. Thus purified, the clay-water is conducted into a series of pits and tanks, where the finely-divided particles of clay slowly subside. In the tanks it is allowed to settle until it acquires a thick creamy consistency, when it is transferred to the drying house or "dry." Formerly the clay was dried naturally by exposure to sun and air, but it is now always artificially dried by means of heated flues, and the preparation of the clay is thus greatly facilitated.

China clay is not only used in the manufacture of pottery, but is also extensively employed by the paper-maker and by the calico-bleacher. It is likewise used to a small extent in the manufacture of alum, artificial ultramarine, and some other chemical products. In 1880 the quantity of china clay raised in Cornwall amounted to 278,672 tons, and in Devon to 25,370 tons.

See J. H. Collins, in *Journal of the Society of Arts*, May 5, 1876; and *Practical China Clay*, by D. Cook, 1880.

KAPURTHÁLA, or **KOPURTHÉLLA**, a native state in the Punjab, India, lying between $31^{\circ} 9'$ and $31^{\circ} 30' 30''$ N. lat., and between $73^{\circ} 9' 15''$ and $73^{\circ} 38' 30''$ E. long. Area, 800 square miles; estimated population, 250,000. The Kapurthála family at one time held possessions on both sides of the Sutlej, and also in the Bari Doab. The cis-Sutlej estates and scattered possessions in the Bari Doab were escheated owing to the hostility of the chief in the first Sikh war, but the latter possessions were afterwards restored to the family in recognition of the loyalty of Rājā Randhīr Singh during the mutiny of 1857, when he led a contingent to Oudh which did good service. He also received a grant of estates in Oudh, 850 square miles in extent, and with an estimated population of 220,000. In these tracts, however, he exercises no sovereign powers, occupying the status only of a large landholder. His total revenue is estimated at £170,000, subject to a charge of £13,000 payable to the British Government in commutation of military service.

KARÁCHÍ See **KURACHÉE**.

KARA-HISSAR is the name of several towns in Asiatic Turkey. (1) **AFIUM KARA HISSAR** has been already noticed, vol. i. p. 244. (2) **ESKI KARA HISSAR**, lies 10 miles to the north of Afium. It is identified with the ancient Synnada, which in the time of Flavius was the chief town of a considerable district. The quarries of Docimía, which furnished the famous Synnadic or Docimian marble, are about $2\frac{1}{2}$ miles distant, and in the town numerous traces have been found of ancient sculpture in various stages of execution (see Hamilton's *Asia Minor*, i. 461, pl. 177; and Texler, *Asie Mineure*). (3) The eastern **KARA-HISSAR**, usually distinguished by the prefix Shabin (i.e., "alum"), is situated in the vilayet of Siwas, about 70 miles east of Niksar, on a northern tributary of the Lycus. It is the seat of a mutasarrif or vice-governor, and on a hill to the east there is an old castle which must at one time have been of military importance. The population is estimated at 11,000, mainly Mohammedans, though Armenians also form an important element. The district is rich in mineral products—silver, lead, copper, and iron; but only the alum mines, yielding from 120 to 250 tons per annum, are worked. The remains of the citadel, the ruins of a Byzantine church, traces of Roman brickwork, ancient coins, and a few Greek and Latin inscriptions, all go to show that Kara-Hissar has passed through many vicissitudes. The old town was evidently built not at the foot but up the steep slope of the hill, tier above tier. In 1473 Kara-Hissar made voluntary submission to Sultan Mohammed II. A full description, with a plan of the town and neighbourhood, is given by Barth in Petermann's *Mittheilungen, Ergänzungsheft*, 1860. See also Taylor's "Journal," &c., in *Journal Roy. Geogr. Soc.*, 1868.

KARAITES, or **CARAITES**, a Jewish sect of the Middle Ages, claiming to be distinguished by adherence to Scripture as contrasted with oral tradition, whence the name (from קרי, as if "readers," *scripturarii*; sometimes also קרייזן). They have frequently been identified with the Sadducees or with the Samaritans, with neither of whom have they any historical connexion or much spiritual affinity. The schism arose at Bagdad about the middle of the 8th century, when the hereditary claims of Anan, a learned Talmudist, to the office of Reah Galutha were set aside by the Gaonim or heads of rabbinical schools at Sura and Pumbeditha because he was believed to undervalue the authority of the Talmud. An appeal by Anan to the caliph proved unsuccessful, and he appears even to have been imprisoned for some time; but ultimately he was permitted to migrate along with his followers to Palestine, where they erected in Jerusalem a synagogue which con-

tinued to be maintained until the time of the crusades. From this centre the sect diffused itself thinly over Syria, spread into Egypt, and ultimately reached south-eastern Europe. Anan, who is said to have died in 765 A.D., was the author of a commentary on the Pentateuch and other works in Talmudic Hebrew and Arabic, all of which unfortunately are lost, for our knowledge of the distinctive principles maintained by him we are thus left entirely dependent on the hostile indications of opponents. In general we know that he showed great bitterness against the Talmud and its upholders (the "Rabbanites") for their falsification of the written law by arbitrary additions and subtractions, but there is nothing to indicate that he himself had the insight or the fervour by which he could have become the pioneer of any really great reformation in religion or morals. The questions in dispute appear to have turned entirely on points of very minute detail. Several of them related to the regulation of the calendar, the new moon, for example, being fixed by the Karaites by direct observation, not by astronomical calculation, and the intercalary year also being determined empirically; others related to paschal and pentecostal ritual, such as the precise hour for killing the lamb or for burning its remains. The differences which affected social life most deeply were those relating to Sabbath observance and the forbidden degrees of marriage, the Karaites not recognizing any distinction between relationships of consanguinity and those of affinity, while in their zeal to avoid all risk of infringement of the sacredness of the day of rest they prohibited the burning of any light at all in their houses from sunset to sunset. Little information as to the Karaites can be derived from their liturgies, which are comparatively modern; though differing from those used by the Rabbinical Jews, they are not characterized by any marked divergence in principle. The controversies as to the rules of faith which so deeply divided the Christian church in the 16th century gave to this obscure sect an illusory and passing importance, the Catholics frequently hurling the epithet Karai, in token of contempt, at the Protestants, who in their turn willingly accepted it as sufficiently descriptive of their attitude towards Scripture. The Karaites never have been numerous; the present community in Jerusalem numbers only about four families. They occur in Constantinople and elsewhere in Turkey, but are chiefly met with in southern Russia, and especially in the Crimea, where in 1874 they numbered some 6000, chiefly in Eupatoria, Theodosia, and Sebastopol. In the Crimea their historical capital and chief synagogue was formerly the "Jews' Castle" (Tabufut-Kalo), near Dalichisara. The place is now deserted, its cemetery was the seat of Kirkowitsch's notorious forgeries (inscriptions of 1st century), by which he sought to establish a fabulous antiquity for his sect. According to Strack (*A. Kirkowitsch u. seine Entdeckungen*, 1876) the oldest tombstones do not go back beyond the 14th century. The modern Karaites are generally well spoken of for their honesty, perseverance, and simple habits of life; but their enclavement to tradition is quite as complete as that of any Talmudist could possibly be.

Among the older authorities may be mentioned Morinus, *Exercit. Bibl.*, lib. ii. c. 7, 1669; and Triglandius, *Distributio Sectæ Karaorum*, 1708. See Grätz, *Gesch. der Juden*, especially in vol. v., 1860; and Furst, *Gesch. des Karaitenthums*, 1866.

KARAKORUM, or **KARAKORAM**, a name applied to a city, a mountain range, and a mountain pass in Central Asia. For the range and pass see **KYREN-LUN**. The ancient city or rather camping-ground of Karakorum (the Caracaron of Marco Polo), was situated near the upper course of the Orkhon, a tributary of the Selenge. Founded, according to Chinese authority, by Batu, khan of the

figure, in the 8th century, it was at the time of Jenghis the chief east of Togrul Wang, Marco Polo's Prester John, and under Jenghis's successor Okkoda; it became what it continued to be till 1256, the capital of the Mongolian power. It was visited by Carpin (1246) and Rubruquis (1253). Some ruins of earthworks are still to be traced.

See Rémusat, *Reche, sur la ville de Kasiakorum*; Yule, *Marco Polo*; *Geographical Magazine*, 1874.

KARAMZIN, NIKOLAI MIKHAILOVICH (1765-1826). Russian historian, critic, novelist, and poet, was born at the village of Mikhailovka, in the government of Orenburg, and not at Simbirsk as many of his English and German biographers incorrectly state, on the 1st of December old style 1765. His father, an officer in the Russian army, of Tartar extraction, was anxious that his son should follow his own profession. The idea was not, however, persevered in, and the future author was sent to Moscow to study under Professor Schaden, whence he afterwards removed to St Petersburg, where he made the acquaintance of Dvornikoff, a Russian poet of some merit, and occupied himself with translating essays by foreign writers into his native language. After residing some time at St Petersburg, he went to Simbirsk, where he lived in retirement till induced by a friend to revisit Moscow. There, finding himself in the midst of the society of learned men, he again betook himself to literary work. In 1789 he resolved to travel, and visited Germany, France, Switzerland, and England. On his return he published his *Letters of a Russian Traveller*, which met with great success. They are elegantly written, and show the feeling of a poet for the scenery of the countries through which he passed, but so many readers of the present day they will appear insipidly sentimental. These letters were first printed in the *Moscow Journal*, but were afterwards collected and issued in 3 vols. 1797-1801. In the same periodical Karamzin also published translations of some of the tales of Marmontel, whose sickly elegance was then in fashion, and some of his own original stories, among which may be mentioned *Poor Lisa* and *Natalia the Boyar's Daughter*. To judge by the cheap editions which are continually appearing, these tales still find readers in Russia. The best of them is *Marya the Posadnitsa of Novgorod*, but all are more or less disfigured by the sentimentalism already referred to. In 1794 and 1795 Karamzin abandoned his literary journal, and published a miscellany in two volumes, entitled *Aglais*, in which appeared, among other things, "The Island of Bornholm" and "Tia Monrometz," a story based upon the adventures of the well-known hero of many a Russian legend. In 1797-99 he issued another miscellany or poetical almanac, *The Aonides*, in conjunction with Derzhavin and Dmitrieff. In 1798 he compiled the *Pantheon*, a collection of pieces from the works of the most celebrated authors ancient and modern, translated into Russian. Many of his lighter productions were subsequently printed by him in a volume entitled *My Tryfles*. In 1802 and 1803 Karamzin edited the journal *The European Messenger*. It was not till after the publication of this work that he realized where his strength lay, and commenced his *History of the Russian Empire*. In order to accomplish the task, he secluded himself for some years; and, on the cease of his retirement becoming known to the emperor Alexander, Karamzin was invited to Tver, where he read to the emperor the first eight volumes of his history. In 1816 he removed to St Petersburg, where he spent the happiest days of his life, enjoying the favour of Alexander, and submitting to him the sheets of his great work, which the emperor read over with him in the gardens of the palace of Tsarskoe Selo. He did not, however, live to carry his work further than the eleventh volume, terminating it at the accession of Michael Romanoff in 1813. In 1825 the

health of Karamzin began to decline, and the emperor Nicholas, who had succeeded to the throne in that year, and continued the favours which his brother had bestowed on the historian, ordered a frigate to be got ready, that he might visit a warmer climate to recruit his failing powers. It was, however, too late, on the 22d of May (old style) 1826, Karamzin died in the Taurida palace. A monument was erected to his memory at Simbirsk in the year 1846.

As an historian Karamzin has deserved a very high reputation. Till the appearance of his work little had been done in this direction in Russia. The preceding attempt of Tatistcheff was merely a rough sketch, inelegant in style, and without the true spirit of criticism. Karamzin was most industrious in accumulating materials, and the notes to his volumes are mines of accurate information. The style of his history is elegant and flowing, modelled rather upon the easy sentences of the French prose writers than the long periodical paragraphs of the old Slavonic school. Perhaps Karamzin may justly be censured for the false gloss and romantic air thrown over the early Russian annals, concealing the coarseness and crudity of the native manners, in this respect he reminds us of Sir Walter Scott, whose writings were at this time creating a great sensation throughout Europe, and probably had their influence upon our author. Karamzin appears openly as the panegyrist of the autocracy; indeed, his work has been styled the "Epic of Despotism." He does not hesitate to avow his admiration of Ivan the Terrible, and considers him and his grandfather Ivan III. as the builders up of Russian greatness, a glory which in his earlier writings, perhaps at that time more under the influence of Western ideas, he had assigned to Peter the Great. In the battle-pieces (e.g., the description of the bold of Esauikov, the taking of Kazan, &c.) we find considerable powers of description, and the characters of many of the chief personages in the Russian annals are drawn in firm and bold lines. The study of ethnology and historical criticism has advanced so much since the days of Karamzin that some of his work has necessarily become obsolete, but it will always be read with pleasure and advantage. No translation into English of this *opus magnum* has appeared, although even modern Greek boasts its version. Of the French translation by MM Saint Thomas and Jauffret Karamzin himself had a mean opinion; he declared that the average number of mistakes in each of the many volumes was two hundred. As a critic Karamzin was of great service to his country, in fact he may be regarded as the founder of the review and essay (in the Western style) among the Russians. He read extensively, and modelled himself upon Addison and others of our best writers. As a novelist and writer of tales he imitated the sentimental school then in vogue throughout Europe. As a poet he occupies a subordinate place, but his productions are above mediocrity. Many of his lyrics are graceful and melodious, and the sentiments expressed are those of a benevolent and healthily-minded man. The little poem entitled *The Grass* deserves special mention.

KARASU-BAZAR, a town of Russia, in the government of Taurida, near the rivers Tunas and Karasu, in 45° 3' N. lat. and 34° 26' E. long., 27 miles from Simpheropol on the road to Theodosia. The site is low, but it is surrounded by hills, one of which, the Ak-Kaya or White Rock, not only affords protection from the north wind, but so reflects the sunshine upon the town that it enjoys a much milder climate than the surrounding region. The dirty streets full of petty traders, the gloomy bazaar with its multitude of small shops, the market squares, the blind alleys, the little gates in the dead court-yard walls, all give the place the stamp of a Tartar or Turkish town, and remind the visitor that here was after 1763 the seat of the Crimean khans. In 1861 there were twenty-four mosques, but several have fallen into decay; in one of them is the tomb of Yakubkhan-Rudavitch, the founder of the well-known Crimean family. Of the numerous caravanserais, the Tash-Khan is the most notable — a strong half-fortified building erected in 1656. Placed on the high road between Simpheropol and Kertch, and in the midst of a country rich in corn-land, vineyards, and gardens, Karasu-Bazar was to be a chief seat of commercial activity in the Crimea; but it is gradually declining in importance. The population consists of Armenians, Greeks, Jews, Tartars, and (in smaller numbers) Russians. The bulk of the trade is in the hands of the Armenians, and they are also the owners of the great proportion of

the buildings in the town. About 2000 of the Jews are what are known as Krimtshaks, or sometimes as Constantinopolitan Jews. From the ordinary "rabbinical Jews" of Russia they differ by wearing the Tartar costume and by the use of the Tartar tongue, instead of the German jargon. They are engaged in making leather, Tartar knives, Tartar embroidery, and similar articles. The population of Karasu-Bazar is given by the *St Petersburg Calendar* for 1874 as 14,397. Round about the town lie cemeteries of unusual extent.

By Thunman and others Karasu-Bazar has been identified with the Greek town of Maaron-Kastron, but Professor Bruhn thinks that, as there has never apparently been any fortress at Karasu-Bazar, the site of the "Black Castle" is more probably at Mangup-Kale. The caves of Akkaya, however, give evidence of early occupation of the spot. When in 1786 Khan Feta Ghire was driven by the Russians from Bakhichsari he settled at Karasu-Bazar, but next year the town was captured, plundered, and burned by General Douglas. In 1784 it was the temporary seat of the Russian administration of the Crimea.

KARATCHEFF, a town of Russia, in the government of Orel, near the river Snazhet, 59 miles north-west from Orel on the railway to Smolensk. The population is given in the *St Petersburg Calendar* for 1874 as 10,023. A yearly fair is held in the adjoining village of Bereshka, and a good trade is carried on in agricultural produce, as well as in the oil, wax candles, ropes, &c., furnished by the local industry.

Karatcheff is mentioned as early as 1146. In the 17th century it was one of the frontier or "watch" towns of Russia towards the Crimea, and sent out its scouts as far as Kursk. About half the inhabitants perished of the plague in 1664. Only since 1778 has the town been at the head of a district in Orel; it formerly belonged to the governments of Kieff (1768) and Dniegorod (1782).

KARATEGIN, a country of Central Asia, now subject to Bokhara, consisting of a highland district between the Hissar and the Darwas chains. It is bounded on the N. by the Russian province of Ferghana (Khokand), on the E. by Kashgar, on the S. by independent Darwas, and on the W. by Hissar and other Bokharan provinces. The plateau is traversed by the Surkhah or Kyzyl Su, a right-hand tributary of the Oxus, which rises in the Alai mountains, and for the first 132 miles of its course "runs through gorges of extreme wildness." Below the hamlet of Khantia-hota (according to Abramof), the valley widens considerably, and at Sari-pul, the only point where it is crossed by a bridge, the river has a depth of 7 feet. With the neighbouring lands Karategin has no communication except during summer, that is, from May to September. The winter climate is extremely severe even in the more populous districts; the snow begins to fall in October, and it is May before it disappears. During the warmer months, however, the mountain sides are richly clothed with the foliage of maple, mountain ash, apple, pear, and walnut trees; the orchards furnish, not only apples and pears, but peaches, cherries, mulberries, and apricots; and the farmers grow so much corn that the surplus is a regular article of export to the neighbouring states. Every householder has a portion of the soil which he can call his own; but if he leave it fallow for more than three years in succession, he runs the risk of having it confiscated by the Government. Some proprietors possess as much as from 300 to 500 acres, and keep from ten to twelve yokes of work oxen and from six to twelve labourers. The necessity of storing fodder to last for five months tends to keep low the number of domestic cattle. Both cattle and horses are of a small and hardy breed. The wild animals—bears, wolves, foxes, jackals, lynxes, martens, otters, &c.—are of no small economic importance; but the hunters and trappers are obliged to sell their pelts to the Government at half the market price. Rough woollen cloth and mohair are woven by the natives during their long winter; and they make excellent fire-

arms and other weapons. Trade is still carried on by barter, there being neither coinage nor fixed market-places in the country. Foreign wares—iron, cotton, silk, combs, mirrors, soap, &c.—are introduced by merchants from Kashgar and Hissar, who receive in exchange mainly cattle, hides, and skins. Gold, however, is found in various places, more particularly at Sarym Saly (according to Abramof), and there are salt-pits in the mountains near Langar-sha. The chief town, Harm or Gharm, is a place of some eight hundred houses (Arandamuk says three hundred and forty) situated on a hill on the right bank of the Surkhah. With the exception of about five thousand tents of nomadizing Kirghiz, the inhabitants of Karategin are understood to be Galtchaa—by some identified with, by others distinguished from the Tadjiks. They speak a Persian dialect and profess the Mohammedan faith. Schuyler, who met with some of them at Khokand, describes the Karateginese as swarthy, thickest, good-natured fellows, who, gathered in a circle, would after prayers and supper tell tale after tale and legend after legend till they dropped off to sleep. It is calculated that the settled population of Karategin may amount to about 382,000 souls, the number of households being 36,672, distributed among four hundred settlements.

Karategin has hardly been touched by European exploration (the first expedition was that of Oshleinin in 1878); and of its history almost nothing is known. The native princes or shahs, who claimed to be descended from Alexander the Great, were till 1868 practically independent, and kept up a considerable degree of state. Their allegiance was indeed claimed in an ineffective way by Khokand, but eventually Bokhara took advantage of mutual feuds to secure their real submission. Some geographers (Kiepert, for example) have been disposed to recognize in Karategin the Paratseten of Alexander's historians, and Colonel Yule has conjecturally identified it with the Holoma (Germania) of Ervon Wang. See Abramof in *Journ. Roy. Geogr. Soc.*, 1871; Arandamuk's paper in the *Russische Revue*, epitomized in *Des Asiatique*, 1878, and letters from Oshleinin in *Globe*, 1878. See also Colonel Yule's essay prefixed to Wood's *Journal to the Source of the River Gura*, 1872.

KARAULI, or KEMOWLY, a native state in Rājputana, India, lying between 20° 3' and 20° 48' N. lat., and between 76° 38' and 77° 26' E. long. It is entirely surrounded by neighbouring states, and has an area of about 1260 miles, and an estimated population of 140,000. Almost the entire territory is composed of hills and broken ground, but there are no lofty peaks, the highest having an elevation of less than 1400 feet above sea-level. The Chambal river flows along the south-east boundary of the state. Iron ore and building stone comprise the mineral resources of Karauli. The prevailing agricultural products are *bajra* and *jowar*, which form the staple food of the people. The only manufactures consist of a little weaving, dyeing, wood-turning, and stone-cutting. The principal imports are piece goods, salt, sugar, cotton, buffaloes, and bullocks; the exports rice and goats. The Brahmins form the most numerous class of the population. The Minas, who come next, make up the bulk of the cultivating class. The Rājputs, although numerically few, constitute the most important section. These belong almost entirely to the Jadu clan; they make good soldiers, but are indifferent agriculturists. The feudal aristocracy of the state consists entirely of Jadu *thakurs* connected with the ruling house. They pay a tribute in lieu of constant military service, but in case of emergency or on occasions of state display they are bound to attend on the chief with their retainers. The maharajis is the head of the clan, which claims descent from Krishna.

KARAULI, or KEMOWLY, the capital of the above state, is situated in 26° 30' N. lat. and 77° 4' E. long. The town, which is fortified, is surrounded by a wall of sandstone, and is also protected on the north and east by deep

winding ravines. The streets are narrow and irregular, and almost impassable for wheeled conveyances; there are, however, many costly houses and handsome temples, the sole building material being sandstone. The population is estimated at 28,000.

KARCOZAG, or KARDSZAG, a corporate town of Hungary, and formerly the capital of the district of Great Cumania (now included in the county of Jász-Nagy-Kun-Szolnok), lies about 88 miles east-south-east of Budapest, with which city it is connected by railway, in 47° 19' N. lat., 20° 56' E. long. Karcozag is a large straggling town, and contains Roman Catholic, Greek Orthodox, and Protestant churches, royal and magisterial courts of law, and tax and post offices. The soil of the surrounding country is exceedingly humid and fertile, and enormous quantities of melons, fruit, grapes, wheat, maize, rape-seed, and mango are grown. In the more marshy places water-fowl and tortoises are caught in large numbers. Population in 1880, 15,962, almost exclusively Magyar.

KARIKAL, a French town and settlement in India, situated on the south-east coast, within the limits of Tanjore district, 10° 55' 10" N. lat., 79° 52' E. long., with an area of 52 square miles, and a population of 92,516. The site was purchased by the French from the Tanjore rājā in 1738. It was captured by the English in 1760, restored in 1760, again taken in 1768, and finally restored in 1816. It formed the base of Lilly's operations against Tanjore. The town is neatly built on one of the mouths of the Kaveri (Cauvery), and carries on a brisk trade with Ceylon, Europe, and the French colonies, exporting rice, and importing chiefly European articles and timber. A chief de l'administration, subordinate to the government at Pondicherry, is in charge of the settlement.

KARMAATHIANS. See ARABIA, vol. ii. p. 259, and MOHAMMEDANISM.

KARNAK. See ARCHITECTURE, vol. ii. p. 390, and EGYPT, vol. vii. p. 777.

KARNAL, a district in the lieutenant-governorship of the Punjab, India, lying between 29° 9' and 30° 11' N. lat., and between 76° 13' and 77° 15' 30" E. long., bounded on the N. by Umballa (Ambala) and the Patiala state, W. by Patiala and Jind states and by Rohtak district, E. by Delhi district, and E. by the Jumna river. The area is 2351 square miles. Karnal forms a portion of the low dividing ridge which separates the watersheds of the Indus and the Jumna. The district falls naturally into two divisions—the *doogar*, or upland plain, and the *kiddar*, or low-lying land, which skirts the valley of the great river. The banks of the larger streams are fringed with magnificent forest trees, and groves of mangoes mark the neighbourhood of every temple or homestead. Irrigation is afforded by the western Jumna canal. As a whole, Karnal is better supplied with trees than most of the plain country of the Punjab. The Jumna itself here presents the usual characteristics of the upper part of its course. Sandbanks shift from one side to the other of the main channel, and from time to time the whole stream suddenly changes its bed, transferring half a dozen villages together from Muzaffarnagar to Karnal, or *vice versa*. The district is famous for its sport.

The population in 1868 amounted to 610,297 (380,768 males and 229,529 females)—Hindus, 355,305; Mohammedans, 151,723; and "others," 98,604. Jāts numbered 74,840, representing the chief agricultural element; Brahmins, 52,896, most of them engaged in tillage; Bājputrs, 47,600, chiefly Mohammedans; Chamars, the landless labouring class, 37,068; pastoral Gōyars, 20,867, about one-third of them Mohammedans. Five towns have a population exceeding 5000, viz., Karnal, 27,022; Pāmpet, 26,276; Kāthāl, 14,940; Sewān, 9806; and Kunjpurā, 5183. The area under cultivation is 645,120 acres, the uncultivated area 850,800 acres, of which 578,527 are cultivable. The principal spring crop is wheat; the autumn harvest consists of rice, cotton, and sugar-cane, besides millets and pulses

for home consumption. The growth of the more lucrative crops is on the increase. Grain and raw materials are exported to Umballa, Hissar, and Delhi,—the return trade consisting of European piece goods, salt, and refined sugar. A considerable quantity of cotton is woven for local use. Sal-ammoniac is obtained from the clay of Kāthāl and Gūla *tahsil* to the value of 23460 per annum. Karnal town has a few blanket factories, and ornamental glass-ware is made at Pāmpet. The Grand Trunk Road connects Karnal with Delhi and Umballa. The district is administered by a deputy commissioner. In 1872-73 the revenue was 278,847, of which 267,048 was derived from the land, and education was afforded by 96 schools, with 2541 pupils.

No district of India can boast of a more ancient history than Karnal, as almost every town or stream is connected with the legends of the *Mahābhārata*. The city of Karnal itself is said to owe its foundation to Rājā Karṇa, the mythical champion of the Kuravas in the great war which forms the theme of the national epic. Pāmpet, in the south of the district, is said to have been one of the pledges demanded from Duryodhana by Yudisthira as the price of peace in that famous conflict. In historical times the plains of Pāmpet have three times proved the theatre of battles which decided the fate of Upper India. It was here that Ibrahim Lodi and his vast host were defeated in 1526 by the veteran army of Baber; in 1556 Akbar asserted the claims of his family on the same battlefield against the Hindu general of the house of Sher Shāh, which had driven the heirs of Baber from the throne for a brief interval, and at Pāmpet too, on the 7th of January 1761, the Marhatta confederation was defeated by Ahmed Shāh Durrāni. During the troublous period which ensued, the Sikhs managed to introduce themselves, and in 1767 one of their chieftains, Desu Singh, appropriated the forts of Kāthāl, which had been built during the reign of Akbar. His descendants, the Bhūs of Kāthāl, were reckoned amongst the most important *rajdās* or princes. Different portions of the district have passed from time to time into the hands of the British. The towns are not generally in a flourishing condition, but the district possesses considerable commerce and great agricultural resources.

KARNAL, a municipal town, the headquarters of the above district, 29° 42' 17" N. lat., 77° 1' 45" E. long., with a population in 1868 of 27,022. The civil station stretches to the west of the town. The Government maintains a large stud farm. There is a brisk trade with Delhi and Umballa; country cloth is manufactured for local consumption, and blankets for export, the latter trade employing about one hundred looms.

KARNUL, a district in Madras, India, bounded on the N. by the Tungabhadra and Kistna rivers and by Kistna district, S. by Cuddapah and Bellary, E. by Nellore and Kistna, and W. by Bellary, lies between 14° 54' and 16° 14' N. lat., and between 77° 46' and 79° 15' E. long., with an area of 7151 square miles.

Two long mountain ranges, the Nallamalais and the Yellamalais, extend in parallel lines, north and south, through the centre of the district. The principal heights of the Nallamalai range are Buankonda (3149 feet), Gundlābrāhmeswaram (3055 feet), and Durugapukonda (3086 feet). The Yellamalai is a low range, generally flat-topped with scarped sides; the highest point is about 2000 feet. Several low ridges run parallel to the Nallamalais, broken here and there by gorges, through which mountain streams take their course. Several of these gaps were dammed across under native rule, and tanks formed for purposes of cultivation. One of these is the magnificent Cumbum Tank, closed in by a dam across the Gundlālakamma river. It covers an area of nearly 15 square miles. The principal rivers are the Tungabhadra and Kistna, which bound the district on the north. When in flood, the Tungabhadra averages 900 yards broad and 15 feet deep. In 1860 an ancient weir was built across the river at Sunkesala, 18 miles above Karnal town, and a canal dug for irrigation and navigation. The Kistna flows here chiefly through uninhabited jungles, sometimes in long smooth reaches, with intervening shingly rapids. The Bhavanāsī rises on the Nallamalais, and falls into the Kistna at Sun-gameswaram; a place of pilgrimage. Below their junction is a whirlpool which is regarded as holy by the

native pilgrims. There are three recognised forest divisions in the district—the Nallamalai, the Vellikonda, and the Yellamalai. The first two are conserved by the forest department. The chief timber-trees are teak and *yeru*. In the northern parts, where the jungle is poor, there are extensive level grassy lands, which afford pasture to numerous herds of cattle. The jungle products consist of gall-nuts, honey, wax, tamarinds, stick-lac, and bamboo rice. Tigers are numerous in the Nallamalais, and commit great havoc among the herds of cattle pastured in the jungles. The other animals include cheetahs, wolves, hyenas, foxes, bears, spotted deer, wild goats, several varieties of antelopes, bison, porcupines, and pigs.

The population in 1871 numbered 914,469, of whom 519,468 were Hindus, 60,579 Mohammedans, and about 3844 Christians, chiefly Roman Catholics, whose principal station is at Polur. The Catholics originally belonged to the Kapu caste, and their conversion to Christianity has not made any material change in their manners and customs. They eat and drink with Hindus, and in several cases intermarry with them. The Protestant converts are almost entirely low-caste natives in rural tracts. The wild tribes or Chonokus live on the Nallamalais in small communities called *gudem*. Each *gudem* includes several tribes, and has a portion of the hills allotted to it by common consent. The Chonokus are unwilling to cultivate, but are sometimes employed by the villagers in the plains to watch their fields during the harvest, and some of them are employed as rood watchmen. During the hill festival they collect fees from pilgrims. Some of them also enjoy free lands for guarding the jungles. The principal towns are Karnul (population in 1871, 45,679), Nardala (18679), Channarayana (7137), Sdhar (8635), Medikere (8636), Kodumuri (8664), and Palak (6076).

The chief crops are rice, wheat, and other cereals, gram, cotton, tobacco, indigo, sugar-cane, betel, chillies, &c. The staple of the district is cholea (castor-oil) (see page 10). The area under cultivation, in 1877 was 9,588,889 acres, area uncultivated but capable of cultivation 1,017,999 acres, and uncultivated waste 1,896,062 acres. There is not much waste land in the plains, but there is a good deal in the Nallamalais, which was cultivated in ancient times, but is now overgrown with jungle. The main canal of the Madras Irrigation Company intended for both irrigation and navigation carries 142 miles within Karnul; the extent actually irrigated in 1876-76 was 10,479 acres. Both Karnul and the neighbouring district of Bellary suffer from droughts at periodic intervals, and, the mass of the population being small landowners, with no reserve capital, the failure of a single monsoon involves general distress. In 1804, 1810, 1824, 1833, 1854, 1866, and 1878 were all years of drought and consequent scarcity. In the famine of 1876-77 nearly 800,000 was spent on relief works, yet the number of deaths recorded from 1st October 1876 to 30th June 1877 was 48,000, as compared with 18,974 in the corresponding period of the previous year. The chief manufacture in Karnul is weaving. Iron is worked at the foot of the Nallamalais. Of late years this industry has greatly diminished, native iron being superseded for agricultural implements by imported iron. Diamond mines have been worked from early times in the quartzite beds of the Yellamalai hills, which are now rented out by Government for about £20 a year. Quarrying stones is an important industry. Indigo and sugar are also manufactured. Weekly markets are held in most of the towns and important villages. There is little or no export of grain. Salt is imported from the eastern coast, but earth salt is largely manufactured. Cotton, indigo, tobacco, and hides, with cotton carpets and cotton cloth, are the chief exports. European piece goods, areca-nut, cocoa-nut, and various dry condiments required for native households are the chief imports. The total net revenue of the district in 1870-71 was £198,468, the total civil expenditure £46,998; the land revenue was £136,928. Education is backward, only 4 per cent. of the population in 1871 being returned as able to read and write. In 1876 there were altogether 288 schools, with 6781 pupils. The climate is on the whole healthy. The prevailing winds are west and north-east, and the mean temperature is about 85° Fahr. The total annual rainfall is about 58 inches. In the villages along the foot of the Nallamalais a severe type of fever prevails, accompanied by enlargement of the spleen.

KARNUL, the headquarters of the above district, in 18° 49' 58" N. lat. and 78° 5' 28" E. long., had a population in 1871 of 25,579. It is a hot unpleasant town, built on rocky soil at the junction of the Hindri and Tungabhadra rivers. The old Hindu fort was levelled in 1865, with the exception of one of the gates, which was preserved as a specimen of ancient architecture, and in some measure restored. In the famine of 1877-78 Karnul

and the surrounding country suffered terribly, owing to their isolated position. The nearest railway station is Gooty, 80 miles distant; and it was only by extraordinary efforts that food was conveyed to the town. The population is half Hindu and half Moslem, this unusual proportion marking the long rule of the Pathan nababs.

KARS, a fortified town of Armenia, formerly at the head of a sanjak in the Turkish vilayet of Erzeroum, but since 1878 the centre of a territory attached to the Russian governor-generalship of the Caucasus. It is situated in 40° 36' 52" N. lat. and 43° 5' 76" E. long., 30 miles south-west of Alexandropol (Osmiri) and 130 miles north-east of Erzeroum, on the eastern end of a spur of the Soghanli Daghi, the site of the town proper being out off from the rest of the range by the Kara Tebat, a sub-tributary of the Araxes. There are three considerable suburbs—Orta Kapi to the south, Basram Pasha to the east, and Timur Pasha on the western side of the river. To the south-eastward opens up a vast plain. Owing to the bareness of the dark basalt hills, and the sombre colour of the buildings, a touch of melancholy mingles with the picturesqueness of the view. At the north-west corner of the town, overlooking the river, rises the ancient citadel (the Itoh Kaleh of the Turks), which in earlier times was a strong military post, but is now of almost no moment in a regular siege, being commanded completely by several of the surrounding eminences. The value of the position depends on the line of forts, and even this is greatly diminished by the fact that they are disposed in a circuit of about 10 miles round the town. Of chief importance are the works on the Kara Daghi heights to the north-east and the line on the heights above the left bank of the river. The population of Kars was at one time estimated at 40,000; but, according to Baron von Seidlitz, it had in 1878 only 8672 inhabitants (including 7330 Turks, 1101 Armenians, 138 Greeks).

Though during the 8th and 10th centuries the seat of an independent Armenian principality, Kars has nothing to boast of beyond its military fence. The citadel, it would appear, was built by Ananush II. during the war with Feroz, in the close of the 16th century. It was strong enough to stand a siege by Nadir Shah in 1781, and in 1807 it successfully resisted the Russians. After a brave defence it surrendered on 28th June 1828 to the Russian general Paskevitch, 15,000 men becoming prisoners of war. During the Crimean war the Turkish garrison, guided and stimulated by General Williams (afterwards knighted as Sir W. Fovvok Williams of Kars) and other foreign officers, kept the Russians gallantly at bay during a protracted siege; but, after the garrison had been devastated by cholera, and food had utterly failed, nothing was left but to capitulate (November 1856). The fortress was again surrendered by the Russians in the war of 1877-78.

See Knolly, *The Defence of Kars, 1856*, translated from the German; Lake, *Kars and our Captivity in Russia, 1860*, and *Narrative of the Defence of Kars, 1861*; Dr Sandwith, *The Siege of Kars, 1860*; G. B. Norman, *Armenia and the Campaigns of 1877, 1878*, London, *Suttons Army and its Campaigns in Turkey*, 1878.

KARSHI, an important town of Central Asia, the centre of a begship dependent on Bokhara. It is situated about 85 miles south-south-west of Samarkand, in a vast plain at the junction of two of the main confluent of the Kashkadarya, a river which, though fed by numerous mountain streams, soon loses itself in the sands. It is a large and straggling place, with a circuit of 5 miles, and the population within the walls amounts to 26,000. There are three colleges, with accommodation for upwards of three hundred students. The Biki mosque is a fine building inlaid with blue and white tiles. All the ordinary houses are built of clay, but they are often two stories high. Along the river stretches a fine public promenade sheltered by clumps of poplars. Round the town lie gardens and fields watered from wells. Poppies and tobacco are both largely grown, the tobacco being deemed the best in Central Asia. There is also a considerable trade in grain; but the commercial prosperity of Karshi is mainly due to

the fact that it is a meeting point for the roads from Samarkand, Bokhara, Hissar, Balkh, and Maimana, and serves as the mercantile centre for the surrounding steppes, the market where horses are obtained for the caravans, and where the Turkomans and Uzbeks dispose of the products of their camps (carpets, seats, &c.). The knives and weapons manufactured in Karsai are known as far as Persia and Arabia, and its coppersmiths turn out excellent work.

KÄRWÄR, or KÄRWÄR, the chief town and headquarters station of North Känara district, Bombay, 50 miles south-east of Goa, 14° 50' N. lat., 74° 14' E. long. It was once an important place of commerce; the East India Company had a factory there in the year 1663. It is the only safe harbour all the year round between Bombay and Cochin. In the bay is a cluster of islets called the Oyster Rocks, on the largest of which is a lighthouse. There are two smaller islands in the bay, which afford good shelter to native craft and small vessels during the strong north-west winds that prevail from February to April. The average annual value of the imports at Kärwär port during the five years ending 1873-74 was £244,469, of the exports £310,884. Population in 1872, 13,203.

KÄSAN, See KAZAN.

KÄSANLIK, or KRZANLYK, a town of Roumelia, in the vilayet of Adrianople, is situated at the foot of the Balkans, about 5 miles south of the Shipka Pass, in a highly fertile plain watered by the Tundja and its numerous tributaries. Throughout the plain there are extensive fields of roses grown for the manufacture of attar of roses, which is exported largely to western Europe. Maize is also grown; and cattle and sheep are reared in considerable numbers. The town is surrounded by valuable woods of walnut trees. The Russo-Turkish war of 1877-78 has done serious injury to the prosperity of the whole region, and has told on the production of attar of roses, which formerly was estimated at about 200 gallons for the Käsanklik district. The population is variously estimated at from 10,000 to 12,000. Two-thirds of these are Bulgarians and Christians; the remainder are Turks.

KÄSCHAU (Hung. *Kassa*; Lat. *Cassovia*), an ancient royal free town, and capital of the cis-Tisian county of Abau, Hungary, is pleasantly situated on the right bank of the Hernád, in a valley surrounded by sloping vineyards, about 130 miles north-east from Budapest, with which city, as also with Cracow, Lemberg, and other centres, it is connected by railway, 46° 42' N. lat., 21° 17' E. long. Kaschau is the see of a Roman Catholic bishop suffragan of Eger (Erlau), the headquarters of the general administration for the county, and has royal and magisterial courts of law, as well as boards of assay, finance, and postal direction, and the supervision of the tobacco manufacture. Kaschau is one of the best built towns in Hungary, and consists of the inner town, intersected by the Caermel, which forms an island and is crossed by several bridges, and three suburbs (upper, middle, and lower) approached by a broad glacis. The most remarkable edifice, considered the grandest masterpiece of architectural skill in Hungary, is the cathedral of St Elizabeth, situated in the great square, and built in a faultless Gothic style. Commenced about 1270 by Stephen V., the structure was continued 1324-82 by Queen Elizabeth, wife of Charles I., and her son Louis I., and finished about 1468, in the reign of Matthias I. (Corvinus). The interior was transformed in the 18th century to the Renaissance style, and restored in 1859-66. The church of St Michael and the Franciscan or Garrison church date from the 13th century. The royal law academy, founded in 1659, and sanctioned by golden bull of King Leopold I. in 1680, has an extensive library; there are also a museum, a Roman Catholic upper gymnasium and seminary for priests, and other schools

and benevolent institutions. Kaschau is the centre of the trade for the surrounding counties in wine, gall-nuts, salt, and most descriptions of grain, and from its commercial importance forms a kind of provincial capital. About 3 miles north-west of the town are the baths of Bankó, with alkaline and ferruginous springs. The population of Kaschau in 1880 amounted to 26,422 (in 1870 it was 21,742), consisting of Magyars, Germans, Slovaks, and Ruthens. The majority are Roman Catholics.

Kaschau consisted originally of two villages, Upper and Lower Kassa, of which the latter was created a town and granted special privileges by Rula IV. (1235). Under Stephen V. (1270) the two separate portions were united, and raised to the rank of a royal free town. In 1280 it was surrounded with walls. The subsequent history presents a long record of revolts, sieges, and disastrous conflagrations. In 1430 the plague carried off a great number of the inhabitants. In 1468 the right of minting money according to the pattern and value of the Habsburg coins was granted to the municipality by King Matthias I. The bishopric was established in 1804. In the revolutionary war of 1848-49 the Hungarians were twice defeated before the walls of Kaschau by the Austrians under General Schlick, and the town was held successively by the Austrians, Hungarians, and Russians.

KÄSHGAR, or KÄSHGAR, an important city of eastern Turkestan, in 39° 24' 28" N. lat., 76° 8' 47" E. long., 4043 English feet above the sea-level. It consists of two towns, Kuhna Shahr or "old city," and Yangi Shahr or "new city," about 5 miles apart, and separated from one another by the Kuzil Su, a tributary of the Tarim river, which receives and deposits in the distant lake Lob Nor the drainage of the vast semi-desert plain included between the Kuen-lun, Thian Shan, and Pamir mountains. Situated at the junction of routes from the valley of the Oxus, from Kholand and Samarkand, Almaty, Aksu, and Khotan, this last leading from China and India, Kashgar has been noted from very early times as a political and commercial centre. Like all other cities of Central Asia, it has changed hands repeatedly, but its greatest modern prominence is probably due to its having formed a few years ago the seat of government of the Amir Yakub Beg, surnamed the Atalik Ghazi, who established and for a brief period ruled with remarkable success a Mohammedan state comprising the chief cities of the Tarim basin from Turfan round along the skirts of the mountains to Khotan. During his rule both Russian and British missions visited Kashgar, and it is chiefly to this circumstance that we are indebted for a full and tolerably recent knowledge thereof. Kuhna Shahr is a small fortified city on high ground overlooking the river Tuman. Its walls are lofty and supported by buttress bastions with loopholed turrets at intervals; the fortifications, however, are but of hard clay, and are much out of repair. The city contains about 2600 houses. Beyond the bridge, a little way off, are the ruins of ancient Kashgar, which once covered a large extent of country on both sides of the Tuman, and the walls of which even now are 12 feet wide at the top and twice that in height. This city—Askî Shahr as it is now called—was destroyed in 1514 by Mirza Abubekar on the approach of Sultan Said Khan's invading army. About 2 miles to the north beyond the river is the shrine of Hazrat Afak, the saint king of the country, who died and was buried here in 1693. It is a handsome mausoleum faced with blue and white glazed tiles, standing under the shade of some magnificent silver poplars. About it Yakub Beg erected a commodious college, mosque, and monastery, the whole being surrounded by rich orchards, fruit gardens, and vineyards. The Yangi Shahr of Kashgar is, as its name implies, quite modern, having been built in 1838. It is of oblong shape running north and south, and is entered by a single gateway. The walls are lofty and massive, and topped by turrets, while on each side is a projecting bastion to protect

two kinds—on clay (bricks or tiles), and on cakes of lime mortar. For surfaces of one colour, domes &c., both kinds are used, differing only in the shape of the tiles or mortar-cakes. Figured patterns are differently treated with the different materials. On clay tiles, the designs with their several colours are laid on by stencilling, and the tile then glazed. Designs in coloured mortar work have each separate piece of colour on a separate cake of hardened mortar, cut to the required shape; and these, dazed separately, are afterwards cemented together on the walls of the building, or first made up into complete panels, which are then set in their place on the walls. The designs are commonly foliage and flowers, or geometrical figures and interlacing arabesques, and inscriptions in Arabic and Persian characters, and are, many of them, very beautiful.

The colours chiefly used are blue, green, yellow, purple, brown, and white. A tile is first painted over with a very fine clay paste, to make a smooth surface on which to apply the colour; and similarly the little mortar cakes are first painted, on the side to be coloured, with a thin liquid glass. It is perhaps owing to defect in this part of the process, or to imperfect burning, that the tile figured work on some old buildings, particularly on the south side, has flaked off. The glazed work on mortar, and on tiles of one colour, is generally more permanent.

The best specimens of kashī work in India are at Tatta and Hyderabad in Sind, and at Multān and Lahore in the Punjab. There are also buildings thus ornamented, chiefly of the time of Akbar and Jahāngir (16th and 17th centuries), at Delhi, Agra, Gwalior, and some other places, but the best and most numerous are in the western provinces above named, particularly at Lahore and at Tatta. The buildings at Lahore having the finest figured kashī work are the mosque of Wazīr Khan, the gateways of certain old pleasure gardens, and the Gōin Sarai. There is a tomb at the same place (the tomb of Abd' ur Razzāk) built in the early part of the 16th century, which bears the name of the blue dome, its covering being of clay bricks coloured blue on the narrow exposed face. Another, built about fifty years later (the tomb of Shah Mīrā), is known as the green dome. It is covered with little mortar blocks, in shape half cylinders, coloured and glazed on the flat face, and with two deep nicks on the rounded back to give a hold on the plaster in which they are set. A celebrated tomb at Meshhed in northern Persia bears the same name, and likewise another at Kirman; the domes of these buildings, however, though called green, are in reality blue. At Tatta the kashī work is all on clay tiles; there is no inlaid work of coloured mortar. The finest of the buildings at Tatta, a mosque built by Shah Jahān, has lately had the defective parts of the figured tile-work restored.

The art is now carried on at Tatta, at Hala, a village 30 miles north of Hyderabad, and at a few other places.

KASHIN, a district town of Russia, in the government of Tver, 125 miles north-east of the government town, near the Kashiyska, a tributary of the Volga. A considerable trade is carried on in the despatch of grain to St Petersburg. The chief buildings are the cathedral and three monastic establishments. Kashin, first mentioned about 1236, was in the 14th century a separate principality which contended with Tver for pre-eminence in the region. There are still some remains of the defences erected in 1601. Population, according to St Petersburg Calendar for 1874, 7846.

KASHKĀR, also called CHITTAZI, from the residence of the prince, a high-lying Moharmanā estate among the spurs of Hindu Kush, has been already spoken of under HINDU KUSH (vol. xi, p. 538). Since that was published, a work (*Tribes of the Hindu Kush*, Calcutta, 1880) has

come from the pen of Major Biddulph, the only European known to have visited the state, and we here enter a very few corrections or new particulars from his work. The geographical position of Kashkār is likely to give it great interest in the future. A considerable part of Upper Kashkār belongs to Yassin, in the Gilgit basin (see GILGIT, vol. x, p. 597). Indeed the left bank of the Chitral river, down to within 20 miles of Chitral itself, belongs to Yassin. The chief place of this Upper Kashkār is Mastōi (vol. x, p. 596). The rulers of the two states are of the same blood, sprung from a Khorāsāni adventurer who immigrated hither about the first half of the 17th century, and are respectively descended from two brothers of his family, Shāh Knōr and Shāh Khāshwakht, who lived a century later. The two royal families are hence known as *Knōr* and *Khāshwakht* respectively, they generally act in concert, though neither is dependent on the other.

We know not the origin of the former name, but most probably it is connected with an ancient tribal name in KAFIRISTĀN (q.v.). The ruler of Chitral is known both as *Mīshār*, or "Prince," and by the pretensions title of *Bāshāh*. He has five viziers, of whom the chief, or *Dewān-begī*, has charge of the king's slave-agency, an important part of the reigning system. Under this the rulers of Chitral have come to regard the sale of their subjects as a legitimate and ordinary supplement to their revenue. But of late the market has become circumscribed. The population of the kingdom is estimated at 200,000, not including the tributary tribe of Bāshgāl Kāfirs, who occupy a nearly parallel valley on the west, confluent with that of Kashkār. The ethnology of Kashkār is very intricate.

The largest, and probably aboriginal, population are called *Kho*. Their language, *Khondr*, is closely allied to the dialects of the Kafir tribes. There are also tribes in a depressed position, immigrants from the other side of the watershed, and speaking the language of Mūnāzi, a hill canton of the Oxus valley, calling themselves *Yidghāh*. In the lower part of the valley is a race, also with a peculiar language, called *Gabar* (mentioned by Salān Beber), and some broken tribes of Shāhpōsh, &c. All these constitute the lower or *ryot* class, who alone pay regular revenue, cannot hold slaves, and are styled *fakīr muskātān* ("poor beggars"). Above them are several privileged classes, descended from the founders of the reigning family, or from older ruling families also of foreign blood. We may add that Chitral is identical with the *Shang-mi* of Hwen Tsang (644 A.D.), see *J. R. A. Soc.*, new ser., vol. vi, p. 114. A somewhat later Chinese record gives, as an alternative name of *Shang-mi*, *Khiu-sei*, which evidently contains the *Kho* just mentioned. In this *Kho* also we have probably an element of *Chowayce*, the Greek name of the Chitral river. A singular point in Chitral history is the fact that it was invaded by a Chinese army about the middle of last century, probably in 1759-60, and continued to send occasional tribute to China at least to 1769, i.e., twelve years after the battle of Plassey. This was brought to notice by the present writer in 1872 (*J. R. A. Soc.*, xlii, 477), when tracing the curious history of the name *Bolor*. And now Major Biddulph has found in the country itself the memory of the Chinese invasion, and thus entire corroboration of the identification of the Chinese *Potowt* or *Bolor* with Kashkār.

(K. Y.)

KASHMIR, or KASHMĪR, an elevated and enclosed valley in the Himalaya mountains, north of the Punjab. It is surrounded by lofty hills, with one opening on the west, by which flows out from the valley the river Jhelum. The enclosing hills on the north and east belong to the Bānā Lācha chain, and on their outer side is the broad mountainous region which holds the valley of the upper Indus, and which, beyond the Indus, culminates in

the great parallel range of Karakorum or Muegh. On the west and south, the hill boundary, which joins the other half of the enclosure at the south-east end of the valley, is the Panjal or Panchal range, which on its outer side sends down its branches southward, through the Jamti territory, to the plains of the Punjab. The length of the Kashmir valley, including the inner slopes of its surrounding hills, is about 120 miles from north-west to south-east. Its greatest width is about 75 miles. The low and comparatively level floor of the basin is 84 miles long and 20 to 24 miles broad. Its lowest part is 5300 feet above the sea, and its mean height 6000 feet.

This valley is but a small portion, in area, of the dominions of the maharaja of Kashmir, which, in addition to the Jamti territory on the south (the previous possession of the present maharaja's father, Ghulab Singh, before he acquired Kashmir), include Baltistan and Gilgit on the north, and Kishtwar and Ladakh on the east. On the west Kashmir is separated from the valley of Khagan by a continuous range of high hills, and from the British district of Hazara by the river Jhelum.

Jamti, to which Kashmir was annexed in 1846, occupies the southern slopes of the Panjal range, with a strip of plain country at their foot, and extends about 220 miles from east to west, with a greatest direct breadth, north to south, of about 75 miles. All the rest of the maharaja's dominions is hill country.

The hills forming the northern half-circuit of the Kashmir valley, and running beyond, include many lofty mountain masses and peaks, the most conspicuous of which, a little outside the confines of Kashmir, is Nanga Parbat, a grand hill ($35^{\circ} 15' N.$, $74^{\circ} 35' E.$), rising 26,629 feet above the sea, with an extensive area of glacier on its eastern face. The great ridge which is thrown off to the south-west by Nanga Parbat rises, at a distance of 12 miles, to another summit 20,740 feet in height, from which run south-west and south-east the ridges which are the northern watershed boundary of Kashmir. The former range, after running 70 miles south-west, between the valleys of the Kishanganga and the Kunhar or Nain-sakh, turns southward, closely pressing the river Jhelum, after it has received the Kishanganga, with a break a few miles further south which admits the Kunhar. This range presents several prominent summits, the two highest 18,487 and 15,544 feet above the sea. The range which runs south-east from the junction peak above-mentioned divides the valley of the Kishanganga from that of the Astor and other tributaries of the Indus. The highest points on this range, where it skirts Kashmir, are 16,795, 16,930, and 17,202 feet above the sea. For a distance of more than 60 miles from Nanga Parbat there are no glaciers on this range; thence eastward they increase; one, near the Zoji-la Pass, is only 10,850 feet above the sea. The mountains at the east end of the valley, running nearly north and south, drain inwards to the Jhelum, and on the other side to the Wardwan, a tributary of the Chenab. The highest part of this eastern boundary is 14,700 feet. There are no glaciers. The highest point on the Panjal range, which forms the south and south-west boundary, is 15,523 feet above the sea.

The river Jhelum or Behat (Sanskrit *Vishasta*)—the Hydaspes of Greek historians and geographers—flows north-westward through the middle of the valley. After a slow and winding course it expands, about 25 miles below Srinagar, over a slight depression in the plain, and forms the Wular lake and marsh, which is of ill-defined extent, but may be called about 10 miles long and 6 broad. The hills which this lake touches at its north end give it a more defined margin on that side. Leaving the lake on the south-west side, near the town of Sopur, the river pursues its sluggish course south-westward, about 18 miles,

to the gorges at Baramula. From this point the stream is more rapid through the narrow valley which conducts it westward 75 miles to Muzaffarabad, where it turns sharply east, joined by the Kishanganga. At Islamabad, about 40 miles above Srinagar, the river is 5400 feet above sea-level, and at Srinagar 5235 feet. It has thus a fall of about 4 feet per mile in this part of its course. For the next 24 miles to the Wular lake, and thence to Baramula, its fall is only about $\frac{1}{2}$ feet in the mile. On the 80 miles of the river in the flat valley between Islamabad and Baramula there is much boat traffic, but none below Baramula, till the river comes out into the plains.

On the north-east side of this low narrow plain of the Jhelum is a broad hilly tract between which and the higher boundary range runs the Kishanganga river. Near the east end of this interior hilly tract, and connected with the higher range, is one summit 17,839 feet. Around this peak and between the ridges which run from it are many small glaciers. These heights look down on one side into the beautiful valley of the Sind river, and on another into the valley of the Lidar, which join the Jhelum. Among the hills north of Srinagar rises one conspicuous mountain mass, 16,903 feet in height, from which on its north side descend tributaries of the Kishanganga, and on the south the Wangat river, which flows into the Sind. By these rivers and their numerous affluents the whole valley of Kashmir is watered abundantly.

Around the foot of many spurs of the hills which run down on the Kashmir plain are pieces of low table-land, which are called *karavas*. These terraces vary in height at different parts of the valley from 100 to 300 feet above the alluvial plain. Those which are near each other are mostly about the same level, and separated by deep ravines.

The level plain in the middle of the Kashmir valley is fine clay and sand, with water-worn pebbles. The *karavas* consist of horizontal beds of clay and sand, the lacustrine nature of which is shown by the shells which they contain. The hills surrounding the valley are chiefly gneiss and schists. In the Lidar valley are slate and sandstones of the Carboniferous period over green slate of a period corresponding to Silurian. The irregular ridges of the Panjal range are granite and gneiss, with schists and slates. Limestone is found in parts of the east and west ends of the valley, and in the hills upon the Manas Bal lake. In various places are marks of glacial action, down to a height of about 500 feet above the level part of the basin. From the plain rise isolated hills of trap; among these are the Hari Parbat and the Takhti-i-Suliman at Srinagar, the former of which stands the fort, and on the latter a conspicuous and well known ancient Hindu temple. No fossils have been found in Kashmir below the rocks of the Carboniferous period. The chief mineral resources of the maharaja's dominions are outside the Kashmir valley, especially in Ladakh.

In the hills of the north boundary are two passes, the Buzil (13,500 feet) and the Kamri (13,200). By the former is the direct route between Srinagar and Iskardu. It is usually practicable only between 15th July and 16th September. The road from Srinagar to Lé in Ladakh goes by the Zoji-la Pass (11,300 feet), near the north-east corner of the valley. Only a short piece of the road, where snow accumulates, prevents this pass being used all the year. At the south-east end of the valley are three passes, the Murgil (11,600 feet), the Holcar (13,315), and the Marbul (11,550), all leading over to the valleys of the Chenab and the Ravi. South of Islamabad, on the direct route to Jamti and Sialkot, is the Banihal Pass (9300 feet). Further west on the Panjal range is the Pir Panjal or Panchal Pass (11,400 feet), with a second pass, the Rattan Pir (8200 feet), across a second ridge about 15 miles south-

west of the other. Between the two passes is the beautifully situated fort of Baramgali and a well-known rest-house for travellers. This place is in the domain of Raja Mōti Singh of Pūnch, cousin and tributary of the maharaja of Kashmir. At Rājāori, south of these passes, the road divides: one leads to Dhimbar and Gūjrat, the other to Jamū and Sīlākot by Aknūt. Next, south-west of Baramūla, is the Haji Pir Pass (8500 feet), by which crosses the road to Pūnch. From Pūnch one road leads down to the plains at the town of Jhelum, another eastward through the hills to the Rattan Pir Pass and Rājāori. Lastly there is the river pass of the Jhelum, which is the easy route from the valley westward, having two ways down to the plains, one by Muzaffarābād and the Hazāra valley to Hassan Abdāl, the other by the British hill station of Marri (Murree) to Rāwal Pindī.

The valley of Kashmir, sheltered from the south-west monsoon by the Panjāl range, has not the periodical rains of India. Its rainfall is irregular, greatest in the spring months. Occasional heavy storms in the monsoon pass over the crests of the Panjāl and give heavy rain on the elevated plateaus on the Kashmir side. And again clouds pass over the valley and are arrested by the higher hills on the north-east side, on which they pour themselves. Snow falls on the surrounding hills at intervals from October to March, and sometimes in great quantity. In the valley the first snow generally falls about the end of December, and never to any great amount. The highest monthly average of temperature from May to October, at Srinagar, is 89° in the shade at noon. There has been no regular winter register; but the temperature is never very low.

For all crops except rice, which is irrigated, the rain is ordinarily sufficient. Barley, sown in November, ripens in June, wheat in July. Rice, sown in May and June, ripens in October. Millet, maize, and buckwheat, also turnips, peas, and mustard, are grown in considerable quantity.

There is no natural forest in the level parts of the valley. Of the cultivated trees the finest is the plane (*chinar*), which grows to a large size, and is of great beauty. The principal other trees of the valley are the poplar, willow, cypress, walnut, apple, pear, quince, apricot, cherry, mulberry. Vines are grown extensively, commonly trained up poplar trees. There are many kinds of grape. On the hills around are deodar, *Pinus eccelsa* and *Gerardiana*, *Picea Webbiana*, hazel, birch, viburnum, juniper, rose, &c. The herbaceous plants and flowers are very numerous. The umbelliferous plant called *prangos*, growing on the drier hills, is much valued as winter food for sheep. In spring the bright orange-coloured colechium shows itself in great quantity; and in autumn are seen many acres of saffron with its beautiful light purple flowers, grown in large fields divided into small square beds. Saffron was among the articles of annual tribute to the Mughal emperors. The Dal lake at Srinagar is full of reeds and water plants, *Potamogeton*, *Nymphaea*, *Nelumbium*, &c. On this lake there are floating gardens: a shallow layer of soil on sheets of the great leaves of water lilies is made to grow quantities of vegetables. The curious *singhara*, or horned water nut (*Trapa bispinosa*), which grows in great quantity in all the lakes, is much used for food, prepared in various ways. Since 1874 hops have been grown experimentally for the Murree Brewery Company, with fair success, in five different parts of the valley.

Much has been said and written about the beauty of the vale of Kashmir. Spring encircles a fresh, green, smiling valley with a noble belt of glistening snow-capped ridges; autumn fills the eye with the wonderful richness of the many-coloured foliage. At all times flows on the quiet glassy river, showing back the groves and avenues upon its

banks, the strange tall shadowy wooden houses, and the craggy hills. There is no place or season which has not something to show of real beauty. The rapturous praises of Mohammedan writers may be often extravagant; and it is with some of their materials, reproduced with more modern additions, that Moore has built up great part of his romances; still few will really think that here extravagance and fiction have left truth much too far behind.

Many Englishmen every year resort to Kashmir for shooting. The game is in consequence now only to be found within reduced areas of the more secluded little valleys and more difficult hill sides, and many sportsmen now cross over into Ladāk. The animals chiefly sought in both countries are the *Ovis ammon*, *Ovis poli*, antelope, ibex, *mus-khōr* or wild goat, musk deer, Tibetan stag, brown and black bear, and leopard. In various parts of Kashmir are to be found the fox, lynx, weasel, marmot, and hare. The black and grey monkey (*langur*) is common on the Panjāl range. Kashmir has the snow pheasant, snow owl, wild goose, duck, and teal; and the eagle is also found.

The Kashmir valley has a large number of old buildings of the Hindu period, interesting from their style, which is peculiar to Kashmir, and from the traces which many of them bear of Greek art. Their ruinous condition is ascribed partly to Sikandar the idol-breaker, partly to earthquakes, which are frequent in Kashmir. The most ancient of these buildings (about 220 A.D.) is the temple of Shankar Acharya (or, as it was formerly called, of Jansati Iswar), on the hill at Srinagar, known as Taklit-i-Sulman, or Solomon's Throne,—a designation thought to be a Mohammedan adaptation of the name of Rājā Sandhaman, who repaired or rebuilt the temple. The other Hindu buildings mostly belong to the time from the 6th to the 10th century. The chief points which distinguish them from Hindu buildings in India are the trefoil-headed doorways and recesses, high pediments, high straight-lined pyramidal roofs, and fluted pillars.

The temple of the sun at Marttand or Mstān has been one of the finest. It occupies a very striking position on a karwa or natural terrace about 3 miles from Islamabad, and commands a splendid view of the valley of the Jhelum. Of the others the most worthy of notice are the remains of two of the four temples at Avantipūr, 15 miles south-east of Srinagar; the temple of Bhūmzo near Marttand, built in a cave; Pāyach, on the karwa of Naunagar near Avantipūr, a small temple, the whole superstructure built of six stones; Pandrētan, 3 miles south-east of Srinagar, standing with its floor below the water, in a tank; Bhāniār (Bhawāniār) and Knūtrū, a few miles west of Baramūla, both backed by fine wooded cliffs crowned with deodars. A mound, with masonry in and about it, at the village of Ushkara near Baramūla, is supposed to be the remains of a Buddhist tope (*stūpa*), the place taking its name from Hushka, one of the Tartar kings of Kashmir.

Srinagar, the capital (34° 4' 6" N., 74° 48' 5" E.), said to have been founded by Pravarā Sēn, in the beginning of the 6th century, is built on both banks of the Jhelum. It is a somewhat confused mass of houses, many of them built of wood, with balconies and carved lattice windows, and projecting upper stories propped on poles, and overhanging the narrow streets or the little canals which in some parts are the streets. The city has seven bridges across the river, built of beams laid on stone and timber piers. In the fort on the south side of the river is the palace. There are several small Hindu temples in the town. The two chief mosques are the Jamī mosque and that of Shah Hamadān, the latter one of the most conspicuous buildings, with walls of stone and timber, low sloping wooden roof, and little wooden spires. On the shores of the Dal lake are the old pleasure-gardens of the Mughals.

The people of Kashmir are now mostly Mohammedan. Physically of fine form, a large proportion of the town-people are enabled by poverty and sedentary occupation in close rooms. A few years ago the shawl weavers of Srinagar were reckoned to be about 25 per cent. of the inhabitants. The proportion is now less, owing to the reduced demand for Kashmir shawls, both loom-made and hand-sewn. The maharaja has endeavoured to meet the depression of the shawl trade by extension of silk manufactures, silk is successfully worked, and well dyed. The chief demand for shawls has generally been from France, and French patterns have somewhat interfered with native art. At Islāmābād also many hands are employed in shawl and blanket weaving. A kind of coarse chintz is also made there. Embroidery on fine woollen cloths is the employment of many Kashmiris, both in their own country and in their Indian settlements, Amritsar, Nūrpur, and Ludhiana. The manufacture of a variety of articles in papier mâché and ornamental painted wood-work employs a number of people in Srinagar. The silversmiths do a good deal of business in ornamental vases, goblets, flower-holders, &c., silver and silver gilt. Engraved and embossed copper work employs a smaller number of people, also the manufacture of ornamental vessels of tinned copper, and some other minor kinds of work. A very good kind of paper is made in Kashmir. A museum of Kashmir products and manufactures was established at Srinagar in 1875. The people of the country, with more healthful occupations and surroundings than those of the towns, especially Srinagar, are robust and of active habits. The Kashmiris, both men and women, wear commonly a kind of loose gown with sleeves, called *phéran* (Pers., *pairdān*, "a robe"). In cold weather they are in the habit of carrying, under this loose dress, a small portable brazier with heated charcoal. The country people and boatmen use a more close fitting costume. The mountaineers, like those of neighbouring hill countries, bandage the legs from the knees to the foot for protection in walking.

According to a report prepared by order of the maharaja in 1873, the population of the valley at that time was nearly 492,000. Of these about 64,000 were Hindus and the rest Moslems, about 4 per cent. of the latter being Shites. The estimated population of Jāmū was 861,000, of Pānch 77,500, of Lādāk, Iskardo, and Gilgit, 104,500; total about 1,538,000:—Hindus, 507,000; Moslems, 919,000; Buddhists, 20,000; and "miscellaneous," 89,000. Of Srinagar the estimated population was about 132,000, of which number nearly 40,000 were Hindus. A great diminution, caused by deaths and emigration, has followed the famine of 1873. It was said that the towns of Islāmābād and Sopūr lost nearly two-thirds of their inhabitants. The rice crop of 1879 was abundant, and the rains of the next year seasonable and plentiful. The shawl-weaving and carpet-making trades revived in 1880, and numbers of people who had left the country during the famine returned.

The language of Kashmir (which is spoken only in the valley itself, and in the few outlying settlements of Kashmir in the neighbouring hills and in northern India) is of the Aryan family. It is allied to the Hindi, Sindhi, and Panjabi, and also to the current Urdu of India (Hindustani). It uses a form of the Sanskrit character like the Nāgarī of the Panjab. It may be said to possess no literature, though Kashmir has produced many literary men. The Urdu is now very generally understood in Kashmir, among the better educated people and more intelligent artisans.

The chief articles of export from Kashmir are shawls and other woollen fabrics, rice, saffron, fruits. The chief imports are shawl wool, English piece goods, Indian cloths,

metals, precious stones, skins, fells, dye-stuffs, tea, *charas* (hemp juice), groceries, and salt. The imports into Kashmir from British India are much below those into Jāmū, except tea (of which the Kashmiris are extremely fond), indigo, and earthenware. Kashmir imports annually a very large amount of rock salt from the Panjab. The gross annual value of the imports is about £210,000, and of the exports about £173,000. This latter amount is less than formerly, owing chiefly to the reduced demand for shawls. The import duties, which used to be very heavy, were modified in 1864; the duty on piece goods was limited to 8 per cent. and on other imports to 12½ per cent. In April 1870 a commercial treaty was entered into with the British Government for developing trade with eastern Turkestan, in which, among other things, the maharaja agreed to abolish all transit duties. Joint commissioners were appointed, on the part of the two Governments, to reside at Leh.

The gross annual revenue of Kashmir is believed to be about £660,000, and of the maharaja's whole territories a little over £800,000. The chief source of income is the land revenue. Of this there is now a cash settlement in place of the annual valuation of crops which was the practice till lately. The Government ordinarily takes one-half the gross produce. Grain is stored in public granaries, and sold at fixed rates to the army and the civil officials. Much grain is also purchased from the zamindars, and stored by Hindu merchants in Srinagar.

The maharaja's military force numbers 25,600 infantry (including police), 1400 cavalry, and 1200 artillery, with 78 field guns and 80 other pieces.

At Srinagar and elsewhere the maharaja has established dispensaries, with native medical men educated in India; and he has built at his own cost a large hospital for the medical mission at Srinagar.

The current rupee of Kashmir, called *chikt* ("glittering"), has varied in value at different times from one-half to five-eighths of the rupee of British India. The latest issued bears the latter value.

The admission of British visitors to Kashmir each season is limited. To military officers, up to a fixed number, permission is granted by the commander-in-chief or by the Government of India. Others do not require previous permission, but must intimate their intention of going to Kashmir, and obtain a copy of the rules. In like manner, more than eight centuries ago, as we learn from the Arabic historian Al Biruni, the passes used to be watched, and few outsiders admitted. Connected with this long-cherished exclusiveness has been the general badness of the roads. A really improved road has been made by the present maharaja from Kohala to Baramulla, the easiest and best entrance to the valley. The author just referred to mentions the covered litters, in which people in Kashmir used to be carried, raised on men's shoulders. The same conveyances are in use now. To the present day there are no wheeled conveyances in Kashmir. For English visitors four routes are authorized by the Government of India, one by the Pir Panjal Pass and three by Baramulla,—from Pānch, from Murree, and from Muzaffarabad.

In the government of his own territories the "maharaja of Jummoo and Kashmir" is independent. His relations with other states are subject to the supreme authority of the Government of India. The Government of India has no resident at either of the maharaja's capitals, but annually an "officer on special duty," as he is officially termed, is sent to Kashmir during the season from March to November. A native news-writer, employed by the British Government, remains in Kashmir. The annual tribute of the maharaja, presented in token of the supremacy of the British Government, in accordance with Act X. of the

D'Anville, *Antiquité Géographique du Flude*; Stanislaus Juhn, *Histoire de la Vie de l'Empereur, Jean*; of the *As. Soc. of Bengal*, x (Edinburgh), xii (Leeds), vii (A. Cunningham), xxv. ixiv W. G. Cowie, xxxix (Edinburgh), ka., George Forster, *Journey from Bengal to England*, Vigee's *Kishinur*; Yule's *Marco Polo*; Russell, *Memoir of a King of Hindostan*, Tirohthulu, *Le Géographie de l'Indostan*; Punjab Administration Reports, E. H. Davies, *Report on the Trade and Resources of the Countries on the North-West Boundary of British India*, J. E. T. Atchison, *Handbook of the Trade Products of Loh* (R. M. L.).

KĀSĪMBĀZĀR, or **COSSIMBĀZĀR**, a decayed town in Murshidābād district, Bengal, $24^{\circ} 7' 40''$ N. lat., $88^{\circ} 19'$ E. long. Long before the days of Murshid Kuli Khān, who founded and gave his name to the city of Murshidābād, the trade of Bengal was centred at Kāsimbāzār. The different European nations who traded to India had factories there from very early times. An English commercial agent was appointed to Kāsimbāzār in 1658; and at the close of the century it had become the leading English commercial agency in Bengal. The decay of the town dates from the beginning of the present century, when its climate, which had previously been celebrated for its salubrity, underwent an unexplained change for the worse, and its ruin was completed in 1813 by a sudden change in the course of the Bhāgrathi, on which it stood. The site is now a swamp, marked by a few ruins.

KASIMOFF, a town of Russia, in the Ryazan government, situated in $54^{\circ} 56'$ N. lat. and $41^{\circ} 9'$ E. long., 90 miles east-north-east of the government town, on the left bank of the Oka, a tributary of the Volga. It possesses a cathedral, and a mosque supposed to have been built by Kasim. Near the mosque stands a mausoleum built by Shah Ali in 1555. Lying on the direct road from Astrakhan to Moscow and Nislan Novgorod, Kasimoff is a busy place, with numerous industrial establishments. Of special note are the Kasimoff bells, whose jingle may be heard on the post-horses throughout the country. The waiters in the best hotels of St Petersburg are mostly Kasimoff Tartars. Population, according to St Petersburg Calendar for 1874, 12,027.

Kasimoff existed in the 14th century under the name of the Meakhtshek Gorodets or Gorodok (from the Meshcheryks, a Turkic-Finnish tribe). It was laid completely waste by the Mongolians in 1376, but shortly afterwards rebuilt on a new site. About 1452 the place was beset by Beid the Dark on the Tartar prince Kasim who had come to assist him in his wars, and thus became the seat of a Tartar principality or kingdom, which lasted till 1677. The last of the line of Kasim accepted Christian baptism, and recovered the name of Jacob. On his death the principality was incorporated with the empire; and Peter I. sent a number of the Tartar inhabitants to Voronezh.

KASSA. See **KASCHAU**.

KĀSTĀMŪNĪ, sometimes **COSTAMBONK**, the chief town of a Turkish vilayet of the same name in Asia Minor, is situated on the Gök Irmağ, about 250 miles east of Constantinople. It is the seat of a commercial court, consisting of two Mohammedan and two Christian members. The mosques are said to number thirty-six, and there are four dervish monasteries. Situated as it is in the Angora goat district, Kāstāmūnī has a large trade in goat's hair (about 980,000 lb annually), and carries on the manufacture of mohair cloth. Copper is obtained in the neighbourhood, and the copper mines of Kāstāmūnī are well-known in Asia Minor. Coal was for a time worked close to the town, but, the people objecting, it is said, to the smoke, the governor closed the mines. The population is estimated at 40,000. Kāstāmūnī is the Costamoun frequently mentioned by the Byzantine historians.

KĀSTORIA, a town of European Turkey, in the vilayet of Monastir and sanjak of Priesend, about 33 miles south of Monastir (Bitolia), on the western banks of a lake (6 miles long and 4 broad) which drains into the Indjeh, Karasu, or Bistrizza. It is the seat of a caimacam, and

the inhabitants carry on a good trade. Of the twelve quarters of the town three are occupied by Turks, two by Jews, and the rest by Christians. Kāstoria is the ancient Celestrum, captured by Sulpicius during the first Macedonian campaign, 200 B.C., and better known for the defence maintained by Bryennios against Alexis I. in 1084 (see Anna Comnena's *Alexias*). A Byzantine wall with round towers runs across the peninsula on which part of the town is built. Population, 8000.

KATER, HENRY (1777-1835), a distinguished physicist of remarkable experimental skill, was born at Bristol, April 16, 1777. At first he purposed studying law, but this he abandoned on his father's death in 1794, and entered the army, obtaining a commission in the 12th regiment of foot, then stationed in India, where he rendered valuable assistance in the great trigonometrical survey. Failing health, however, obliged him to return to England; and in 1808, being then a lieutenant, he entered on a distinguished student career in the senior department of the Royal Military College at Sandhurst. Shortly after he was promoted to the rank of captain. In 1814 he retired on half-pay, and devoted the remainder of his life to scientific research. He died at London, April 20, 1835.

His first important contribution to scientific knowledge was the comparison of the merits of the Cassagranian and Gregorian telescopes, from which (*Philosophical Transactions*, 1813 and 1814) he deduced that the illuminating power of the former exceeded that of the latter in the proportion of 5 : 2. This inferiority of the Gregorian he explained as being probably due to the mutual interference of the rays as they crossed at the principal focus before reflexion at the second mirror. His most valuable work, however, was the determination of the length of the second's pendulum, first at London and subsequently at various stations throughout the country (*Phil. Trans.*, 1818, 1819). In these researches he skillfully took advantage of the well-known property of reciprocity between the centres of suspension and oscillation of an oscillating body, so as to determine experimentally the precise position of the centre of oscillation; the distance between these centres was then the length of the ideal simple pendulum having the same time of oscillation. As the inventor of the floating collimator, Captain Kater rendered a great service to practical astronomy (*Phil. Trans.*, 1825, 1828). He also published memoirs (*Phil. Trans.*, 1821, 1831) on British standards of length and mass; and in 1832 he published an account of his labours in verifying the Russian standards of length. For his services to Russia in this respect he received in 1814 the decoration of the order of St Anne; and the same year he was elected a fellow of the Royal Society. His attention was also turned to the subject of compass needles, his Bakerian lecture "On the Best Kind of Steel and Form for a Compass Needle" (*Phil. Trans.*, 1821) containing the results of many interesting and valuable experiments. The treatise on "Mechanics" in Lardner's *Cyclopaedia* was partly written by him and partly by Dr Lardner; and his interest in more purely astronomical questions was evidenced by two communications to the *Astronomical Society's Memoirs* for 1831-33—the one on an observation of Saturn's outer ring, the other on the method of determining longitude by means of lunar eclipses.

KĀTHIĀWĀR, or **KATTIĀWĀR**, also **SUNĀSITRA**, a peninsula forming a collection of native states in Guzerat, western India, lying between $20^{\circ} 41'$ and $23^{\circ} 8'$ N. lat., and $68^{\circ} 56'$ and $72^{\circ} 20'$ E. long. It is bounded on the N. by the Rann or Gulf of Cutch, on the E. by Ahmedābād district and the Gulf of Cambay, and on the S. and W. by the Arabian Sea; the extreme length is 230 miles, the greatest breadth about 165 miles, the area about 22,000 square miles, and the estimated population 2,800,000.

It is divided into one hundred and eighty-eight separate states, large and small, of which thirteen pay no tribute, ninety-six are tributary to the British Government, and seventy to the *gokwār* as the representative of the Marhattas, while of these three classes of states one hundred and thirty-two pay a tax called *sartaldā* to the *nawāb* of Junāgarh. The states are arranged in seven classes. The chiefs of the first and second classes exercise plenary jurisdiction, both civil and criminal; the judicial powers of the lesser chiefs are graded in a diminishing scale, the residuary jurisdiction being vested in four British officers, each superintending a group of states. The political agent controls the whole. As a rule, no appeal lies from the decision of a chief; but on presumption of maladministration his proceedings may be called for and reviewed. During the past twenty years the states have established civil and criminal courts and written codes. Justice is administered by the political officers on the non-regulation system over 2058 square miles, or about one-tenth of the whole area. Outlawry, political and predatory, has been suppressed, and life and property are as safe as in British districts. A village police has been established, and municipal funds are voted by the states. In 1878 there were 488 schools, with 28,171 scholars; while at the Rāj Kumar College, and three high schools many of the chiefs receive a liberal education during their minority. There is railway communication with Wadhvān, and an extension is in progress to Dhorāḍī and Bhaunagar, while a network of good roads extend from Rājkot, the headquarters of the agency, over the greater part of the province. Kāthiawār is divided for administrative purposes into four *prants* or districts.—Jhalawār, Hālār, Sorāth, and Gohelwār; but the old territorial *prants* are ten, viz., Jhalawār in the north, containing about fifty states, Machhukūtā; Hālār, with twenty-sixty states; Okhamandāl, belonging to Baroda; Baradā or Jālwar, also known as Porbandar; Sorāth; Bahriwār; Kāthiawār, Und-Sarvār, and Gohelwār. The last-named comprises the Gogo district, belonging to the Ahmedābād collectorate, Bhaunagar, probably the foremost state in Kāthiawār; and many others.

Generally speaking, the surface of the country is undulating, with low ranges running in very irregular directions; with the exception of the Tāghā and Māndhav hills, in the west of Jhalawār, and some unimportant hills in Hālār, the northern portion of the country is flat; but in the south, from near Gogo, the Gīr range runs nearly parallel with the coast, and at a distance of about 20 miles from it, along the north of Bahriwār and Sorāth, to the neighbourhood of Gīrār. Opposite this latter mountain is the solitary Osam hill, and then still farther west is the Baradā group, between Hālār and Baradā, running about 20 miles north and south from Gumtī to Rānāwan. The Gīrār clump of mountains is an important granitic mass, the highest peak of which rises to 3600 feet. The principal river is the Bhādar, which rises in the Māndhav hills, and flowing south-west falls into the sea at Navī-Bandar, in Baradā, it is everywhere marked by highly cultivated lands adjoining its course of about 116 miles. Other rivers are the Aji, Machhū, and Sātṛnūj—the last remarkable for wild and romantic scenery. Four of the old races, the Jātīvas, Churkamas, Solunkis, and Wāls are now existing as proprietors of the soil who exercised sovereignty in the country prior to the immigration of the Jhalās, Jākṛas, Purnars, Kāthīs, Gohels, Jāts, Mohammodans, and Marhattas, between whom the country is now chiefly portioned out.

The principal agricultural products consist of cotton, *kat*, and *kat*, and in some parts sugar-cane, turmeric, and indigo. Hops and sheep breeding is carried on to a great extent—these animals, together with foot grains, raw cotton, and wool, forming the chief exports. The principal imports are cotton manufactures, metals, and

sugar. Iron is found in many parts of Baradā and Hālār. Many iron-mines have, however, had to be abandoned of late years owing to the scarcity of fuel for smelting the ore. The principal towns are Jāmāgar, Bhaunagar, Junāgarh, Rājkot, Porbandar, and Mangrol. The last two, as also Vardol, are thriving seaport towns. Kāthiawār has many notable antiquities, comprising rock inscriptions of Asoka, Buddhist caves, and fine Jain temples on the sacred hill of Gīrār, and at Pāṭana.

KATIF, or EK-KATIF, a town of Arabia, in the maritime region which skirts the northern part of the Persian Gulf on the low muddy shore of the northmost of the secondary bays that break the outline of the Bay of Bahrain, in 26° 29' N. lat. and 60° E. long. Town and district are sometimes considered as part of El Hass, sometimes as an independent province. The town lies embosomed amid luxuriant palm groves and gardens, but, according to Palgrave, is "crowded, damp, and dirty." As the seaport of Nejd, it has a considerable trade. The principal building is the fortress or palace—a strong and spacious structure, whose erection is popularly assigned to Abu Sa'īd al Jamādhī of Karmat, the founder of the Karmathians. Katif was the chief seat of the Karmathian power. About the middle of the 18th century we find it, along with El Hass, in the hands of The Muffik, whose influence was paramount throughout Nejd. In 1791 it was captured by Sa'īd, the leader of the Wahhābī revolution. In 1871 it was attacked, and according to their own account subjugated, by the Turks from Bagdad. The population of the town and district is given as from 90,000 to 100,000. Katif is not far from the probable site of the ancient Gerrha, which was inhabited by Chaldean exiles from Babylon (Strabo, xvi. 768); in more modern times the population has been recruited from Persia.

See Captain C F Sadler, in *Trans. Asiatic Soc. Bombay*, 1888, p. 101, in *Journ. Roy. Geogr. Soc.*, 1888; Palgrave, *Central and Eastern Arabia*, 1875; Zelmie, *Arabien und der Araber*, Halle, 1875.

KATSENA, KASINA, or KASHNA, a town of Central Africa, situated about 170 miles to the east of Sokoto, the capital of the state to which it now pays tribute. The walls have a circuit of between 13 and 14 English miles, but at the time of Barth's visit only the north-western quarter was inhabited, and he estimated the population at not more than 7000 or 8000. In the 17th and 18th centuries it appears to have been the largest town in the whole region, and its inhabitants cannot have numbered less than 100,000. The date of its foundation must be comparatively modern, for at the time of Leo Africanus there was no place of any considerable size in the province which bore the name now applied to the town. In the beginning of the present century it fell into the hands of the Fellatah, but only after a protracted and heroic defence.

KATTOWITZ, chief town of a circle in the government district of Oppeln and province of Silesia, Prussia, is situated on the Kawa, in a busy mining and manufacturing region near the Polish border. There are large iron-works, foundries, and machine shops in the town, and near it zinc and anthracite mines. The growth of Kattowitz, like that of many villages in the same circle, has been very rapid, owing to the development of the mineral resources of the district. In 1815 it was a mere village, in 1865 it became a town, and in 1875 it had a population of 11,552.

KATWA, or CUTWA, a town in Bardwān district, Bengal, India, situated at the confluence of the Bhāgīrathī and Ajāī rivers, 23° 35' N. lat., 88° 10' 40" E. long. It is one of the principal seats of district trade, and the residence of many wealthy native merchants. Now a purely commercial town, it was formerly regarded as the key to Murshidābād. The old fort, of which scarcely a vestige now remains, is noted as the scene of the defeat of the Marhattas by Ak Bādur Khān. Population in 1872, 7963.

KAUFBEUREN, an ancient town in the government district of Swabia and Neuburg, Bavaria, is situated on the Wertach, about 55 miles south-west of Munich by rail. The chief industry is cotton spinning and weaving, and there is a tolerably active trade in cotton-stuffs and cheese. The population in 1875 was 5563.

Kaufbeuren is said to have been built in 842, and to have become a free imperial city by purchase in 1288 or 1289. In 1603 it passed to Bavaria. It was formerly a resort of pilgrims, and Roman coins have been found in the vicinity.

KAUFFMAN, or KAUFFMANN, ANGELICA (1740-1807). This once popular artist and Royal Academician was born at Coire in the Grisons, October 30, 1740 or 1741. Her baptismal name was Maria-Anne-Angelica-Catharina. Her father, John Joseph Kauffmann, was a poor man and mediocre painter, but apparently very successful in teaching his precocious daughter. She rapidly acquired several languages, read incessantly, and showed marked talents as a musician. Her greatest progress, however, was in painting; and in her twelfth year she had become a notability, with bishops and nobles for her sitters. In 1754 her father took her to Milan, where she diligently studied the great masters. Later visits to Italy of long duration appear to have succeeded this excursion, and in 1763 she visited Rome, returning to it again in 1764. From Rome she passed to Bologna and Venice, being everywhere fêted and caressed, as much for her talents as for her personal charms. Writing from Rome in August 1764 to his friend Franke, Winkelmann refers to her exceptional popularity. She was then painting his picture, a half length, of which she also made an etching. She spoke Italian as well as German, he says; and she also expressed herself with facility in French and English,—one result of this last-named accomplishment being that she painted all the English visitors to the Eternal City. "She may be styled beautiful," he adds, "and in singing may vie with our best virtuosi." While at Venice, she was induced by Lady Wentworth, the wife of the English ambassador, to accompany her to London, where she appeared in 1765. One of her first works was a portrait of Garrick, exhibited in the year of her arrival at "Mr Moreing's great room in Maiden Lane." The rank of Lady Wentworth opened society to her, and she was everywhere well received, the royal family especially showing her great favour.

Her firmest friend, however, was Reynolds. In his pocket-book her name as "Miss Angelica" or "Miss Angel" appears frequently, and in 1766 he painted her, a compliment which she returned by the Portrait of Sir Joshua Reynolds, *et al.* 46, which was exhibited by Lord Morley at the "Old Masters" in 1876. Another instance of her intimacy with Reynolds is to be found in the variation of Guercino's "Et in Arcadia ego" produced by her at this date, a subject which Reynolds repeated a few years later in his portrait of Mrs Bourverie and Mrs Crowe. When, in 1768 or thereabouts, she was entrapped into a marriage with an adventurer who passed for a Swedish count, Reynolds befriended her, and it was doubtless owing to his good offices that her name is found among the signatories to the famous petition to the king for the establishment of the Royal Academy. In its first catalogue of 1769 she appears with "R.A." after her name (an honour which she shared with another lady and compatriot, Mary Moser); and she contributed the Interview of Hector and Andromache, and three other classical compositions. From this time until 1782 she was an annual exhibitor, sending sometimes as many as seven pictures, generally classic or allegorical subjects. One of the most notable of her performances was the Leonardo expiring in the Arms of Francis the First, which belongs to the year 1778. In 1773 she

was appointed by the Academy with others to decorate St Paul's, and it was she who, with Biaggio Rebecca, painted the Academy's old lecture room at Somerset House. It is probable that her popularity declined a little in consequence of her unfortunate marriage; but after her first husband's death (she had been long separated from him) she married Antonio Zucchi, a Venetian artist, then resident in England. This was in 1781. Shortly afterwards she retired to Rome, where she lived for twenty-five years with much of her old prestige. In 1782 she lost her father, and in 1795—the year in which she painted the picture of Lady Hamilton now at South Kensington—her husband. She continued at intervals to contribute to the Academy, her last exhibit being in 1797. After this she produced but little, and in November 1807 she died, being honoured by a splendid funeral under the direction of Canova. The entire Academy of St Luke, with numerous ecclesiastics and virtuosos, followed her to her tomb in St Andrea delle Fratte, and, as at the burial of Raphael, two of her best pictures were carried in procession.

Popular as they were during her lifetime, the works of Angelica Kauffman have not retained their reputation. She had a certain gift of grace, and considerable skill in composition. But her drawing is weak and faulty; her figures lack variety and expression, and her men are masculine women. Her colouring, however, is fairly enough defined by Waagen's term "cheerful." Rooms decorated by her brush are still to be seen in various quarters. At Hampton Court is a portrait of the duchess of Brunswick; in the National Gallery an allegorical composition of Religion attended by the Virtues. There are other pictures by her at Paris, at Dresden, in the Hermitage at St Petersburg, and in the Pinakothek at Munich. The Munich example is a portrait of herself, there is a second in the Uffizi at Florence, and a third in the National Portrait Gallery, South Kensington. A few of her works in private collections have also been exhibited among the "Old Masters" at Burlington House. But she is perhaps best known by the numerous engravings from her designs by Schiavonetti, Bartolozzi, and others. Those by Bartolozzi especially still find considerable favour with collectors. Her life was written in 1810 by Giovanni de Rossi. It has also been used as the basis of a romance by Léon de Wailly, 1888; and it prompted the charming novelle contributed by Miss Richmond Ritchie to the *Cornhill Magazine* in 1875 under the title of "Miss Angel." (A. D.)

KAULBACH, WILHELM VON (1805-74), an acknowledged leader in modern art, was born in Westphalia 15th October 1805. His parentage was humble, and his father, who was poor, combined painting with the goldsmith's trade, but means were found to place Wilhelm, a youth of seventeen, in the art academy of Düsseldorf, then re-organized, and becoming renowned under the directorship of Peter von Cornelius. Young Kaulbach at the outset had to fight a hard battle. His circumstances were necessitous; he contended against hardships, even hunger. But his courage never failed; and, uniting genius with industry, he was ere long found foremost among the young national party which resolved that the arts of Germany should see a great revival.

Munich is the city most closely identified with Kaulbach. The large and ambitious works by which Louis I. sought to transform the capital of Bavaria into a German Athens afforded to the young painter an appropriate sphere. Cornelius had for some years been commissioned to execute the enormous frescoes in the Glyptothek, and his custom was in the winters with the aid of Kaulbach and others to complete the cartoons at Düsseldorf, and then in the summers, accompanied by his best scholars, to carry out the designs in colour on the museum walls in Munich. But in 1824 Cornelius became director of the Bavarian academy. Kaulbach, not yet twenty, followed, took up his permanent residence in Munich, laboured hard on the public works, executed independent commissions, and rose to such distinction that in 1849, when Cornelius left for Berlin, he succeeded to the directorship of the academy, an office which he held for a quarter of a century, up to the day

of his death. The training, experience, and opportunity of Kaulbach had been extraordinary; he became a prime mover in one of the most signal of art manifestations known in modern times; he matured, after the example of the masters of the Middle Ages, the practice of mural or monumental decoration, he once more conjoined painting with architecture, and displayed a creative fertility and readiness of resource scarcely found since the era of Raphael and Michelangelo.

Early in the series of his multitudinous works came the famous *Narrenhaus*, the appalling memories of a certain madhouse near Düsseldorf; the composition all the more deserves mention for points of contact with Hogarth. Somewhat to the same category belong the renowned illustrations to *Reineke Fuchs*. These, together with occasional figures or passages in complex pictorial dramas, show how dominant and irrepressible was the artist's sense of satire and enjoyment of fun; character in its breadth and sharpness is depicted with keenest relish, and at times the sardonic smile bursts into the loudest laugh regardless of the propriety and solemnity appropriate to high art. Thus occasionally the grotesque degenerates into the vulgar, the grand into the ridiculous, as in the satire on "the Pictorial Age" in a fresco outside the New Pinakothek. Yet the genius of Kaulbach was far too transcendent to be marred by these exceptional extravagances; such exaggerations came not of weakness but from excess of power; they are as the sturdy traits and lawless forces of the Teutonic and northern races whence the Westphalian painter had sprung. Kaulbach tried hard to become Grecian and Italian; but he never reached Phidias or Raphael; in short the blood of Dürer, Holbein, and Martin Schongauer ran strong in his veins. The art products in Munich during the middle of this century were of a quality to preclude first-rate quality, and Kaulbach contracted a fatal facility in covering wall and canvas by the score. He painted in the Hofgarten, the Odeon, the Palace, and on the external walls of the New Pinakothek. His prepossessing and showy manner also gained him abundant occupation as a book-illustrator; in the pages of the poets his fancy revelled; he was glad to take inspiration from Wieland, Goethe, even Klopstock; among his engraved designs are the Shakespeare gallery; the Goethe gallery, and a folio edition of the Gospels. All these signal examples of what may be called "the Munich school," though by the many applauded to the skies, were yet subjected to censorious criticism. In a volume entitled *Social Life in Munich* it was with some show of reason urged that Kaulbach had been unfortunate alike in having found Cornelius for a master and King Louis for a patron, that he attempted "subjects far beyond him, believing that his admiration for them was the same as inspiration"; the lack of real imagination he supplied by "a compound of intellect and fancy"; he "thinks his feelings," and his creations are but "the triumph of intellect."

Nevertheless no one appreciating at their worth such master compositions as the Destruction of Jerusalem and the Battle of the Huns can deny to Kaulbach creative imagination. As a dramatic poet he tells the story, depicts character, seizes on action and situation, and thus as it were takes the spectator by storm. The manner may be occasionally noisy and ranting, but the effect after its kind is tremendous. Within the whole range of modern art no finer composition can be named than the Battle of the Huns, no bolder conception than the fierce fight in mid air between the spirits of the warriors slain in combat. The drawing, the foreshortening, the grouping and lines of composition, are almost as a matter of course masterly. The cartoon, which, as usual in modern German art, is superior to the ultimate picture, was executed in the artist's prime at the age of thirty. At this period, as here seen, the

knowledge was little short of absolute; subtle is the sense of beauty, playful, delicate, firm, the touch; the whole treatment artistic.

Ten or more years were devoted to what the Germans term a "cyclus,"—that is, a series of pictures which, as successive chapters or essays, illustrate one theme, as Raphael in the Vatican gave pictorial exposition to universal knowledge under the distinctive titles of Theology, Philosophy, Jurisprudence, and Poetry. The fundamental idea whereon Kaulbach discoursed was civilization or the progress of the human race as displayed in the following historic epochs:—the Tower of Babel, the Age of Homer, the Destruction of Jerusalem, the Battle of the Huns, the Crusades, and the Reformation. These major tableaux, severally 30 feet long, and each comprising over one hundred figures above life-size, are surrounded by minor compositions making more than twenty in all. The idea is to congregate around the world's historic dramas the prime agents of civilization, thus here are assembled allegoric figures of Architecture and other arts, of Science and other kingdoms of knowledge, together with lawgivers from the time of Moses, not forgetting Frederick the Great. The chosen situation for this imposing didactic and theatric display is the Treppenhaus or grand staircase in the new museum, Berlin, the surface is a grained, absorbent wall, specially prepared; the technical method is that known as "water-glass," or "liquid flint," the infusion of silica securing permanence. The same medium was adopted in the later wall-pictures in the Houses of Parliament, Westminster.

The painter's last period brings us new departure; his ultimate works stand conspicuous by exaggerations of early characteristics. The series of designs illustrative of Goethe, which had an immense success, were melodramatic and rendered to popular taste. The vast canvas, more than 30 feet long, the Sea Fight at Salamis, painted for the Maximilianum, Munich, evinces wonted imagination and facility in composition; the handling also retains its largeness and vigour, but in this astounding scene uprear moderation and the simplicity of nature are thrown to the winds, and the whole atmosphere is hot and feverish. The painter verily had within him a fire which burnt fiercely; and, when past the age of sixty he received visitors within his spacious studio, he looked the perfect impersonation of his art. On the walls, upon easels, even on the floor, were large cartoons, rolls of canvas, piles of drawings—fruits of a restless and inexhaustible intellect. Kaulbach in the midst moved to and fro impulsively and discoursed volubly on the creations he was about to call out of chaos. But his career was drawing to a close; seized by the cholera, he died in 1874, at the age of sixty-nine.

Kaulbach can scarcely be counted among religious painters; yet the range of his thought is most lofty. Whatever is noblest in humanity, whatever has raised the human race, freed or enlightened the mind, given dignity and beauty to life, or reared the body into godlike frame, falls within the province of his art. Nothing small or mean finds a place; the accidents and crudities of common nature are cast out; typical forms are selected and matured; and all is brought into harmony with beauty. Kaulbach's was indeed a beauty-loving art. He is not supreme as a colourist; he belongs in fact to a school that holds colour in subordination; but he lead, in common with the great masters, the sure foundation of his art in form and composition. Indeed, the science of composition has seldom if ever been so clearly understood or worked out with equal complexity and exactitude; the constituent lines, the relation of the parts to the whole, are brought into absolute agreement; in modern Germany painting and music have trodden parallel paths, and Kaulbach is musical in the melody and harmony of his compositions. His narrative too is lucid, and moves as a stately march or royal triumph; the sequence of the figures is unbroken; the arrangement of the groups accords with even literary form; the picture falls into incident, episode, dialogue, solilo, plot, as a drama. The style is eclectic; in the Age of Homer, the types and the treatment are derived from Greek marbles and vases; then

in the Tower of Babel the severity of the antique gave place to the sanity of the Italian renaissance, while in the Crusades the composition let loose into modern romanticism, and so the manner descends into the midst of the 19th century. Analyze this scholastically compounded art is so nicely adjusted and smoothly blended that it casts off all incongruity and becomes homogeneous as the sense of one mind. But a fickle public craved for change; and so the great master in later years waned in favour, and had to witness, not without inquietude, the rise of an opposing party of naturalism and realism. Yet few men have had a brighter career, or enjoyed a reward better earned. Kaubach's works are monumental, and will be handed down to future ages as the highest products of the renaissance of the arts in modern Germany. (J. B. A.)

KAUNITZ, WENZEL ANTON (1711-1794), count of Rieberg, Austrian statesman, was born at Vienna, February 2, 1711. As the fifth and youngest son of an Austrian count, he was destined at first for the church, but on the death of his brothers he turned his attention to statesmanship. He was sent by Maria Theresa on embassies to Rome and Florence, and was engaged at Turin in strengthening the alliance between Austria, Sardinia, and Great Britain against the Bourbons. In the meantime he had acquired the countship of Rieberg by marriage. In 1744 he was sent as minister to the court of the duke of Lorraine, governor-general of the Austrian Netherlands. During the duke's absence, Kaunitz administered affairs ably; and, when the French besieged Brussels in 1746, he secured a free retreat for the Austrian troops to Antwerp. After a brief retirement on account of his health, Kaunitz reappeared on the political stage at the congress of Aix-la-Chapelle in 1748, where he laid the foundation of his reputation, and earned the rank of minister of state. During his stay as ambassador at Paris, from 1750 to 1752, he concluded a secret alliance between Austria and France, a diplomatic stroke which involved the complete reversal of the former hostile attitude of the two powers, and which was rewarded by his appointment as chancellor of state or prime minister. In 1766 he was made chancellor of the Netherlands and of Italy. For nearly forty years he continued in this capacity to direct the affairs of Austria, steadily cultivating the French and Russian alliances, and jealously watching the rising power of Prussia, against which he formed the coalition of 1756. At the partition of Poland in 1772 he secured Galicia for Austria; and it was during his ministry also that Bukovina (1776) and the so-called "Inn quarter" came under the Austrian crown. He enjoyed the unbounded confidence of Maria Theresa, and was an active agent in furthering the reforms under her and her son Joseph II. He showed himself a liberal patron of education and art, as well as an accomplished statesman. Under Joseph II. and Leopold II. his influence waned, and he resigned all his offices at the accession of Francis II. in 1792. In 1764 he was created a prince of the empire. He died June 37, 1794.

See the life by Hornay in the *Oesterreichischer Plutarch*, and *Denkschriften des Kaiserlichen Akademie*, Vienna, 1872, by Boer.

KAVA, an intoxicating drink used in the islands of the South Pacific from the Sandwich Islands to Fiji. In Hawaii it is called "kawa"; in the Marquesas "kava kava"; "ava," "ava-ava," and "ovava" in Tahiti; and in Fiji "yagouana." It is made from the roots or leaves of *Piper methysticum*, Mif., a species of pepper indigenous in these islands, several varieties are also cultivated by the natives, those growing in a dry soil being considered to be the most active. To prepare the liquid the fresh roots or leaves, after being chewed by young girls or boys, with good teeth, clean mouths, and free from colds, are placed in a large wooden bowl ("umete") on three legs made of the wood of the vesi (*Azadirachta indica*, Gray), and water or cocoa-nut milk poured over the mass. The liquid is then stirred up, and the woody matter of the root is removed by repeatedly drawing through the infusion

long fibres prepared by crushing the green stems of the van (*Hibiscus*, sp.), and passing them frequently between two pieces of wood. By this means a muddy-looking liquid resembling *caffé au lait* in appearance, or of a greenish hue if made from the leaves, is left in the bowl, a quantity of fecula remaining suspended in the fluid. The drink is then distributed into cups made of plantain leaves, by dipping some of the van fibre into it and squeezing the liquid into the cups, which are handed to the individuals present. As the process of infusion only takes about twenty minutes, it is obvious that no fermentation can take place. The taste of the liquid is at first sweet and then pungent and acid. The usual dose is half a cupful, equal to about two mouthfuls of the root. Intoxication follows in about twenty minutes, or immediately if twice the usual quantity be taken.

The drunkenness produced by kava differs from that of alcohol in being of a melancholy, silent, and drowsy character, accompanied, if the drink be made from roots growing in a damp soil, with great irritability at the slightest noise. The fit lasts for about two hours, but in persons who only take it occasionally it may continue for six or twelve hours. At Nukahiva kava is said to be used as a daily beverage, probably in small quantities,—its use, however, being forbidden to women and children. In many of the Pacific islands kava is given at official receptions, being the offered and accepted token of hospitality. Formerly the drinking of it preceded warlike enterprises and religious festivals.

The daily use of the drug is sometimes followed by a kind of skin disease, called in Tahiti "areareva." The effect on those who are addicted to the use of kava for any length of time is to produce obscurity of vision, red conjunctiva, and yellow coloration of the teeth, while the skin where thick becomes dry, scaly, cracked, and ulcerated, and the body becomes emaciated and decrepit. In Nukahiva it is given as a medicine in phthisis and in bronchitis, a small dose being taken before going to bed.

Mr. Collie, surgeon to the ship "Blossom," states that he observed the infusion of the root to be useful in certain skin diseases (Beauch, *Voyage of the "Blossom,"* vol. ii. p. 120). Some years ago it was introduced into France as a remedy for various diseases of the mucous membranes (*Annal. de Thérap.*, 1857, p. 61), and it has also been recommended in gout (*Med. Times and Gazette*, 1856, p. 591).

The root contains an essential oil of a yellow colour and agreeable odour, 3 per cent. of a balsamic resin called kavin, and about 40 per cent. of starch, also a neutral crystalline principle discovered in 1844 by Mr. J. R. N. Morson, and called *kavamine*, or by Gobley *methysticin*. It is readily soluble in boiling alcohol, crystallizing out on cooling. Hydrochloric acid colours it red, this colour changing to yellow on exposure to the air; concentrated sulphuric acid changes it to a rich purple violet, which on exposure to the air gradually becomes green, or immediately if diluted with water. These tests distinguish it from cubebin and piperin.

See *Pharm. Journ.*, (1) ii. 474, (2) iv. 85, (2) ix. 219, (3) vii. 149; *Comptes Rendus*, l. 436, 598, lii. 206; and *Journ. de Pharm.*, 1860, p. 20, and 1862, p. 218; Seemann, *Flora Pitcairni*, p. 280.

KAYALA, or CAYALLO, a walled town of European Turkey in the vilayet of Saloniki, situated on a promontory stretching southwards into the bay of Kavala, opposite the island of Thaso. Numerous Roman remains have been found in the neighbourhood, of which the chief is the large aqueduct on two tiers of arches, which still serves to supply the town and dilapidated tidal water from Mount Pangaea. Kavala has a port on each side of its promontory, and exports cotton and tobacco. The Turkish college

was founded by Mehmet Ali, pasha of Egypt, who was born in the town in 1769. The population is about 5000. Kavala has been identified with Neapolis, at which St Paul landed on his way from Samothrace to Philippi, 10 miles to the north (Acts xvi. 11). Neapolis was the port of Philippi, as Kavala now is of Seres; and in the bay on which it stands the fleet of Brutus and Cassius was moored during the battle of Philippi. Some authorities identify Neapolis with Dabrus (*Advers*), mentioned by Herodotus as famous for its gold mines.

KAVANAGH, JULIA (1824-1877), novelist, was born at Thurlis in Tipperary, Ireland, in 1824. She was the daughter of Morgan Kavanagh, author of various philological works, and she spent several years of her early life with her parents in Normandy, laying there the foundation of a perfect mastery of the French language and practical insight into French modes of thought, which was perfected by her later frequent and long residences in France. Miss Kavanagh's literary career began with her arrival in London about her twentieth year, and, beyond the publication of her successive works, her uneventful life with her widowed mother affords few incidents to the chronicler. On the outbreak of the Franco-German war the two ladies removed from Paris, where they were living, to Rouen. Thence they subsequently passed to Nice, where on October 28, 1877, Julia Kavanagh died, in her fifty-fourth year. She is described as having been in person extremely small, with large, luminous, brown eyes, and a wealth of splendid hair. She was a devout Roman Catholic.

Julia Kavanagh's first book was *Three Paths*, 1847, a story for the young, but her first work to attract notice was *Madeline*, a tale of *Auvergne*, 1848. *A Summer and Winter in the Two Sicilies*, 2 vols., 1856, was the fruit of a journey made about 1853 to France, Switzerland, and Italy. *French Women of Letters*, 3 vols., 1862, and *English Women of Letters*, 2 vols., 1863, are collections of slight biographical essays on Irish novelists. She wrote also *Woman as France during the 18th century*, 2 vols., 1856, and *Women of Christendom*, 1859. But Miss Kavanagh is better known by her numerous novels and tales contributed to various magazines. The scenes of these are almost always laid in France, and the authoress handles her French themes with fidelity and skill. Her style is simple and pleasing rather than striking, her characters are interesting without being strongly individualised; and the paucity of incident in the unravelling of her plots sometimes seems to threaten monotony. Her most popular novels are perhaps *Addie*, 1857, *Queen Mab*, 1863; and *John Dorrer*, 1876. Others are *Nathalie*, 1850, *Daisy Burns*, 1855; *Grace Lee*, 1856, *Rachel Gray*, 1855, *Seven Years*, &c., 1859; *Beatrice*, 1855, *Edith's Second Love*, 1867, *Dora*, 1868; *Suzette*, 1870; *Bessie*, 1873, *The Pearl Fountain*, &c. (written along with her mother), 1876; and *Two Little*, 1877. *Forged-me-nots*, 2 volumes of shorter tales, appeared after her death.

KÁVERÍ, or CAUVÉRY, a great river of southern India, famous for its traditional sanctity, its picturesque scenery, and its utility for irrigation. Rising in Coorg, high up amid the Western Gháts, in 13° 25' N. lat. and 75° 34' E. long., it flows with a generally south-eastern direction across the plateau of Mysore, and finally pours itself into the Bay of Bengal through two principal mouths in Tanjore district. Its total length is about 475 miles; the estimated area of its basin, 25,000 square miles. It is known to devout Hindus as Dakshini Gange, or the Ganges of the South, and the whole of its course is holy ground. According to the legend there was once born upon earth a girl named Vishnumáyá or Lopamúdrá, the daughter of Brahma; but her divine father permitted her to be regarded as the child of a mortal, called Kávera-muni. In order to obtain beatitude for his adoptive father, she resolved to become a river whose waters should purify from all sin. Hence it is that even the holy Ganges resorts underground once in the year to the source of the Káveri, to purge herself from the pollution contracted from the crowd of sinners who have bathed in her waters. The course of the Káveri in Coorg is very tortuous. Its bed is generally rocky; its banks are high and covered with luxuriant vegetation. On entering Mysore it passes through a narrow gorge, but pre-

sently widens to an average breadth of from 300 to 400 yards. Its bed continues rocky, so as to forbid all navigation; but its banks are here bordered with a rich strip of cultivation. In its course through Mysore, the channel is interrupted by twelve alicuts or dams for the purpose of irrigation. From the most important of these, known as the Maddakatte, an artificial channel is led to a distance of 72 miles, irrigating an area of 10,000 acres, yielding a revenue of £7000, and ultimately bringing a water-supply into the town of Mysore. In Mysore state the Káveri forms the two islands of Srirangapatam and Sivasamudram, which vie in sanctity with the island of Srirangam lower down in Trichinopoly district. Around the island of Sivasamudram are the celebrated falls of the Káveri, unrivalled for romantic beauty. The river here branches into two channels, each of which makes a descent of about 200 miles in a succession of rapids and broken cascades. After entering the Madras presidency, the Káveri forms the boundary between the Coimbatore and Salem districts, until it strikes into Trichinopoly district. Sweeping past the historic rock of Trichinopoly, it breaks at the island of Srirangam into two channels, which enclose between them the delta of Tanjore, the garden of southern India. The northern channel is called the Coleroon (Koldam); the other preserves the name of Káveri. On the seaward face of its delta are the open roadsteads of Negapatam and French Kámkal. The only navigation on any portion of its course is carried on in boats of basket-work. It is in the delta that the real value of the river for irrigation becomes conspicuous. The most ancient irrigation work is a massive dam of unhewn stone, 1080 feet long, and from 40 to 60 feet broad, across the stream of the Káveri proper, which is supposed to date back to the 4th century, is still in excellent repair, and has supplied a model to British engineers. The chief modern work is the ancient across the Coleroon, 2250 feet long, constructed by Sir Arthur Cotton between 1836 and 1838.

KAY, JOHN (1742-1826), Scottish caricaturist, was born in April 1742, near Dalkeith, where his father was a mason. At thirteen he was apprenticed to a barber, whom he served for six years. He then went to Edinburgh, where in 1771 he obtained the freedom of the city by joining the corporation of barber-surgeons. For some years he practised his craft with success; but in 1785, induced by the favour which greeted certain attempts of his to etch in aquafortis, he took down his barber's pole and opened a small print shop in Parliament Square. There he continued to flourish, painting miniatures, and publishing at short intervals his sketches and caricatures of local celebrities and oddities, who abounded at that period in Edinburgh society. He died on February 21, 1826. Kay's portraits were collected by Hugh Paton and published under the title *A Series of Original Portraits and Caricatures Sketchings by the late John Kay, with Biographical Sketches and Illustrative Anecdotes* (Edin., 2 vols. 4to, 1838; 8vo ed., 4 vols., 1842; new 4to ed., with additional plates, 2 vols., 1877), forming a unique record of the social life and popular habits of Edinburgh at its most interesting epoch. The caricatures have little strictly artistic merit, beyond their graphic power; the drawing is always stiff and often false; but they are admitted to have been accurate likenesses, and they possess the evident recommendation of abundant and apt humour.

KAYE, SIR JOHN WILLIAM (1814-1876), historian, was born in 1814, the son of a solicitor. Educated at Eton and Addiscombe Royal Military College, he served as an officer in the Bengal artillery till 1841, when he exchanged his sword for the pen. In 1856 he entered the service of the East India Company in England; and, when next year the crown assumed the government of India, Kaye suc-

ceeded John Stuart Mill as secretary in the political and secret department of the India office. In 1871 he was created a knight of the Star of India. In 1874 his failing health warned him to resign his post; and he died in London, July 24, 1876. To his historical and biographical writings Sir John Kaye brought an historical sagacity, an honesty of purpose, and a military knowledge that make them at once valuable and interesting.

His best known works are his *History of the Sepoy War*, 3 vols., 1854; *History of the War in Afghanistan*, 2 vols., 1851; and his *Life of Lord Roberts*, 2 vols., 1864. He was the author also of *Peregrine Pultney* (1844) and *Long Engagements* (1861), two Indian novels; *History of the Administration of the East India Company*, 1853; *Life of Henry Tucker*, 1854; *Life of Sir John Malcolm*, 2 vols., 1855; *History of Christianity in India*, 1859; *Letters of Indian Officers*, 2 vols., 1867; *Essays of an Optimist*, 1870; and numerous contributions to periodicals.

KAZALA, or **KAZALINAK**, a fort and town, at the point where the Kazala falls into the Jaxartes, about 47 miles from its mouth. It is situated in 45° 45' N. lat. and 62° 7' E. long., "at the junction," to quote Schuyler's description, "of all the trade routes in Central Asia, as the road from Orenburg meets here with the Khivan, Bukharan, and Tashkent roads"; and thus, besides carrying on a lively local trade with the Kirghiz of the surrounding country, it is a point of growing importance in the general current of commerce. In other respects the position of the place is far from attractive: the floods on the river make it an island in the spring; in summer it is parched by the sun and hot winds, and hardly a tree can be got to grow. The streets are wide, but the houses, as well as the fairly strong fort known as Fort No. 1, are built of mud bricks. The population, stated at 5000, is on the increase.

KAZAN, a government of European Russia, belonging to the basin of the Volga, and continuous with the governments of Nizhni Novgorod, Vyatka, Orenburg, Samara, and Simbirsk. The area, according to the government survey, is 23,998 square miles. By the Volga and its tributary the Kama the surface of the government is divided into three regions of differing aspect: the first, to the right of the main river, is traversed by deep ravines sloping to the north-east and by two ranges of hills, one of which, keeping company with the river, has a height of 300 to 500 feet; the second, between the left bank of the Volga and the left bank of the Kama, is an open steppe; and the third, between the left bank of the Volga and the right bank of the Kama, resembles in its eastern part the first region, and in its western part is covered with forest. Marls, limestones, and sandstones, Permian or Triassic, are the main rocks; the Jurassic formation appears in a small part of the Tetyushli district; and Tertiary rocks stretch along the left bank of the Volga. There are no minerals of importance; but mineral springs (iron, sulphur, and naphtia) exist in several places. The Volga is navigable in all the 198 miles of its course through Kazan, as well as the Kama (120 miles); and the Vyatka, the Kazanka, the Rutka, the Tavil, the Greater Kotelska, the Ilet, and the Bezdon are not without value as waterways. About four hundred small lakes are enumerated within the government; the Upper and Lower Kaban supply the city of Kazan with water.

About 7,135,610 acres (more than 46 per cent. of the surface) are arable, upwards of 1,394,900 acres (over 8 per cent.) are meadow land, and 5,190,900 acres (nearly 84 per cent.) are under forest. Rye and oats form the principal crops; barley, wheat, buckwheat, and potatoes are also grown. In 1879 the official returns gave 1,048,002 as the number of sheep in the government, and of these 18,748 were of fine woolled breeds; the horned cattle amounted to 859,899, the horses to 466,664, the swine to 192,190, and the goats to 45,892. No fewer than 806 persons were engaged in bee-keeping, and the produce of this department was valued at £29,945. Industrial activity is on the increase; the number of the smaller

manufacturing establishments is diminishing, but those which remain (372 in 1879, employing 8899 hands) are greatly increasing in production. The total value of their manufactures in 1879 was £2,084,137. Apart from the regular factories, there is a large industrial activity. The weaving and dyeing of linen and hemp goods gave employment in 1879 to 13,466 men; wool-combing, &c., to 8428, flour and malt making to 8850, and the forest industries, wood-cutting, tar-bolling, &c., to 10,423. The aggregate commerce of the towns is estimated at £3,656,000. Of the seventy-six annual fairs, the chief are the timber fair of Kozmodemyansk, and those of Tshitolop and Tchobokarsk. Administratively Kazan is divided into twelve districts—Kazan, Svyazlsk, Tchobokarsk, Tavitsk, Yadrin, Kozmodemyansk, Tsarevokokhansk, Mamadulsk, Tshitolop, Lushoff, Spasek, Tetyushli. Besides the city of Kazan, the following are the largest towns.—Tshitolop (20,298 inhabitants in 1879), Lushoff (5058), Tchobokarsk (4586), Kozmodemyansk (4608), Mamadulsk (4008). The total population of the government in 1879 was 1,872,437 (194,348 in the towns, 1,678,094 in the country districts). The males in the former class numbered 109,615, and the females 84,428, and in the latter the males 820,144, and females 867,960. An increase of 267,733 has taken place since 1862. More than half of the inhabitants are of non-Slavonic origin, and the Mohammedans number over half a million.

The formation of the Kazan government dates from the year 1708, at first it contained a large portion of south-eastern Russia, but in 1781 the present limits were determined. The division into twelve districts was made in 1802.

KAZAN, chief town of the above government, is situated in 55° 48' N. lat. and 49° 26' E. long., 528 miles east of Moscow and 970 miles from St. Petersburg. The summer course of the Volga lies several miles to the south-west, and is gradually increasing its distance; but when the river is at its height in spring the intervening space is laid under water, and the steamers, which at other times stop at the mouth of the Kazanka, are able to approach the town. Though the hill on which the citadel stands is only about 40 feet high, it forms a striking relief to the level country in front. Contrary to what might be expected from its history, the town is almost completely destitute of Oriental colouring; but the number and brightness of the Greek churches helps to relieve the general air of modern and commonplace regularity. The cathedral of the Annunciation was founded in 1562 by Gury, the first bishop of the diocese of Kazan; and the Bogoroditski convent was erected in 1579 for the reception of the "Black Virgin of Kazan," which was removed in 1821 to the famous Kazan cathedral in St. Petersburg. Of pre-Russian buildings there is hardly a trace; the red brick Sumbek tower, 245 feet high, is an object of great veneration to the Tartars, who consider it as the burial-place of one of their saints; but its similarity to the towers of Moscow proves its Muscovite origin. As an intellectual centre Kazan is the most important city of eastern Russia in Europe. The gymnasium, founded in 1750, was the third national institution for secondary education established in the empire; and the university, which dates from 1801, has become a great seat of Oriental scholarship. It has four faculties, with fifty-six teachers and about seven hundred students. The library contains about 86,000 volumes; but the most valuable part of its manuscript collection has been removed to St. Petersburg. There is an astronomical observatory; and from the university press are issued a learned journal (*Izvestiya i Sborniki*) and a very considerable number of works, especially in Oriental philology. The ecclesiastical academy founded in 1846 contains the old library of the Solovki monastery, of importance for the history of Russian sects. Schools are maintained by the Tartar population, which still occupies some of the suburbs; and Tartar text-books (by Radloff) after the European type have been introduced. As a seat of commerce and industry Kazan holds a respectable place. Its leather goods, especially those of the finer qualities, are in repute; and it also manufactures alcohol, flour, cotton and hemp goods, starch, tallow, and alumen. The trade connexion of the Tartar merchants more particularly is a very extensive and important one. The population

of the town, which was 63,084 in 1863, had increased in 1879 to 134,434, of whom 13,635 are Tartars.

The present government of Kazan was the centre of a great Bulgarian kingdom, the first historical monarchy of north-eastern Russia. On the ruins of this kingdom the Mongolian (Tatar) "kingdom of Kazan" was founded in the 15th century by Ulu-Mahmet, whose descendants continued to rule till the destruction of their city by Ivan the Terrible in 1552. Of the town of Kazan the early notices are of doubtful interpretation, but according to S. M. Smolovsk: the Kazan mentioned in 1376 must be Bulgar (the present Bulgarians in the district of Spassk), the "Great Town" of the Bulgarians, the ruins of which are among the most notable in the Kazan region; and the Kazan of even some of the later chronicles is to be identified with Koshan on the Kama. Nor is the present the original of Kazan proper, on the banks of the Kama; are extensive remains of *Iakt* (Tartar for "Old") Kazan, near a modern village of the same name. Kazan was laid waste by Pugachev, and the confiscations of 1815 and 1825 were especially destructive. During the French invasion the Moscow university took asylum in the town.

The name of Kazan Tartars is given, not only to those of the government of Kazan, but to those of Ufa, Samara, Vyatka, Semotoff, Penza, Nizhni Novgorod, Orenburg, and Tamboff. In 1870 they amounted altogether to 1,060,000. In many ways they differ considerably from those of Astrakhan, the Crimea, &c. They have pretty certainly incorporated a good deal of Bulgarian blood.

The history of Kazan has been written by Tarsarelli (1841), Leyteff, Kurbski, and others. The evidence of Arabic, Tartar, and Russian writers in regard to the antiquities of town and government has been collected by Shipilovsk (*Ziv. i Zap. Imp. Kas. Gv.* 1877, pp. 1-586). A bibliography of the Oriental books published in this town is given in *Bull. of the St. Petersburg Academy*, 1867. Compare Louis Lager, "Kazan et les Tartares," in *Bibl. Univ. de Genève*, 1874.

KAZINCZY, FERENCZ or FRANCIS (1769-1831), an Hungarian author, known as the most indefatigable agent in the regeneration of the Magyar language and literature at the end of the 18th and beginning of the 19th century, was born 27th October 1769, at Er-Semlyén, in the county of Bihar, Hungary. After passing through the gymnasium of Sáros-Patak, he studied law at Kassa and Epres, and in Pest, where he also obtained a thorough knowledge of French and German literature, and made the acquaintance of Gideon Ráday, who allowed him the use of his library, and encouraged him in literary pursuits. In 1784 Kazinczy became subnotary for the county of Abodj, and in 1786 he was nominated inspector of schools at Kassa. There he began to devote himself to the restoration of the Magyar language and literature by translations from classical foreign works, and by the augmentation of the native vocabulary from ancient Magyar sources. In 1788, with the assistance of Baróti Szabó and John Bacányi, he started at Kassa the first Magyar literary magazine, *Magyar Museum*; the *Orpheus*, which succeeded it in 1790, was of his own creation. Although, upon the accession of Leopold II., Kazinczy, as a non-Catholic, was obliged to resign his post at Kassa, his literary activity in no way decreased, and he not only assisted Gideon Ráday in the establishment and direction of the first Magyar dramatic society, but also enriched the repertoire with several translations from foreign authors. His *Hamlet*, which first appeared at Kassa in 1790, is a rendering from the German version of Schröder. Having become implicated in the democratic conspiracy of the abbot Martinovsky, Kazinczy was arrested on the 14th December 1794, conveyed to Buda, tried, and condemned to death; but the sentence was commuted to imprisonment. He was released in 1801, and shortly afterwards married Sophia Török, daughter of his former patron, and retired to his small estate at Szépföld on "Fairhill," near Sátor-Ujhely, in the county of Zemplén. In 1828 he took an active part in the conferences held for the establishment of the Hungarian academy, in the historical section of which he became the first corresponding member. He died of Asiatic cholera, at Szépföld, on the 23d August 1831, in the seventy-second year of his age.

Kazinczy, although possessing great beauty of style, cannot be regarded as a powerful and original thinker; his fame is chiefly due to the felicity of his translations from the masterpieces of Lessing, Goethe, Wieland, Klopstock, Ossian, Le Rochefoucauld, Marmontel, Molière, Metastasio, Shakspeare, Sterne, Cicero, Xenophon, Anacreon, and many others. He also edited the works of Barkey (Pest, 1812, 8 vols.) and of the poet Zany (1817, 2 vols.), and the poems of Dryden (1818, 8 vols.) and of John Keats (1825, 3 vols.). A collective edition of his works, consisting for the most part of translations, was published at Pest, 1814-1816, in 9 vols. His original productions, largely made up of letters, were edited by Joseph Bajai and Francis Földy at Pest, 1830-45, in 5 vols. Editions of his poems appeared in 1869 and in 1869. See HUNGARY, vol. xii. p. 877.

KEAN, CHARLES JOHN (1811-1868), tragedian, son of Edmund Kean noticed below, was born at Waterford, Ireland, 18th January 1811. In his fourteenth year he was sent to Eton College, where he remained three years. The name of Kean secured him an engagement at Drury Lane Theatre, where he made his debut 1st October 1827, in the character of Norval, but failed to create a very favourable impression, his talents being such as required long practice and careful study for their development; and his continued failure to achieve popularity led him to leave London in the spring of 1828 for the provinces. After a visit to America in 1830, where he was received with much favour, he in 1833 appeared at Covent Garden as Sir Edmund Mortimer, but his success was not pronounced enough to encourage him to remain long in London, especially as he had already in the provinces won a high position. In January 1838 he returned to Drury Lane, and played Hamlet with a success which gave him a place among the principal tragedians of his time. After his marriage with the actress Miss Ellen Tree in 1842, he paid a second visit to America. Returning to England in 1847, he entered on a successful engagement at the Haymarket, and in 1850, along with Mr Kelly, he became lessee of the Princess Theatre. The most noteworthy feature of his management was a series of gorgeous Shakspearean revivals. Charles Kean cannot be called a great tragic actor. He did all that could be done by the persevering cultivation of his powers, and in many ways manifested the possession of high intelligence and refined taste, but his defects of person and voice made it impossible for him to give a representation at all adequate of the varying and subtle emotions characteristic of pure tragedy. In melodramatic parts such as Louis XI. and the Corsican Brothers his success was unequivocal and complete. From his "tour round the world" Kean returned in 1866 in broken health, and he died at London, January 22, 1868.

The Life and Theatrical Times of Charles Kean, by John William Cole, appeared in 1860 in two volumes.

KEAN, EDMUND (1787-1853), an English actor, chiefly celebrated as the impersonator of Shakspearean characters, was born at Chancery Lane, London, November 4, 1787. His reputed father was Aaron Kean, stage carpenter, and his mother was a strolling actress, Ann Carey, granddaughter of Henry Carey, the author of the *National Anthem*, and the natural son of George Savile, marquis of Halifax. When only in his fourth year Kean made his first appearance on the stage as Cupid in one of Novarre's ballets at the opera-house. His fine black eyes, his bright vivacity and cleverness, and his ready affection to those who treated him with kindness, made him in childhood a universal favourite, but the harsh circumstances of his lot, and the want of proper restraint, while they developed strong self-reliance, fostered wayward tendencies. About 1794 a few persons benevolently provided the means of sending him to school, where he mastered his tasks with remarkable ease and rapidity; but finding this restraint intolerably irksome, he shipped himself as a cabin boy at Portsmouth. Soon discovering that he had only escaped to a more rigorous bondage, he

counterfeited both deafness and lameness with a lustrous mastery which deceived even the physicians at Madras. On his return to England he sought the protection of his uncle Moses Kenn, mimic, ventriloquist, and general entertainer, who, besides continuing his pantomimic studies, introduced him to the study of Shakespeare. At the same time Miss Tidswell, an actress who had been specially kind to him from infancy, taught him the principles of acting. On the death of his uncle he was taken charge of by Miss Tidswell, and under her direction he began the systematic study of the principal Shakespearean characters, displaying even at this early period the peculiar originality of his genius by interpretations entirely different from those of Kenble. His brilliant talents and interesting countenance induced a Mrs Clarke of Guildford Street, Russell Square, to adopt him, but the unlucky remark of a visitor so touched his sensitive pride that he suddenly left her house and went back to his old surroundings. In his fourteenth year he obtained an engagement to play leading characters for twenty nights in York Theatre, appearing as Hamlet, Hastings, and Cato. Shortly afterwards, while he was in the strolling troupe of Richardson, the rumour of his abilities reached the ear of King George III., who commanded him to recite at Windsor Castle. It is affirmed that this incident led some gentlemen to send him to Eton College; but the next three years of his life, from 1803 to 1806, are without authentic record. In 1807 he played leading parts in the Belfast theatre along with Mrs Siddons, who said that he "played very well," but that "there was too little of him to make a great actor." An engagement in 1808 to play leading characters in Beverley's provincial troupe was brought to an abrupt close by his marriage with Miss Chambers, the leading actress, and for several years after his prospects were so dark that, when contemplating the possibility of a debut in London, he was in the habit of exclaiming, "If I succeed I shall go mad." In 1814, however, the committee of Drury Lane theatre, the fortunes of which were then so low that bankruptcy seemed inevitable, resolved to give him a chance among the "experiments" they were making to win a return of popularity. His debut there on the 28th January as Shylock roused the audience to almost uncontrollable enthusiasm, and successive appearances in Richard III., Hamlet, Othello, Macbeth, and Lear only served to demonstrate to the fullest the greatness of his powers and his complete mastery of the whole range of tragic emotion.

Probably the irregular habits of Keen, even from the period when he became famous, were prejudicial to the refinement of his taste, and latterly they tended to exaggerate his special defects and mannerisms. The adverse decision in the divorce case Cox v. Keen, and his consequent separation from his wife, roused against him such bitter feeling as almost compelled him to retire permanently into private life. Ultimately he was received with all the old favour, but the contest by its effects both on his bodily health and on his feelings had made him so dependent on the use of stimulants that the gradual deterioration of his gifts was inevitable. Still, even in their decay his great powers triumphed during the moments of his inspiration over the absolute wreck of his physical faculties, and compelled admiration when his gait had degenerated into a weak hobble, when the lightning brilliancy of his eyes had become dull and bloodshot, and the tones of his matchless voice were marred by rough and grating hoarseness. His last appearance on the stage was at Covent Garden, on the 25th March 1833, when he played Othello to his son's Iago. At the words "Villain, be sure" in scene 3 of act iii. he suddenly broke down, and fell insensible into his son's arms. He died at Richmond, 15th May 1833.

It was especially in the impersonation of the great creations of Shakespeare's genius that the varied beauty and grandeur of the acting of Keen were displayed in their highest form, although probably his most powerful character was Sir Giles Overreach, the effect of his first impersonation of which was such that the pit rose *en masse*, and even the actors and actresses themselves were overcome by the terrific dramatic illusion. His only personal disadvantage as an actor was his small stature. His countenance was strikingly interesting and unusually mobile; he had a matchless command of facial eloquence, his fine eyes scintillated even the slightest shades of emotion and thought; his voice, though weak and harsh in the upper register, possessed in the lower range tones of penetrating and relentless power, and a thrilling sweetness like the wistfulness of the finest mmeo, above all, in the grand moments of his passion, his intellect and soul seemed to rise beyond material barriers and to glorify physical defects with their own greatness. Keen specially excelled as the exponent of passion. In Othello, Iago, Shylock, and Richard III., characters utterly different from each other, but in which the predominant element is some form of passion, his identification with the personality, as he had conceived it, was as nearly as possible perfect, and each isolated phase and aspect of the plot was elaborated with the minutest attention to details, and yet with an absolute subordination of these to the distinct individuality he was endeavouring to portray. If the range of character in which Keen attained supreme excellence was narrow, no one except Garrick has been so successful in so many great impersonations. Unlike Garrick, he had no true talent for comedy, but in the expression of biting and satirising wit, of grim and gloomy gaiety, he was unsurpassed.

See Proctor's *Life of Keen*, but especially the *Life of Edmund Keen*, by F. W. Hawkins, 2 vols., 1880, and the authorities therein mentioned. Some interesting details will also be found in Edward Stirling's *Old Drury Lane*, 1881.

KEATS, JOHN, born October 29, 1795, published his first volume of verse in 1817, his second in the following year, his third in 1820, and died of consumption at Rome, February 23, 1821, in the fourth month of his twenty-sixth year. In his first book there was little forecast of anything greatly or even genuinely good; but between the marshy and sandy flats of sterile or futile verse there were undoubtedly some few purple patches of formal promise. The style was frequently detestable—a mixture of sham Spenserian and mock Wordsworthian, alternately florid and arid. His second book, *Endymion*, rises in its best passages to the highest level of Barnfield and of Lodge, the two previous poets with whom, had he published nothing more, he might most properly have been classed, and thus, among minor minstrels, is no unenviable place. His third book raised him at once to a foremost rank in the highest class of English poets. Never was any one of them but Shelley so little of a marvellous boy and so suddenly revealed as a marvellous man. Never has any poet suffered so much from the chaotic misarrangement of his poems in every collected edition. The rawest and the rankest rubbish of his fitful spring is bound up in one sheaf with the ripest ears, flung into one basket with the richest fruits, of his sudden and splendid summer. The *Ode to a Nightingale*, one of the final masterpieces of human work in all time and for all ages, is immediately preceded in all editions now current by some of the most vulgar and fulsome doggerel ever whispered by a vapid and effeminate rhymester in the sickly stage of whelphood. Shelley, up to twenty, had written little or nothing that would have done credit to a boy of ten; and of Keats also it may be said that the merit of his work at twenty-five was hardly by comparison more wonderful than its demerit at twenty-two. His first book fell as flat as it deserved to fall; the reception of his second, though less considerate than on the whole it deserved, was not more contemptuous than that of immeasurably better books published about the same time by Coleridge, Landor, and Shelley. A critic of exceptional carefulness and candour might have noted in the first book so singular an example of a stork among the cranes as the famous and noble sonnet on Chapman's Homer; a just judge would have indicated, a partial advocate might have exaggerated, the value of such golden grain amid a garish harvest of tares as the hymn to Pan and the translation

into verse of Titian's Bacchanal which glorify the weedy wilderness of *Endymion*. But the hardest thing said of that poem by the *Quarterly* reviewer was unconsciously echoed by the future author of *Adonais*—that it was all but absolutely impossible to read through, and the obscurer insolence of the "Blackguard's Magazine," as Landor afterwards very justly labelled it, is explicable though certainly not excusable if we glance back at such a passage as that where Endymion exchanges fulsome and liquorish endearments with the "known unknown from whom his being slips such darling (!) essence." Such nauseous and pitiful phrases as these, and certain passages in his correspondence, make us understand the source of the most offensive imputations or insinuations levelled against the writer's manhood, and, while admitting that neither his love-letters, nor the last piteous outcries of his wailing and shreking agony, would ever have been made public by merciful or respectful editors, we must also admit that, if they ought never to have been published, it is no less certain that they ought never to have been written; that a manifold kind of man or even a manly sort of boy, in his love-making or in his suffering, will not howl and snivel after such a lamentable fashion. One thing hitherto inexplicable a very slight and rapid glance at his amatory correspondence will amply suffice to explain: how it came to pass that the woman so passionately beloved by so great a poet should have thought it the hopeless attempt of a mistaken kindness to revive the memory of a man for whom the best that could be wished was complete and compassionate oblivion. For the sake of the man's nature presented to her inspection, this probably was all that charity or reason could have desired. But that there was a finer side to the man, even if considered apart from the poet, his correspondence with his friends and their general evidence to his character give more sufficient proof than perhaps we might have derived from the general impression left on us by his works, though indeed the preface to *Endymion* itself, however illogical in its obviously implied suggestion that the poem published was undeniably unworthy of publication, gave proof or hint at least that after all its author was something of a man. And the eighteenth of his letters to Miss Brawne stands out in bright and brave contrast with such as seem incompatible with the traditions of his character on its manlier side. But if it must be said that he lived long enough only to give promise of being a man, it must also be said that he lived long enough to give assurance of being a poet who was not born to come short of the first rank. Not even a hint of such a probability could have been gathered from his first or even from his second appearance; after the publication of his third volume it was no longer a matter of possible debate among judges of tolerable competence that this improbability had become a certainty. Two or three phrases cancelled, two or three lines erased, would have left us in *Lamia* one of the most faultless as surely as one of the most glorious jewels in the crown of English poetry. *Isabella*, feeble and awkward in narrative to a degree almost incredible in a student of Dryden and a pupil of Leigh Hunt, is overcharged with epical effects of splendid and pathetic expression beyond the reach of either. *The Eve of St Agnes*, aiming at no doubtful success, succeeds in evading all casual difficulty in the line of narrative; with no shadow of pretence to such interest as may be derived from stress of incident or depth of sentiment, it stands out among all other famous poems as a perfect and unsurpassable study in pure colour and clear melody—a study in which the figure of Madeline brings back upon the mind's eye, if only as moonlight recalls a sense of sunshine, the nuptial picture of Marlowe's Haro and the sleeping presence of Shakespeare's Imogen. Beside this poem should always be placed the

less famous but not less precious *Eve of St Mark*, a fragment unexacted for the simple perfection of its perfect simplicity, exquisite alike in suggestion and in accomplishment. The triumph of *Hyperion* is as nearly complete as the failure of *Endymion*, yet Keats never gave such proof of a manly devotion and rational sense of duty to his art as in his resolution to leave this great poem unfinished, not, as we may gather from his correspondence on the subject, for the pitiful reason assigned by his publishers, that of discouragement at the reception given to his former work, but on the solid and reasonable ground that a Miltonic study had something in its very scheme and nature too artificial, too studious of a foreign influence, to be carried on and carried out at such length as was implied by his original design. Fortified and purified as it had been on a first revision, when much introductory allegory and much tentative effusion of sonorous and superfluous verse had been rigorously clipped down or pruned away, it could not long have retained spirit enough to support or inform the shadowy body of a subject so little charged with tangible significance. The faculty of assimilation as distinguished from imitation, than which there can be no surer or stronger sign of strong and sure original genius, is not more evident in the most Miltonic passages of the revised *Hyperion* than in the more Shakespearean passages of the unvisited tragedy which no radical correction could have left other than radically incorrigible. It is no conventional exaggeration, no hyperbolic phrase of flutter with more sound than sense in it, to say that in this elastic and puerile play of *Othello the Great* there are such verses as Shakespeare might not without pride have signed at the age when he wrote and even at the age when he rewrote the tragedy of *Romeo and Juliet*. The dramatic fragment of *King Stephen* shows far more power of hand and gives far more promise of success than does that of Shelley's *Charles the First*. Yet we cannot say with any confidence that even this far from extravagant promise would certainly or probably have been kept; it is certain only that Keats in these attempts did at least succeed in showing a possibility of future excellence as a tragic or at least a romantic dramatist. In every other line of high and serious poetry his triumph was actual and consummate; here only was it no more than potential or incomplete. As a ballad of the more lyrical order, *La Belle Dame sans Merci* is not less absolutely excellent, less triumphantly perfect in force and clearness of impression, than as a narrative poem is *Lamia*. In his lines on Robin Hood, and in one or two other less noticeable studies of the kind, he has shown thorough and easy mastery of the beautiful metre inherited by Fletcher from Barnfield and by Milton from Fletcher. The simple force of spirit and style which distinguishes the genuine ballad manner from all spurious attempts at an artificial simplicity was once more at least achieved in his verses on the crowning creation of Scott's humbler and manlier genius—Meg Merrilies. No little injustice has been done to Keats by such devotees as fix their mind's eye only on the more salient and distinctive notes of a genius which in fact was very much more various and tentative, less limited and peculiar, than would be inferred from an exclusive study of his more specially characteristic work. But within the limits of that work must we look of course for the genuine credentials of his fame; and highest among them we must rate his unequalled and unrivalled odes. Of three perhaps the two nearest to absolute perfection, to the triumphant achievement and accomplishment of the very utmost beauty possible to human words, may be that to Autumn and that on a Grecian Urn; the most radiant, fervent, and musical is that to a Nightingale; the most pictorial and perhaps the tenderest in its ardour of passionate fancy is that to Psyche; the subtlest in sweetness of thought and feeling is that on

Melancholy. Greater lyrical poetry the world may have seen than any that is in these; lovelier it surely has never seen, nor ever can it possibly see. From the divine fragment of an unfinished ode to *Masa* we can but guess that if completed it would have been worthy of a place beside the highest. Its remaining lyrics have many beauties about them, but none perhaps can be called thoroughly beautiful. He has certainly left us one perfect sonnet of the first rank; and as certainly he has left us but one.

Keats, on high and recent authority, has been promoted to a place beside Shakespeare; and it was long since remarked by some earlier critic of less note that as a painter of flowers his touch had almost a Shakespearian felicity,—recalling, a writer in our own day might have added, the hand of M. Fantin on canvass. The faultless force and the profound subtlety of this deep and cunning instinct for the absolute expression of absolute natural beauty can hardly be questioned or overlooked; and this is doubtless the one main distinctive gift or power which denotes him as a poet among all his equals, and gives him right to a rank far ever beside Coleridge and Shelley. As a man, the two admirers who have done best service to his memory are, first and far foremost, Lord Houghton, and secondly Mr Matthew Arnold. These alone, among all who have written of him without the disadvantage or advantage of a personal acquaintance, have clearly seen and shown us the manhood of the man. That ridiculous and degrading legend which imposed so strangely on the generous tenderness of Shelley, while evoking the very natural and allowable laughter of Byron, fell to dust at once for ever on the appearance of this admirable and unsurpassed biography which gave perfect proof to all times that "men have died and worms have eaten them," but not for fear of crimes or through suffering inflicted by reviews. Somewhat too sensually sensitive he may have been in either capacity, but the nature of the man was as far as was the quality of the poet above the pitiful level of a creature whose soul could "let itself be snuffed out by an article"; and in fact, owing doubtless to the accident of a death which followed so fast on his early appearance and his dubious reception as a poet, the insolence and injustice of his reviewers in general have been comparatively and even considerably exaggerated. Except from the chief fountain-head of professional ribaldry then open in the world of literary journalism, no roek of personal insult arose to offend his nostrils; and then as now the tactics of such unwashed malignants were inevitably suicidal; the references to his brief experiment of apprenticeship to a surgeon which are quoted from *Blackwood* in the shorter as well as in the longer memoir by Lord Houghton could leave no bad odour behind them save what might hang about men's yet briefer recollection of his assailant's unmemorable existence. The false Keats, therefore, whom Shelley pitied and Byron despised would have been, had he ever existed, a thing beneath compassion or contempt. That such a man could have had such a genius is almost evidently impossible; and yet more evident is the proof which remains on everlasting record that none was ever further from the chance of decline to such degradation than the real and actual man who made that name immortal.

(A. O. S.)

Subjoined are the most important facts in the life of Keats. He was born, as already stated, in London on October 29, 1795. At an early age he was sent to school at Enfield, and in 1810 he was apprenticed to a surgeon at Edmonton. On the completion of his apprenticeship, in 1816, he removed to London for the purpose of walking the hospitals, and soon made the acquaintance of Leigh Hunt, and subsequently that of Haydon, Hazlitt, Shelley, and others. After having published some sonnets in the *Boarmer*, of which Hunt was at that time editor, he was encouraged by the praise of his friends to give to the world a volume of *Poems* in 1817, and a second, entitled *Hyperion, a Poetic Romance*, in the

following year. Meanwhile, symptoms of hereditary lung-disease having shown themselves, he spent some months in visiting the English lake district and portions of Scotland and Ireland, but without re-establishing his failing health, on his return to London the despondency which had fallen upon him on this account was deepened by the death of his younger brother. Soon after this event he first became acquainted with Miss Haywood, and the friendship rapidly grew into a passion which combined with statistical circumstances and the steady progress of disease to give a tragical cast to all that remained of his brief career. In 1820 the results of his literary activity during the two preceding years were published in *Letters, Imagination, the life of St Agnes, and other Poems*. In autumn of the same year, having been advised to winter in a more genial climate, he sailed for Italy. The voyage proved of little advantage, and after some months of suffering he died at Rome on February 23, 1821. *The Life, Letters, and Literary Remains of Keats* were published in two volumes by R. Monckton Milnes in 1838. *The Letters of John Keats to Fanny Brawne*, with introduction and notes by Harry Buxton Forman, appeared in 1878.

KERLE, JOHN (1792-1866), the poet of the *Christian Year*, was born on St Mark's Day (April 25), 1792, at Fairford, Gloucestershire. He was the second child and eldest son of the Rev. John Kerle and Sarah Maule; three sisters and one brother completed the family circle. Descended from a family which had attained some legal eminence in the time of the Commonwealth, John Kerle, the father of the poet, was vicar of Coln St Aldwyn, but lived at Fairford, about 3 miles distant from his cure. He was a clergyman of the old High Church school, whose adherents, untouched by the influence of the Wesleys, had moulded their piety on the doctrines of the non-jurors and the old Anglican divines. Himself a good scholar, he did not send his son to any school, but educated him and his brother at home so well that both obtained scholarships at Corpus Christi College, Oxford. John was elected scholar of Corpus in his fifteenth, and fellow of Oriol in his nineteenth year, April 1811. In Easter term 1810 he had obtained double first class honours, a distinction which had been obtained only once before, and that by Sir Robert Peel. After his election to the Oriol fellowship, Kerle gained the University prizes, both for the English essay and also for the Latin essay. But he was more remarkable for the rare beauty of his character than even for academic distinctions. Sir John Taylor Coleridge, his fellow scholar at Corpus and his life-long friend, says of him, looking back on his youth, after their friendship of five and fifty years had closed, "It was the singular happiness of his nature, remarkable even in his undergraduate days, that love for him was always sanctified by reverence—reverence that did not make the love less tender, and love that did but add intensity to the reverence." Oriol College was, at the time when Kerle entered it, the centre of all the finest ability in Oxford. Copeland, Davison, Whately, were among the fellows who elected Kerle; Arnold, Pusey, Newman, were soon after added to the society. In 1815 Kerle was ordained deacon, and priest in 1816. His real bent and choice were towards a pastoral cure in a country parish; but he remained in Oxford, acting first as public examiner in the schools, then as tutor in Oriol, till 1823. In summer he sometimes took clerical work, sometimes made tours on foot through various English counties, during which he was composing poems, which afterwards took their place in the *Christian Year*. He had a rare power of attracting to himself the finest spirits, a power which lay not so much in his ability or his genius as in his character, so simple, so humble, so pure, so unworldly, yet wanting not that severity which can stand by principle and maintain what he holds to be the truth. In 1823 he left Oxford, and returned to Fairford, there to assist his father, and with his brother to serve one or two small and poorly endowed curacies in the neighbourhood of Coln. He had made a quiet but deep impression on all who came within his influence in Oxford,

and during his five years of college tutorship had won the affection of his pupils, some of whom afterwards rose to eminence. But it was to pastoral work, and not to academic duty, that he thenceforth devoted himself, associating with it, and scarcely placing on a lower level, the affectionate discharge of his duties as a son and brother. Filial piety influenced in a quite unusual degree his feelings and his action all life through. It was in 1837, a few years after he settled at Farnford, that he published the *Christian Year*. The poems which make up that book had been the silent gathering of years. Keble had purposed in his own mind to keep them beside him, correcting and improving them, as long as he lived, and to leave them to be published only "when he was fairly out of the way." This resolution was at length overcome by the importunities of his friends, and above all by the strong desire of his father to see his son's poems in print before he died. Accordingly they were printed in two small volumes in Oxford, and given to the world in June 1837, but with no name on the title page. The book continued to be published anonymously, but the name of the author soon transpired. Probably no book of poetry in this century has had a wider circulation. Between 1837 and 1873 one hundred and fifty-eight editions had issued from the press, and since the latter date it has been largely reprinted both by the original publishers and by others. The author, so far from taking pride in this widespread reputation, veiled all his life long to wish to discontinue his name with the book, and "as if he would rather it had been the work of some one else than himself." This feeling arose from no false modesty; it was because he knew that in these poems he had painted his own heart, the best part of it; and he doubted whether it was right thus to exhibit himself, and by the revelation of only his better self, to win the good opinion of the world, on which he knew that a war had been pronounced.

Towards the close of 1831 Keble was elected to fill the chair of the poetry professorship in Oxford, as successor to his friend and admirer, Dean Milman. This chair he occupied for ten years, probably the most eventful ten years which Oxford has seen since the Reformation. The professor is required by statute to deliver at least one lecture during each of the three terms that make up the academic year; and during Keble's tenure these lectures were still required to be in Latin. In the course of his professorship he delivered a series of lectures, clothed in excellent idiomatic Latin, in which he expounded a theory of poetry which was original and suggestive, and which grew naturally out of his own character and habits of mind. He looked on poetry as a vent for overcharged feeling, or a full imagination, or some imaginative regret, which had not found their natural outlet in life and action. It was a relief provided for those feelings which are apt to fill the mind too full, and to overburden the heart. This suggested to him a distinction between what he called primary and secondary poets,—the first employing poetry to relieve their own hearts, the second, poetic artists, composing poetry from some other and less impulsive motive. Of the former kind were Homer, Lucretius, Burns, Scott; of the latter were Euripides, Dryden, Milton. This view is set forth in an article contributed to the *British Critic* in 1838 on the life of Scott, and was more fully developed in two volumes of *Prælectiones Academicæ*.

His regular visits to Oxford kept him in intercourse with his old friends in Oxial common room, and made him familiar with the currents of feeling which swayed the university. Catholic emancipation and the Reform Bill had deeply stirred, not only the political spirit of Oxford, but also the church feeling which had long been stagnant. Cardinal Newman writes, "On Sunday July 14, 1833, Mr Keble preached the assize sermon in the University pulpit.

It was published under the title of *National Apostasy*. I have ever considered and kept the day as the start of the religious movement of 1833." The occasion of this sermon was the suppression, by Earl Grey's Reform ministry, of ten Irish bishoprics. Against the spirit which would treat the church as the mere creature of the state Keble had long chafed inwardly, and now he made his outward protest, asserting the claim of the church to a heavenly origin and a divine prerogative. About the same time, and partly stimulated by Keble's sermon, some leading spirits in Oxford and elsewhere began a concerted and systematic course of action to revive High Church principles and the ancient patristic theology, and by these means both to defend the church against the assaults of its enemies, and also to raise to a higher tone the standard of Christian life in England. This design embodied itself in what is known as the Tractarian movement, a name it received from the once famous *Tracts for the Times*, which were the vehicle for promulgating the new doctrines. If Keble is to be reckoned, as Dr Newman would have it, as the primary author of the movement, it was from Dr Pusey that it received one of its best known names, and in Dr Newman that it soon found its genuine leader. To the tract, which did so much to spread High Church views, Keble made only four contributions.—No. 4, containing an argument, in the manner of Bishop Butler, to show that adherence to apostolical succession is the safest course, No. 13, which explains the principle on which the Sunday lessons in the church services are selected, No. 40, on marriage with one who is unbaptized; No. 89, on the mysticism attributed to the early fathers of the church. Besides these contributions from his own pen, he did much for the cause by suggesting subjects, by reviewing tracts written by others, and by lending to their circulation the weight of his personal influence.

In 1835 Keble's father died at the age of ninety, and soon after this his son married Miss Clarke, left Farnford, and settled at Hursley vicarage in Hampshire, a living to which he had been presented by his friend and attached pupil, Sir William Hesketh, and which continued to be Keble's home and care for the remainder of his life.

In 1841 the tracts were brought to an abrupt termination by the publication of Newman's tract No. 90. All the Protestantism of England was in arms against the author of the obnoxious tract. Keble came forward at the time, desirous to share the responsibility and the blame, if there was any; for he had seen the tract before it was published, and approved of it. The same year in which burst this ecclesiastical storm saw the close of Keble's tenure of the professorship of poetry, and thenceforward he was seen but rarely in Oxford. No other public event ever affected Keble so deeply as the secession of his friend Mr Newman to the Church of Rome in 1845. It was to him both a public and a private sorrow, which nothing could repair. But he did not lose heart; at once he threw himself into the double duty, which now devolved on himself and Dr Pusey, of counselling the many who had hitherto followed the movement, and who now in their perplexity, might be tempted to follow their leader's example, and at the same time of maintaining the rights of the church against what he held to be the encroachments of the state, as seen in such public acts as the Gorham judgment, and the decision on *Essays and Reviews*. In all the ecclesiastical contests of the twenty years which followed 1845, Keble took a part, not loud or obtrusive but firm and resolute, in maintaining those High Anglican principles with which his life had been identified. These absorbing duties, added to his parochial work, left little time for literature. But in 1846 he published the *Lycæum centenary*; and in 1868 he completed a life of Bishop Wilson.

In the late autumn of the latter year, Keble left Hursley for the sake of his wife's health, and sought the milder climate of Bournemouth. There he had an attack of paralysis, from which he died on the 29th March 1866. He was buried in his own churchyard at Hursley; and in little more than a month his wife was laid by her husband's side.

It is as a poet that Keble was best known during his life, and it is as a poet that he will be remembered. His poetical works are the *Christian Year* (1827), *A Select Person of the Pastors* (1850), *Lyræ Innocentium* (1846), and a volume of poems published posthumously.

Keble, though himself childless, was a special lover of children, and the *Lyræ Innocentium* expresses this characteristic. It is a book "about children, their ways, and privileges." It begins with their baptism, follows them through their cradle life and infancy, their childhood sports, troubles, encouragements, warnings, the lessons taught them by nature, those taught them by grace, dwells on their sicknesses, and their deaths. It is a book for parents, especially for mothers. The range of subjects is too limited, and the turn of thought often too subtle, to allow it to be widely popular. But Judge Coleridge pronounced it, if not equal to the *Christian Year* as a whole, yet more than equal to it in parts; and Dean Stanley thinks that "it has more of the true fire of genius, more of the true real of poetic diction. However this may be, it is by the *Christian Year* that Keble won the ear of the religious world, and will retain it. It was a happy thought that dictated the plan of the book, to furnish a meditative religious lyric for each Sunday of the year, and for each saint's day and festival of the English Church. The subject of each poem is generally suggested by some part of the lessons or the gospel, or the epistle for the day. One thing which gives these poems their strangely unique power is the sentiment to which they appeal, and the saintly character of the poet who makes the appeal, illumining more or less every poem. That to which the *Christian Year* appeals is the religious and devotional sentiment which, however hidden, exists more or less in most men. In the words of Sir J. T. Coleridge, "in this feeling it unites its unending appeal, with a voice so earnest, so sincere, so in its helplessness, so unpretending as to the speaker, yet so authoritative and confident as to the cause it pleads, that for the time it seems irresistible."

The preface begins with observations very important in "a sober standard of feeling in matters of practical religion," and indicates that the object of the book is to calm excitement, and to exhibit the soothing tenderness which pervades the Book of Common Prayer. The motto on the title page, "In quietness and confidence shall be your strength," is the keynote to which the whole book is set. The main characteristics which go to make up the charm of this small volume are these—

1. The peculiar tones of religious feeling that pervades it, at once deep, pure, and tender, sober and severely self-denying. The undertones of each poem come out in verse like this—

"The spirit to entice may wander round,
Caught by earthly answers as they float,
But for the soul no help is found,
Save Him who made it free."

Closely connected with this there is a more personal feeling towards our Lord, in His whole nature at once human and divine, than had ever before appeared in English poetry, even in that of Charles Wesley or Cowper. This runs through all the poems; it comes out especially in such verses as these

"Our Saviour's face beauteous,
Beet as with transforming power,
Thou art too, faintly shining."

and again,

"Who loves the Lord aright
No soul of man can writhen find;
All will be precious in His sight,
Shine Christ on all his kind,
But chiefly Christians come, for they
Though weak and sated with sinful day,
Are yet to eyes that read them true,
All glowering with heavenly dew."

2. A second note of the *Christian Year* is reverence for the church, and for the pastoral office within it,—a solemn sense of its dignity and its awful responsibility.

3. A third note is the strong and tender affection for home and friends, the filial piety, which everywhere pervades it. This appears notably in the poem for St Andrew's Day, in the two opening stanzas of the poem on Whit Monday, in some verses of the poem for the 4th Sunday in Advent, and in many more.

4. A prevailing spirit of modesty and of delicate reserve, very unlike the raucous and noisy poets are often credited. Combined with this is a special tenderness for those persons and things which the world thinks least of—for those who plan forgotten in hidden nooks, for the downtrodden and the despaired. These sympathies appear at every turn of the book,—especially, perhaps, in such

poems as that for the 4th Sunday in Lent, that for Visitation of the Sick, and in two well-known stanzas in the poem for St Matthew's Day, not to mention many other like passages.

5. Besides these qualities of Keble's heart as a man, there are others which belong to him especially as a poet. Prominent among these is his love of nature, particularly for the more original and unworked features of English landscape. In these he seemed most to delight, as interwoven with home thoughts and sentiments, and because, as he expresses it,

"Humble scenes and simple views
Lovely thoughts may best inspire."

Many a scene from the neighbourhood of Farnford and Oxford, many a fleeting image caught there in casual walks, has been imprinted, naturally and beautifully, into the web of his devout meditations.

6. The intimacy with the Bible which is manifest in the pages of the *Christian Year*, and the unobtrusive fidelity with which Biblical sentiments and language are introduced, have done much to endear these poems to all Bible readers, not this only, but the fidelity with which Biblical accuracy is rendered ("The exactness of the descriptions of Palestine, which Keble had never visited, have been noted, and verified on this spot," by Dean Stanley. He points to features of the lake of Genesareth, which were first noticed in the *Christian Year*; and he observes that throughout the book "the Biblical accuracy is treated graphically as real scenery, and the Biblical history and poetry as real history and poetry.")

As to its style, the *Christian Year* is calm and grave in tone, and subdued in colour, as becomes its subjects and sentiments. The contemporary poets whom Keble most admired were Scott, Wordsworth, and, as we may add, Southey; and of these influences are visible in his diction. Yet he has a style of language and a cadence of his own, which steal into the heart with strangely soothing power. Some of the poems are faultless, after their kind, flowing from the first verse to the last, land in thought, vivid in diction, harmonious in their passive melody. In others there are superfluities in rhythm, conventionalities of language, obscurities or over-embellishments of thought, which mar the reader's enjoyment. Yet even the most defective poems commonly have, at least, a single verse, expressing some profound thought or tender shade of feeling, for which the sympathetic reader willingly pardons all other imperfections in the rest.

The real power of the *Christian Year* lies in this, that it brings home to the readers, as few poems works have ever done, a heart of love and saintly beauty. We may well believe that ages must elapse ere another such character shall again concur with a poetic gift and power of expression, which, if not of the highest, are still of a high order.

Keble's life was written by his life-long friend the late Mr Justice Coleridge. The following is a synopsis of his chief writings.—(1) *Verse published in Keble's Magazine—Christian Year*, 1827; *Psalter*, 1830; *Prælections Academicæ*, 1831; *Lyræ Innocentium*, 1846; *Bernonia Academicæ*, 1848; *Argument against Episcopate of Marriage*, 1848, 1861; *Substantiated Address*, 1861; *Life of Bishop Wilson*, 1881; *Argument Occasional and Periodical*, 1887. (2) *Posthumous Publications—Village Sermons on the Baptismal Service*, 1868; *Miscellaneous Poems*, 1869; *Lectures of Spiritual Counsel*, 1870; *Sermons for the Christian Year*, A.C., 11 vols., 1872-80; *Occasional Papers and Sermons*, 1871; *Devotional Service*, 1877; *Outline of Instruction or Meditation*, 1880. (J. C. S.)

KECSKEMÉT (Lat. *Egypolis*), a royal free town in the county of Pest-Pilis-Solt-Kis-Kun, Hungary, is situated in an extensive plain, on the railway between Szeged (Szegedin) and Budapest, 53 miles south-east of the latter, in 46° 54' N. lat., 19° 44' E. long. Kecskemét is a poorly built and straggling town. It contains Roman Catholic, Lutheran, and Calvinist churches, as also a synagogue. Among the educational and other establishments are a Calvinist upper gymnasium (since 1860) and juridical lyceum (1862), possessing a library and collection of pictures, a Roman Catholic (Piarist) upper gymnasium, founded in 1714, a Government technical school dating from 1874, monasteries belonging to the Piarist and Franciscan orders, a royal court of law, a hospital, orphan asylum, and theatre. The soil of the surrounding district, known as the Kecskemét heath, though generally arenaceous, is rendered productive by careful tillage. Soap is manufactured; and trade, promoted by the periodical fairs, is generally thriving. János Katona, the author of the famous historical drama *Bánk Bán*, was born at Kecskemét in 1792. The population in 1880 was 46,606, chiefly Magyars by nationality.

KEELING ISLANDS, or COCOS ISLANDS, also called by Henslow the Borneo Canal Islands, a group in the Indian Ocean, about 600 miles south of the coast of Sumatra, in 12° 5' S. lat. and 90° 55' E. long., well known

as having furnished Mr Darwin with the typical example of an atoll or lagoon island.¹ There are altogether twenty-three small islands, $\frac{3}{4}$ miles being the greatest width of the whole atoll.² The lagoon is very shallow, and the passages between many of the islands of such trifling depth that it is possible to "walk at low tide with some slight wading all the way from Direction Island to West Island." An opening on the northern side of the reef permits the entrance of vessels into the northern part of the lagoon, which forms a good harbour known as Port Refuge or Port Albion. Since Mr Darwin's visit some of the minor passages have become completely filled up.

The coco-nut (as the name Cocos Islands indicates) is the characteristic production, and is cultivated on all the islands. There are a few other trees (Sir E. Owen described seven kinds in 1880) and lesser plants; but the whole flora, exclusive of recent introductions, comprises less than thirty species. Of the twenty species, however, represented in Mr Darwin's collection, "nineteen belonged to different genera, and these again to no less than sixteen families." With the exception of man and the domestic pig, the rest appears to be the only mammal in the islands, and there are no free land birds, except domestic poultry. One of the commonest living creatures is a monstrous crab which lives on the coco-nuts, and in some places also there are great colonies of the pomegranate crab, which, to quote Mr Forbes as "labouring assiduously to make the soft pure white olivaceous mud into free-inhabitable land." The climate is temperate and extremely healthy. Terrible storms sometimes break over the island; and it has been more than once visited by earthquakes. The inhabitants "are well developed, strong, and of a wonderfully healthy appearance"; they belong originally to various parts of the Indian archipelago, Borneo, Sumatra, Celebes, &c.

The Keeling Islands were discovered in 1606 by William Keeling on his way home from the Moluccas.³ In 1823 Alexander Hare, an English adventurer, settled on the southernmost island with a number of slaves. Some two or three years after, a Scotchman, J. Ross, who had commanded a brig during the English occupation of Java, settled with his family on Direction Island, and his little colony was soon strengthened by Hare's runaway slaves. The Dutch Government had in an informal way claimed the possession of the islands since 1829; but they refused to allow Ross to hand the Dutch flag, and accordingly the place was taken under British protection in 1856. In 1873 it was attached to the government of Ceylon.

Besides Mr Darwin's *Journal of the Voyage of the Beagle* (1859) and the work already mentioned, see Henry O. Forbes in *Proc. Roy. Geog. Soc.*, December 1873 (with a good map); Komer in *Proc. Roy. Geog. Soc.*, 1881; A. van der Jagt in *Verh. Dut. Ges. van K. en N.*, xii., A. J. Dalmier in *Indes et Siam*; *Swettenham's*, iv., *Voyage of English Frigate "Porpoise"* (Berlin, 1860), and likewise papers on ichthyology in *Natuurk. Tijdschr. van Ned. Ind.*, vii., viii., xv., &c.

KEFF, more correctly El-Keff (El Kaf), a town of the regency of Tunis, about 95 miles south-west from the capital, and 75 miles south-east of Bone in Algeria, "on the western declivities of a rocky range of bold hills," 5 or 6 miles to the east of the course of the Wady Medjardak. It is considered the third in importance of the Tunisian towns, ranking after Tunis and Kairwan; and, though distant some twenty-two miles from the Algerian frontier, it is practically a frontier post, and its walls and citadel are kept in a state of defence. Keff is identified with the ancient Roman colony of Sica Veneria, which appears from the character of its Venus worship (Val. Max., ii. 6, §15) to have been a Phœnician settlement. Remains of ancient buildings (as, for example, of a temple of Hercules), and a considerable number of ancient Latin inscriptions tend to confirm the identification. Population about 12,000.

See Barth, *Die Küstenländer des Mittelmeers*, 1849; *Corpus Inscription. Lat.*, viii.; *Sombrun in Bull. de la Soc. de Géog. de Bordeaux*, 1878.

¹ *Geological Observations on Coral Reefs*, London, 1861; new ed., 1874.

² The names of the more important are as follows:—Hemburgh on North Island (the most northern of the group); Direction Island or in Malay Pulau Tikus (Mopse Island); Prison Island; Rios (Rijet) or Water Island; in Malay Pulau Tawan; South Island (Salmu or Fuzile); Long, West, or Rose Island.

³ His narrative is given by Forbes, and epitomized in Arley's *Dictionary*.

KEIGHLEY, locally Keithley, anciently Keighley, a market and manufacturing town in the northern division of the West Riding of Yorkshire, is beautifully situated in a deep valley near the junction of the Worth with the Aire. By the Midland Railway it is 95 miles south-east of Carlisle and 222 north of London. A canal between Liverpool and Hull affords it water communication with both west and east coasts. The town is rather irregularly built, and a considerable portion of it consists of workmen's cottages. Its growth has of late years been very rapid. Large reservoirs have been constructed for supplying water to the town. The principal buildings are the parish church of St Andrew in the late Perpendicular (dating from the time of Henry I., modernized in 1710, rebuilt with the exception of the tower in 1805, and again rebuilt in 1878), the Cnven bank, the court-house, the mechanics' institute and school of art, the theatre (in the Gothic style, completed in 1870, at a cost of £8000), the baths, the union workhouse, and the Liberal and Conservative clubs. The educational institutions are the Drake and Tomson's school for girls, the trade school for boys, the national schools, and several board schools. The manufactures consist chiefly of worsted and woollen goods, machinery, machine tools, and sewing and wringing machines. Iron-founding is also extensively carried on. The population of the local board district in 1871 was 19,776, and in 1881 had increased to 25,245.

Henry Keighley, who in the reign of Edward I. possessed the manor of Keighley, obtained for it from that monarch the privilege of a market, a fair, and a free warren. The town in 1846 was the scene of a skirmish between the royal and parliamentary troops.

KEI ISLANDS, a group in the East Indian archipelago, consisting of one large and several smaller islands, situated about 6° 30' S. lat. and 138° E. long, some 90 miles to the south of the western end of New Guinea, and between the southern Moluccas and the Aru Islands. The name, which appears in a great variety of spellings—Kee, Ke, Key, Ki, &c.—has been in use among Europeans from the days of Valentijn downwards, and may be the Spanish Cayo, a rocky island. The natives call the group Evar, the chief island Iut.

The Kei Islands have been very frequently visited, but in such a cursory fashion for the most part that there is considerable doubt in regard even to their general cartography. Of Great Kei the outline and extent are known, but as to the other islands—often lumped together under the name of Lesser Kei—even the number of the more important has yet to be determined. Cape Borang, the northern point of Great Kei, lies in 5° 17' Dullah-Darat, Dullah-Laut, Letman, and Hodjan are believed to be separate islands, though Dullah-Darat and Letman are parted only by a very narrow passage, and Letman and Hodjan may possibly be one. The seat of the rajah recognized by the Dutch Government as the chief authority in the group is Dullah on the west coast of Dullah-Darat.

The inhabitants of the Kei islands are supposed to number 18,000 or 20,000. A certain proportion of them (distinguished by the use of a special language and by the profession of Mohammedanism) are known to be descendants of natives of the Banda islands who had fled eastward before the encroachments of the Dutch. The great bulk of the people are still pagans, with rude statues of local deities and places of sacrifice indicated by flat-topped cairns. In physique the Kei islander is like the Aru islander, but more strongly built.

Coco-nuts, sago, fish, limestone, trepang, and timber are the chief productions of the islands. At Eki, on the east coast of Great Kei, there are extensive potteries which furnish earthenware for export as well as for local use.

The native prongs are well built, after the shape of a whole-boar.

See C. Boscher in *Tijdschr. van het Oost Gen.*, iv. J. B. J. van Doren in *Dijks, lot de Tweede, &c.*, van M. J. I., new series, iv. C. B. H. van Rosenberg, *Isis naar de Zuiderzee-landen*, Guido 'Ois's Comos, vol. iii; Veth, "Geogr. Antiek." (with map), in *Tijdschr. van het Oost Gen.*, ii, 1876.

KEIM, THEODORE (1825-1878), a prominent German theologian of the "mediation" school, was born December 17, 1825, at Stuttgart, where he attended the gymnasium, proceeding in 1843 to Tübingen, at which university he continued to study until 1848, F. C. Baur being the teacher who exercised the greatest influence over his thinking. For some time he held a private tutorial appointment, and in 1850 he attended classes in Bonn, returning in 1851 to his alma mater as "repetent." In 1857 he became diaconus at Esslingen, and two years afterwards rose to the rank of archidiaconus. From 1860 to 1873 he held the office of professor ordinarius of theology in Zürich, and from 1873 until shortly before his death in November 1878 he occupied a similar post at Giessen.

He wrote *Reformationsgeschichte der Reichsstadt Ulm*, 1851; *Schlecht'sche Reformationsgeschichte der zum Reichstage von Augsburg, 1555, Reformationsstädter der Reichsstadt Esslingen*, 1860; *Ambrusius Blarer, der Schwabische Reformator*, 1860; *Der Übertritt Konstantin's d. Gr. zum Christenthum*, 1862; two volumes of sermons entitled *Friedensworte zur Gemeindevorlesung*, 1861-62, and *Oelwein's Predigten*, 1878. But the works to which he owes the considerable celebrity he possesses among Protestant theologians even outside of Germany are those in which he has investigated, with much sense of independent research and acuteness of discernment as well as with unusual power of noble appreciation, the narrative of the life of Christ contained in the gospels. *Das menschliche Bildelement Jesu Christi* (1861), *Die geschichtliche Wörde Jesu* (1864), and *Der geschichtliche Christus* were followed by what without exaggeration may be called the truly great work, *Geschichte Jesu von Nazareth* (3 vols., 1867-72; English translation, 1878-77), of which the *Geschichte Jesu nach den Ergebnissen heutiger Wissenschaft, für unsere Kirche überliefert*, 1878, is a popular abridgment.

KEITH, an old Scotch family which takes its name from the barony of Keith in East Lothian, bestoweth, it is said, by Malcolm II. on a member of the house along with the office of hereditary grand marshal in reward of bravery shown in a battle against the Danes. The importance of the family was increased by a grant in 1320 of part of the forfeited estates of the earl of Buchan to Sir Robert Keith for his valour in support of the cause of Robert the Bruce, and by the inheritance in the next century of the lands of the Frasers of Kincardineshire through the marriage of Sir William Keith, who in 1458 was created Lord Keith and Earl Marshal of Scotland. William, earl marshal, great grandson of the first of the line, distinguished himself at the battle of Pinkie in 1547, and was a member of the council of the kingdom during the minority of Queen Mary. By his marriage with his cousin Margaret, daughter of Sir William Keith of Inverurie, he nearly doubled his estates, but, becoming involved in money embarrassments, he lived for some time in seclusion in his castle of Dunnottar, obtaining on that account the sobriquet of "William that kept the tower." He was succeeded in 1581 by his grandson George, fifth earl, who, besides having studied under the direction of Beza at Geneva, had acquired a comprehensive knowledge of the politics and customs of most of the courts of Europe. Probably for this reason he was chosen by King James to negotiate his marriage with Queen Anne of Denmark and bring her to Scotland. Throughout life he showed a keen interest in the advancement of learning. He was one of the commissioners appointed in 1582 to inquire into the management of King's College, Aberdeen, and out of his own private fortune he founded and endowed Marischal College in that city, which received a charter in 1593. He died at Dunnottar, April 5, 1623. The estates of the Keiths were forfeited on account of the part taken by

George Keith, tenth earl, and his brother Francis (see next article) in the rebellion of 1715. Through the influence of his brother with Frederick the Great, the earl became governor of Neufchatel. After the reversal of the standard he returned to Scotland, but soon made his way back to Berlin, where he died in April 1788. Through his death without issue the male line of the house became extinct. From the female line descended the Keith Elphinstones, one of whom, Sir George, was on account of his brilliant naval services created an Irish peer with the title of Baron Keith of Stonehaven Marischal. Sir John Keith, third son of the sixth earl marischal, was created Earl Kintore and Lord Keith of Inverurie and Keith Hall, on account of the part he was supposed to have taken in saving the regalia of Scotland when Dunnottar Castle, where they were deposited, was besieged by Cromwell.

See *Account of the Ancient and Noble Family of Keith*, by P. Buchan, 1828; and *Douglas's Scotch Peerage*.

KEITH, FRANCIS EDWARD JAMES (1696-1758), generally known as Marshal Keith, son of William the ninth earl marischal (see last article), was the most notable member of the house of Keith. Through his careful education under Bishop Keith, and his subsequent university curriculum at Edinburgh in preparation for the legal profession, he acquired that taste for literature which afterwards secured him the esteem of the most distinguished savants of Europe; but at an early period his preference for a soldier's career was decided and enthusiastic. The rebellion of 1715, in which he displayed qualities that gave some augury of his future eminence, compelled him to seek safety on the Continent. After spending two years in Paris, chiefly in studying at the university, he in 1719 took part in the ill-starred expedition of the Pretender to the Highlands of Scotland. He then passed some time at Paris and Madrid in obscurity and poverty, until he obtained the pay of a colonel from the king of Spain. Finding his Protestantism a barrier to promotion, he obtained from the king of Spain a recommendation to the emperor Peter II. of Russia, from whom he received the command of a regiment of the guards. In several Russian campaigns the calm, intelligent, and watchful valour which was his chief characteristic was displayed to such advantage that he obtained the rank of general and the reputation of being one of the ablest officers in the Russian service. Judging, however, that his rewards were not commensurate with his merits, he in 1747 offered his services to king Frederick of Prussia, who at once gave him the rank of field marshal, and gradually came to cherish towards him a strong personal affection and regard. In the subsequent wars of Frederick he displayed conspicuous ability, manifesting in critical contingencies a remarkable union of circumspection and promptitude. He was killed, 14th October 1758, at the battle of Hochkirch. Keith is described by Carlyle as "agacious, skilful, imperturbable, without fear and without noise, a man quietly ever ready"; and also as "not given to talk unless there is something to be said, but well capable of it then."

See *Varnhagen von Ense, Leben des Feldmarschalls Jakob Keith*, 1844; *Fragment of a Memoir of Field Marshal James Keith, written by himself, 1714-1784*, edited by Thomas Constable for the Spalding Club, 1843; and *Keith's Frederick the Great*.

KEJ, the capital of the province of Mekran (the Gedrosia of the Greeks) in Baluchistan, is situated in 26° N. lat. and 62° 60' E. long. There exists really no town, but a number of small villages dominated by a fort built upon a rock, on the eastern bank of the Kej river. This fort, like many others similarly placed throughout the country, is supposed to be impregnable, but is in fact of no strength except against the metallocks of the surrounding tribes.

Kej in former days was considered of very great importance by the rulers of Khelat, who have at various times marched large armies into the province with a view to maintaining their supremacy. At the commencement of the present century it had the reputation of being a town of considerable commercial importance, trading through Panjgur with Kandahar, with Kurrachee via Bayla, and with Muscat and the Persian Gulf by the seaport of Guader, distant about 80 miles. The present ruler of Khelat is able to exert but a feeble sway over this portion of his dominion, although he appoints a governor to the province. The principal tribe residing around Kej is that of the Gtchiki, who claim to be of Rajput origin, and to have settled in Mekran during the 17th century, having been driven out of Rajputana. There are numerous other tribes having very curious traditions as to the time and manner of their settling in the country. The climate during summer is almost unbearable for Europeans. During winter, however, it is temperate. The principal exports consist of dates, which are considered of the finest quality. There is little chance of Kej resuming its former prosperity.

KELAT. See KHELAT.

KELLERMANN, FRANÇOIS CHRISTOPHE (1735-1820), duke of Valmy and marshal of France, was born near Rothenburg, in Bavaria, in May 1735. He entered the French army as a volunteer, and served in the Seven Years' War and in Louis XV's Polish expedition of 1771. By 1785 he had attained the rank of marshal-de-camp. In 1789 Kellermann enthusiastically embraced the cause of the Revolution, and in 1791 he became general of the army in Alsace. In August 1792 he received command of the army of the centre, with orders to effect a junction with Dumouriez in Champagne. The day after he had succeeded in this operation (September 20), he was forced to give battle to the allies on the heights of Valmy. General Kellermann's dash and bravery led his troops to a decisive victory, whose moral effects were of the utmost importance. Transferred next to the army on the Moselle, Kellermann was accused by General Custine of neglecting to support his operations on the Rhine; but from this, as from a similar charge in 1793, he was acquitted at the bar of the Convention in Paris, and was placed at the head of the army of the Alps and of Italy. Shortly afterwards he received instructions to reduce Lyons, then in open revolt against the Convention. The hesitation he displayed in executing that order brought him again into suspicion; and he was imprisoned in Paris for thirteen months. Once more honourably acquitted, he was reinstated in his command, and did good service in maintaining the south-eastern border against the Austrians. When Napoleon came to power Kellermann was named successively senator, marshal of France, and duke of Valmy. In 1814 he voted for the deposition of the emperor, and became a peer under the royal government. After the "Hundred Days" he sat in the high chamber and voted with the Liberals. He died September 12, 1820.

KELLOGG, JOHAN HENRIK (1751-95), Swedish poet and critic, was born at Floby in West Gothland, December 1, 1751. He studied at the university of Åbo, and had already some reputation as a poet when in 1774 he there became a "docent" in aesthetics. Three years after this he removed to Stockholm, where in conjunction with Leangren he began in 1778 the publication of the journal *Stockholmsposten*, whose chief contributor he continued to be almost throughout the remainder of his life. Kellogg was private librarian to Gustavus III. from 1780, and from 1785 his private secretary. On the institution of the Swedish Academy in 1786 he was appointed by the king one of its first members. He died at Stockholm after a severe illness of two years, April 20, 1795. Early

familiar with the models of the French school of Voltaire, Kellogg did not till late in life awake to a sense of the value of the works of Lessing and Goethe. His strong satiric tendency led him into numerous controversies, the chief of which with Thorild, against whom he directed his satire *Nytt förbukt till ormmat vers*, where he sneers at the "raving of Shakespeares" and "the convulsions of Goethe." His lack of humour detracts from the interest of his polemical writings. His poetical works are partly lyrical partly dramatic, but of the latter only the versification belongs to him, all the rest being due to Gustavus III. The songs interspersed in the four operas which they produced in common, viz., *Gustaf Tasa*, *Gustaf Adolf och Ebba Brahe*, *Aneas i Kartago*, and *Drottning Kristina*, are wholly the work of Kellogg. From about the year 1788 a higher and graver feeling pervades Kellogg's verses, partly owing to his increased knowledge of the newer German and English literature, but probably more directly due to his controversy with Thorild. Of his minor poems written before that date the most important are the charming spring-song *Vinterns eldige lyktar*, and the satirical *Alma Ujen* and *Man ejer ej snille för det man är galen*. The best productions of what is called his later period are the satire *Ljusets stender*, the comic poem *Dumboms lefverne*, the warmly patriotic *Kavaler d. 1 Jan. 1789*, the ode *Till Kristina*, the fragment *Sigevär och Håma*, and the beautiful song *Nya skapelser*, both in thought and form the finest of all his works. Among the lyrics of Kellogg are the choicest fruits of the Gustavian age of Swedish letters. His earlier efforts, indeed, express with great completeness the superficial doubt and pert frivolousness characteristic of his time, but in the works of his riper years he is no mere "poet of pleasure," as Thorild contemptuously styled him, but a worthy exponent of earnest moral feeling and wide human sympathies in the most felicitous and melodious verse. His *Samlade skrifter* (3 vols., 4th ed., Örebro, 1860), revised by himself, were, in accordance with his own direction, published by his friends after his death. His prose works were translated into German by Lappe (Neustadt, 1801).

See Wieselgren, *Svenska sköna litteratur*, 1828-48; *Åttorborn, Svenska namn och skildringar*, 1841-55; C. W. Böttiger in *Ymningsorden of the Swedish Academy*, xiv, 157 sq., 1870; and Gustaf Lundgren's *Kellogg, Leopold, och Thorild*, and his *Svenska vittnesbetyg*, 1878, 1877.

KELLS, a market and municipal town of Meath county, Ireland, is situated on the Blackwater and on the Dublin and Meath Railway, 39 miles north-west of Dublin. The prosperity of the town depends chiefly upon its interesting antiquarian remains. The most notable is St Columba's house, originally an oratory, but afterwards converted into a church, the chancel of which was in existence in 1752. The present church is modern, with the exception of the bell-tower, rebuilt in 1878. Near the church there is a very perfect specimen of the ancient round tower, and there are also several ancient crosses, one being situated in the market-place.

Kells was originally a royal residence, whence its ancient name *Oenacnus*, meaning the dun or circular northern fort, in which the king resided, and the intermediate name *Kemla*, meaning head fort. The other places in Ireland named Kells are probably derived from *Oenla*, signifying church. In the 8th century Kells, it is said, was granted to St Columba. The statement that he founded a monastery at it is probably incorrect; at any rate the town owes its ecclesiastical importance to the abbey founded about 807, and united to Meath in the 13th century. Until the Act of Union Kells returned two members to parliament. Population of urban sanitary district in 1881, 3820.

KELP (Fr., *varesh*) is produced by the incineration of various kinds of seaweed (*Alga*), obtainable in great abundance on the west coasts of Ireland and Scotland, and the coast of Brittany in France. It is prepared from the deep-sea tangle (*Laminaria digitata*), sugar wort (*L.*

saccharina), knobbed wrack (*Fucus nodosus*), black wrack (*F. serratus*), and bladder wrack (*F. vesiculosus*). The Laminaries yield what is termed drift-weed kelp, obtainable only when cast up on the coasts by storms or other causes. The species of *Fucus*, on the other hand, growing within the tidal range, are cut from the rocks at low water, and are therefore known as cut-weeds. In the preparation of kelp, the weeds are first dried in the sun, and are then collected into shallow pits on the ground and burned till they form a fused mass, which while still hot is sprinkled with water in order to break it up into convenient pieces. A ton of kelp is obtained from 20 to 23 tons of wet sea-weed. The average composition may vary as follows:—sulphate of potash, 10 to 12 per cent.; potassium chloride, 20 to 25 per cent.; sodium carbonate, 5 per cent.; other soda and magnesia salts, 15 to 20 per cent.; and insoluble ash from 40 to 50 per cent. The relative richness in iodine of different samples varies largely, good drift kelp yielding as much as 10 to 15 lb per ton of 22½ cwt., whilst cut-weed kelp will not give more than 8 to 4 lb. The rude manner in which kelp is prepared causes much of the iodine to be volatilized, but Mr E O C. Stanford has successfully introduced a process for treating sea-weeds by destructive distillation, whereby the whole of that valuable body is saved. See IODINE.

Previous to the introduction of the Leblanc process for the manufacture of sodium carbonate, kelp was the principal source of that substance, as well as a source of potassium salts, and consequently was a raw material of much importance in chemical industries. About the beginning of the 19th century the value of the kelp prepared on the coast and islands of the west of Scotland was not less than £400,000 per annum, representing 20,000 tons of kelp. With the gradual introduction and improvement of the Leblanc process, and the reduction of the duty on salt and other causes, the value of kelp decreased from £20 and upwards to about £2 a ton, a price altogether unremunerative. Towards the middle of the century, however, a new impetus was given to the trade by the rise of the manufacture of iodine, of which kelp was at first the only commercial source. The introduction of Chili saltpetre (*caliche*) as a source of iodine, and the development of the Stassfurt salt-mines for the production of potash salts, have in their turn had a depressing influence on the kelp manufacture, and it is only by the most careful utilization of all the salts contained in the kelp, and the use of most approved methods of preparing the material, that the industry is continued as a remunerative undertaking. The production of kelp in the British Islands varies greatly from year to year. It may be stated to average about 7000 tons, at a value of about £4 per ton. Two-thirds of this quantity is produced in Ireland, and the remainder on the Scottish coast and islands. The quantity produced in France is probably now somewhat less than the British yield.

KELSO, a burgh of barony and market-town of Roxburghshire, Scotland, is situated on the north side of the Tweed near its junction with the Teviot, 45 miles south-east of Edinburgh and 23 south-west of Berwick by rail. The town is embosomed among woods in a pleasantly undulating and fine agricultural country. The principal streets branch out in four directions from the spacious square, where are the principal shops and hotels. From the bridge of five arches, designed by Rennie, a fine view is obtained of the course of the river. Near it stand the picturesque ruins of the ancient abbey-church, founded by David I., but demolished by the English in 1546, one of the finest extant examples in Scotland of the Early Norman style. A mile west of Kelso, on the north bank of the

river, is Floors Castle, the seat of the duke of Roxburghe, nearly opposite which, on the south bank, stand the ruins of the old fortress of Roxburghe Castle. Kelso possesses a town-hall, a corn exchange, an auction mart, and a collegiate school. About a mile north of the town there is a race course; the fine cemetery and the spacious public park also deserve mention. The trade of the town is chiefly connected with agriculture. There are large nurseries, corn-mills, manure works, coach works, a foundry, and two engineering shops. Kelso was made a burgh of barony in 1634. It is now under the General Public Act. The population in 1881 was 4563.

KEMBLE, CHARLES (1775-1854), a younger brother of John Philip Kemble noticed below, was born at Brecknock, South Wales, 25th November 1775. Like his brother he was educated at Douai. After returning to England in 1792, he obtained a situation in the post-office, but this he soon resigned for the stage, making his debut at Sheffield as Orlando in *As You Like It*. During the early period of his career as an actor, chiefly on account of the great abilities of his sister and brother, he made his way only slowly to public favour. For a considerable time he played along with them, chiefly in secondary parts, and this with a grace and finish which received scant justice from the critics. Ultimately he won independent fame, especially in *comédies larmoyantes*. His gifts had been disciplined to the utmost degree of perfection of which they were capable, by his liberal mental culture and by refined social intercourse; and such characters as Aroner, Doricourt, Charles Surface, and Ranger he played with an airy grace and polished humour that have never been excelled; while he had sufficient fire and energy to give adequate effect to romantic passion and pathos. In genteel comedy he was ably supported by his wife Miss De Camp, whom he married in 1806. His imposing person, classical countenance, and tuneful voice also enabled him to be highly successful in historical drama, some of his principal parts being Alcibiades, Antony, Henry V., and Orestes. The latter period of his career was clouded by money embarrassments in connexion with his joint proprietorship in Covent Garden Theatre. He formally retired from the stage in December 1836, but his final appearance was on April 10, 1840. For some time he held the office of examiner of plays. He died November 12, 1854.

See *Gentleman's Magazine*, January 1855; and *Records of a Girlhood*, by his daughter Frances Ann Kemble, who has achieved distinction both as a tragedienne and an authoress.

KEMBLE, JOHN MITCHELL (1807-1887), Anglo-Saxon scholar and historian, eldest son of Charles Kemble noticed above, was born in 1807. He received his education partly from Dr Richardson, author of the *Dictionary of the English Language*, and partly at the grammar school of Bury St Edmunds, where he obtained in 1826 an exhibition to Trinity College, Cambridge. At school he was distinguished for his miscellaneous knowledge, and at the university his essays on historical subjects gained him high reputation. The historical bent of his studies was confirmed and turned more especially towards the Anglo-Saxon period through the influence of the brothers Grimm, under whom he studied at Göttingen. His thorough knowledge of the Teutonic speeches was shown in his *Beowulf* (1833-37), *Ueber die Stammstift der Westsachsen* (1836), *Codes Diplomatiques Eevi Saxonicis* (1839), and in many contributions to reviews; while his *History of the Saxons in England* (1849) was the first attempt at a thorough examination of the original sources of the early period of English history. He was also for some time editor of the *Foreign Quarterly Review*. In 1857 he published *State Papers and Correspondence Illustrative of the Social and Political State of Europe from the Revolution*

to the Accession of the House of Hanover. He died at Dublin 26th March 1857. His *Horse Fables, or Studies in the Archaeology of Northern Nations*, was completed by Dr Latham, and published in 1864.

KEMBLE, JOHN PHILIP (1757-1823), tragedian, was the second child of Roger Kemble, a strolling player, and his wife Sarah Ward, the eldest child being Sarah, known as Mrs Siddons. He was born at Prescott, Lancashire, February 1, 1757. In his eleventh year he became an inmate of Sedgely Park Catholic seminary, near Wolverhampton, and after remaining there four years entered the college of Douai with the view of becoming a priest. At the conclusion of the course, however, he discovered that he had no vocation for the priesthood, and, arriving in England in the end of 1775, he joined the theatrical company of Crump and Chamberlain, his first appearance being in the character of Theodosius at Wolverhampton, 8th January 1776. Various stories more or less apocryphal are told of his early hardships, until in 1778 he joined the York company of Wilkinson, where he appeared in Hamlet and other leading parts, besides contributing a drama of his own on the subject of Belshazzar. In 1781 he made a decided step in advance, obtaining a "star" engagement in Smock Alley Theatre, Dublin, and achieved astonishing success in the *Comte de Narbonne* by Captain Jephson. Gradually he won for himself a high reputation as a careful and finished actor, and this, combined with the greater fame of his sister Mrs Siddons, led to an engagement in Drury Lane Theatre, where he made his debut 30th September 1783, in the part of Hamlet. His appearance was successful, but rather by awakening interest and discussion than enthusiastic approval. His reading of the part, though highly intellectual and elaborated with the most minute care, was stiff and laboured, especially until he acquired the familiarity with the personation obtainable by repetition. In Edward the Black Prince, Richard III., King John, Sir Giles Overreach, and other characters he did not materially advance his reputation. His first decided success was in the character of Macbeth for his own benefit, when he shared in the enthusiasm aroused by Mrs Siddons, and established for himself a reputation among living actors second to hers only. In December 1787 he married Mrs Brereton, the widow of a young actor. His appointment as manager of the theatre in October of the following year gave him full opportunity to experiment with whatever parts might strike his fancy, and of this he took advantage with greater courage than discretion. His smile, as was wittily said, "resembled the plying on a coffin," and it was only in cases where his gravity gave a certain piquancy to the character that his comedy parts were redeemed from failure, notwithstanding his clever mastery of smart repartee. In Coriolanus, however, which was revived during his first season, the character of the "noble Roman" was so exactly suited to his powers that he not only played it with a perfection that has never been approached, but, it is said, unconsciously allowed its influence to colour his private manner and modes of speech. His tall and imposing person, noble countenance, and solemn and grave demeanour were uniquely adapted for the Roman characters in Shakespeare's plays; and, when in addition he had to depict the gradual growth and development of one absorbing passion, his representation gathered a momentum and majestic force that were irresistible. His defect was in flexibility, variety, rapidity; the characteristic of his style was method, regularity, precision, elaboration even of the minutest details, founded on a thorough psychological study of the special personality he had to represent. His elocutionary art, his fine sense of rhythm and emphasis, enabled him to excel in declamation, but physically

he was incapable of giving expression to impetuous vehemence and searching pathos. In Coriolanus and Cato he was beyond praise, and possibly he may have been superior to both Garrick and Kean in Macbeth, although it must be remembered that in it part of his inspiration must have been caught from Mrs Siddons. In all the other great Shakespearean characters he was, according to the best critics, inferior to them, least so in Lear and Hamlet, and most so in Shylock and Richard III. On account of the eccentricities of Sheridan, the proprietor of Drury Lane Theatre, Kemble withdrew from the management, and, although he resumed his duties at the beginning of the season 1800-1, he at the close of 1802 finally resigned connexion with it. In 1803 he became manager of Covent Garden, of which he was also part proprietor. The theatre was burned down in 1808, and the raising of the prices after the opening of the new theatre in 1809 led to a persevering succession of riots, which practically suspended the performances for three months. Kemble took his final leave of the stage in the part of Coriolanus, June 23, 1817, his retirement being probably hastened by the increasing popularity of Kean. The remaining years of his life were spent chiefly abroad, first at Toulouse, and after a short stay in London at Lausanne, where he died February 20, 1823.

See Bowden's *Life of John Philip Kemble*, 1825; Fitzgerald, *The Kembles*, 1871.

KEMPIS, THOMAS A. (c. 1380-1471), is the name by which Thomas Hammerkon (Hammerchen, Malleus) is commonly known. He was born in 1379 or 1380 in the town of Kempen, lying about 15 miles north-west of Dusseldorf, in one of the many patches of territory between the Meuse and the Rhine belonging to the archiepiscopal principality of Cologne. "Ego Thomas Kempis," he says in his chronicle of the monastery of Mount St Agnes, "scholaris Daventriensis, ex diocesi Coloniensi natus." His father was a poor hard-worked peasant; his mother "ad custodiam rei domesticæ attentæ, in opere alacris, in victu sobria, in potu abstemia, in verbo pauca, in factis pudica," as her son fondly says, kept a dame's school for the younger children of the town. John and Gertrude Hammerkon had two sons, John and Thomas, both of whom found their way to Deventer, and thence to Zwolle and to the convent of Mount St Agnes. Thomas reached Deventer when he was barely twelve years old, was taught by a dame the beginnings of his learning, and in a few months to his great joy entered the classes of Florentius Radewyn. After the fashion of the time he was called Thomas from Kempen, and the school title, as was often the case then, passed aside the family name. Thomas Hammerken was forgotten; Thomas a Kempis has become known to the whole Christian world.

This school at Deventer had become famous long before Thomas a Kempis was admitted to its classes. It had been founded by Gerhard Groot, a wealthy burgher (see Groot), who had been won to pious living mainly through the influence of Ruysbroeck, the Flemish mystic. It was at Deventer, in the midst of this mystical theology and hearty practical benevolence, that Thomas a Kempis was trained. Gerhard Groot was his saintly ideal. Florentius Radewyn and Gerhard's other early disciples were his heroes; their presence was his atmosphere, the measure of their lives his horizon. But he was not like them; he was not an educational reformer like Radewyn, nor a man of affairs like Gerhard. He liked books and quiet corners all his days, he says; and so, when conviction of sin and visions of God's grace came to him in the medieval fashion of a dream of the anger and forgiveness of the Virgin, Florentius

told him that a monk's life would suit him best, advised him to join the Augustinian order, and sent him to Zwolle to the new convent of Mount St Agnes, where his brother John was prior. Thomas was received there in 1399, he professed the vows in 1407, received prior's orders in 1413, became sub-prior in 1435, and died on the 8th of August 1471, being ninety-one years old.

The convent of Mount St Agnes was poor, and most of the monks had to earn money to support their household by copying MSS. Thomas was a most laborious copyist: missals, books of devotion, and a famous MS. Bible were written by him; and the weightiest argument of those who deny that he is the author of the *Imitatio Christi* is that he was a copyist. He also wrote a large number of original writings, most of them relating to the convent life, which was the only life he knew. He wrote a chronicle of the monastery and several biographies—the life of Gerhard Groot, of Florentius Radewyn, of a Flemish lady St Louise, of Groot's original disciples; a number of tracts on the monastic life—*The Monk's Alphabet, The Discipline of Cloisters, A Dialogue of Novices, The Life of the Good Monk, The Monk's Epitaph, Sermons to Novices, Sermons to Monks, The Solitary Life, On Silence, On Poverty, Humility, and Patience*; two tracts for young people—*A Manual of Doctrines for the Young, and A Manual for Children*; and books for edification—*On True Conversion, The Garden of Roses, The Valley of Lilies, The Consolation of the Poor and the Sick, The Faithful Dispenser, The Soul's Soliloquy, The Hospital of the Poor*. He has also left behind him three collections of sermons, a number of letters, some hymns, and the *Imitatio Christi*, if that be his. These writings help us to see the man and his surroundings, and contemporary pious records make him something more than a shadow. We see a real man, but a man helpless anywhere save in the study or in the convent,—a little fresh-coloured man, with soft brown eyes, who had a habit of stealing away to his cubiculum whenever the conversation became too lively; somewhat bent, for it is on record that he stood upright when the psalms were chanted, and even rose on his tiptoes with his face turned upwards; genial, if shy, and occasionally given to punning, as when he said that he preferred Psalm to Salmoes; a man who perhaps led the most placid uneventful life of all men who ever wrote a book or scribbled letters. It was not that he lived in uneventful times: it is impossible to select a stormier period of European history, or a period when the stir of the times made its way so well into the obscurest corners. Bohemia, Huss leading, was ablaze in revolt at one end of Europe; France and England, then France and Burgundy, were at death-grips at the other. Two popes atomized each other from Arignon and from Rome, and zealous churchmen were at their wits' end to connect ways and means, by general councils of Constance and Basel and otherwise, to restore peace to a distracted church, and to discipline the clergy into decent living. But Thomas knew nothing about all this. He was intent on his copying, on his little books, and on his quiet conversations. His very biographies are colourless. He had not even the common interest in the little world coming up to the convent gate which most monks may be supposed to have. His brethren made him economic prefects, but he was too "simple in worldly affairs" and too absent-minded for the post, and so they deposed him and made him sub-prior once more. And yet it is this placid kindly fresh-coloured old man who is commonly said to be the author of that book the *Imitatio Christi*, which has been translated into more languages than any other book save the Bible, and which has moved the hearts of so many men of all nations, characters, and conditions of life.

Did Thomas a Kempis write the *Imitatio Christi*? Had it not been for his connexion with this famous little book, Thomas would have been no better known than Gerard Groot, Florentius Radewyn, or Jan van Ruysbroeck. The problem of authorship has given rise to the most interminable controversy the history of literature has ever seen, and one which seems to be still as fresh as it was in the 17th century. It arose in this way. The author of the *Imitatio* sent it forth anonymously. If Thomas was the author he must have written it when he was about forty five years of age, and it must have found its way into England and France within a very short space of time. Then Thomas was a copyist, a man who spent his life in copying for sale books which he had not composed. These are the only presumptions which make it likely that the *Imitatio Christi* had another author. But down till the beginning of the 17th century Thomas was almost universally esteemed the author of the *Imitatio*. Some MSS. undoubtedly bore the name of St Bernard, and others that of John Gerson; but the great majority of MSS. testified to the authorship of Thomas. In 1604, however, a Spanish student of the *Imitatio* found a sentence from it quoted in what was believed to be a sermon of Bonaventura, who died in 1273, long before either Gerson or Thomas was born. It was afterwards proved that the sermon was not by Bonaventura, but belonged to the end of the 15th century, still far the time it was supposed that Thomas could not have written the *Imitatio*, and learners looked anxiously for a clue to an earlier author. Just then, in 1605, Bernardin Rossignoli, superior of the Jesuit college at Arona, discovered in the college library a MS. of the *Imitatio* without date, and bearing the title *Incomptus capituli priuati Iuliani Alaudis Gersonis, De Imitatione Christi*. The college had formerly belonged to the Benedictines, and it was supposed, wrongly as it turned out, that this MS. had been in the old Benedictine library, and was therefore ancient. Here then was an author, Gerson, and a MS. of the date required. The facts were, however, that the MS. was of the beginning of the 16th century, and had been brought to Arona from Genoa in 1579. Constantinus Cyprian, famous for his intense devotion to the order of St Benedict, got the Arona MS. printed at Rome, declaring that the author was John Gerson, an abbot of the order of St Benedict. Cyprian next discovered in a copy of the printed Venice edition of the *Imitatio* of the title in an unknown hand. "This book was not written by John Gerson, but by Jehu, abbot of Verceil." He also found an MS. bearing the name of John of Canabeco. Weaving these unconnected details together, Cyprian declared that the author of the *Imitatio Christi* was John Gerson of Canabeco, Benedictine abbot of Verceil. Thus began the famous controversy. It has since been a constant battle between the supporters of Thomas a Kempis and the Benedictines, who advocate the claims of John Gerson, a mythical personage whose very existence has been taken for granted and never proved. But, while this is the crux of the dispute, the authorship has been claimed for a great variety of writers—John Scotus Erigena, Bernard of Clairvaux, Giovanni Gerson (an Italian monk and philosopher of the close of the 12th century), Pope Innocent III., Scotus Giovanni and Thomas Gallus, both abbots of Verceil, David of Augsburg, Bonaventura, Ubertus of Casale, Peter do Corbeto, Ludolf of Saxony, Kalke, Humbert, Martinus Carthus, Giovanni Michale, Joannes Pummeri (the last four probably transcribers—their names are appended to single MSS. in an early printed edition), John Gerson a brother of the famous chancellor of Paris, John Gerson the famous chancellor himself, John Gerson the supposed Benedictine abbot, Walter Hilton an English monk, Thomas a Kempis, John a Kempis the other brother of Thomas, and John of Canabeco, probably John of Tambacho, a professor in the university of Prague. It will be sufficient to examine the claims of four of these candidates.

Walter Hilton, a monk of Schene (Shen) in Surrey, who wrote several devotional books, notably *Soliloquies Christianae*, as said by Bale (*Histor. Mag. Brit. Summarium*, published in 1550) to have written a treatise called *De Musica Ecclesiastica*, and this is confirmed by Pits, who wrote much later. The earlier MSS. of the *Imitationes* are called *De Musica Ecclesiastica*, and the earliest English MS., now in Magdalen College, Oxford, dated 1388, bears this title. The inference has been drawn that Hilton wrote the first three books of the *Imitation* in England, and that Thomas copied them and added the fourth book (*see Notes and Queries*, March 1881). We have no contemporary evidence, however, that Hilton did write a treatise called *De Musica Ecclesiastica*, and this work may have been attributed to him because the MS. copies have been found in volumes also containing some of his devotional writings. John Gerson, chancellor of Paris (1393-1429, *see Gerson*), is called the author of the *Imitation* in several undated MSS., and more especially in two MSS. dated 1441 and 1440. His claims have been supported on the ground of MS. evidence, the presence of Gallileus in the Latin of the treatise, the name of Gallileus in the Latin of the treatise, the name of Gallileus in the Latin of the treatise. The evidence to the contrary is so strong, however, that his cause has been given up by all save by Frenchmen who, like Vert, consider it patriotic to declare themselves "pour Gerson, Gerson, et pour la France."

John Gersen, abbot of Ferreoli, is supported by the Benedictine order and by others. The first requisite here is to show that such a man ever lived, and this in spite of the pains taken has not yet been done.¹ In all probability Gersen is a mistake of early copyists for Gerson. The MS. evidence is as follows. The earliest dated MS claimed for Gersen gives the author J. Gers., and is dated 1411, the second gives the author's name in the same contracted fashion, J. Gers., and is dated 1464; while two of the earlier undated MSS, those of Florence and Padollone, call the author J. Gersen, chancellor of Paris. The other MSS which write the author's name J. Gersen are all late or undated. In short, there is not a vestige of early evidence to connect the *Imitatio* with a John Gersen, and there is no contemporary evidence whatever. Gersen is a creation of Cujacian's for the removal of the Benedictine order, and the motive which has prompted Gerson's supporters finds fitting expression in the dedication to St Benedict of the latest contribution to the controversy, that of Wollgasthuber (Angsborg, 1880).

Thomas a Kempis is acknowledged to be the author by most of the earliest dated MSS, by most of the earliest printed editions of the book, by a great mass of contemporary evidence, and by a great deal of internal evidence, some of a most interesting kind. Of MSS may be mentioned the Kirchheim MS of 1425, the autograph of Thomas (1441), the MS. of Innerodorf (1441), and that of Lügge (1444). Twenty-two printed editions in the 15th century attributed the *Imitatio* to Thomas. The contemporary witnesses are numerous and convincing. John Bhechius of the canon's regular of Windesheim, scarcely a league from Mount St Agnes, who had met and conversed with Thomas, calls him the author of the *Imitatio*. Brother Herman, living in a monastery of the canon's regular near Halle, who had met Thomas at Windesheim, declared that Thomas was the author of the *Imitatio*. Similar testimony is borne by Mathias Farnast, a transcriber of the book by Peter Schetz by Johann Lambert, other during the lifetime of Thomas or a few years after his death. And Hirschke has produced a new contemporary witness from an old Belgian chronicle ("Chronique de Jean Brandon, avec les additions d'Adrien de But," p. 447, published in *Collet. de Chroniques de Belgique*, 1891), which says that Thomas wrote the *Qui acquiesce me in meire*. The proof from internal evidence has been set on quite a fresh basis by the studies of Carl Hirschke, who has discovered from a careful examination of the MSS. of 1441 (Bibliothèque de Bourgogne, Brussels, No. 5856 and 5861) that the *Imitatio* was written and pointed for the purpose of chanting. This discovery has enabled him to compare the book with other writings of Thomas as to punctuation, rhythm, and rhymes, with the result that he has inconceivably proved the great similarity between the *Imitatio* and the undisputed works of Thomas.

The *Imitatio Christi* is commonly classed among the mystical writings of the 15th century, and in the opinion of writers of the most opposite schools of thought it came up all that is best of that era of Latin Christianity which moulds the theology of the Victorians, of Bernard and Bonaventura, of Eckhart, Tauler, and Rhyabroock. Medieval Christianity shows two ideas of the Christian life struggling for the mastery, each with the common watchword of separation from the world. The one was modelled on Augustine's *City of God*, and was fulfilled in Hilchenbrand's conception of a spiritual empire to be reared on the ruins of political society; the other came to light in the aspirations of Francis of Assisi, and the assimilation of Anselm's maxim that sinners can appropriate the benefits won for them by Christ by imitating the Saviour. France's idea of imitation was really profane. The *Imitatio Christi* was Christ obedient, poor, unmarried; we can imitate the Master by keeping the vows of obedience, poverty, and chastity. This cross idea of an imitation of Christ gave new force to the monastic movement, and put new meaning into its vows, and it spread in various ways through France, Spain, and Germany. This idea of imitation by "evangelical poverty" was almost spent by the 14th century, and was succeeded by the more refined conception of imitation by "renunciation," the watchword of the mystical movement of the 14th and 15th centuries. But by this time the conflict of the Franciscan ideal of the Christian life with the medieval notion of knowledge in the European atmosphere seems to have the mystic idea to fall away) had it not been saved by its clinging to the sacraments, the one medieval

means of grace, and by its contact with practical Christian work. And gradually out of Eckhart through Tauler two schools arose, both of which use "renunciation" as their watchword—imitation by renunciation. The one school, that of Henry Suso, saw Christ's renunciation best exhibited in His passion, and therefore held that men can imitate by suffering; they too have a body to mortify. The other, that of Rhyabroock, saw Christ's renunciation in His incarnation; so that men can renounce by contemplation, which gives us imitation into the incarnation. Rhyabroock was Groot's teacher, and Groot taught Thomas, in whom we see the gathered wisdom of that idea of a quest for perfection by imitation of Christ which began with Anselm and came down through Franciscan revivals and mystical movements to him in the 15th century. But Thomas is far more than Rhyabroock or Groot. He is wider and more sympathetic. He includes Rhyabroock, Tauler, Eckhart, Bonaventura, the Franciscans, and even the old Victorines. He sums up in his little book the heart religion of Latin Christianity.

For the life of Thomas a Kempis see the Nuremberg edition of 1604, *Opera d'libertatis Thomas a Kempis*, Dithmarus Hoon elab. *Vita Thomas a Kempis*, 1600. The best edition of the collected works is that of Sommariva, *Vita Thomas a Kempis*, 1891. . . . *Opera Omnia* . . . in two parts, *Imitatio*, 1880. The best edition of the *Imitatio* is that of Hirschke, Berlin, 1884. A very complete list of the principal writers in the controversy may be found in Wollgasthuber, *Imitatio Christi*, 1880, p. 344 sq. For authority by Gersen, see C. G. L. art. *Course de l'imitation de Jésus-Christ, collation et concordance*, Toulouse, 1891. For Thomas as author, see *Recherches historiques et critiques sur la véritable auteur de l'Imitatio de Jésus-Christ*, Tournay, 1814. Carl Hirschke, *Die Imitatio Christi als literarischer Ausprägung der Imitatio Christi*, Berlin, 1880, and Samuel Kettler, *Die Imitatio Christi als Imitatio Christi*, London, 1877. (7 M L.)

KEMPTEN, a town in the government district of Swabia and Neuburg, Bavaria, is situated on the Iller, about 85 miles south-west of Munich. It is the seat of numerous local and special tribunals, and contains a castle, a gymnasium and a grammar school, two hospitals, and other educational and benevolent institutions. There is a hand some town-house, and the aqueduct is noteworthy. The industries include wool spinning and weaving on a large scale, and the manufacture of paper, beer, machines, hosiery, matches, and wooden wares. As a commercial centre of the Aigau, Kempten carries on active trade in linen, timber, and dairy produce. In 1875 the population, including the garrison, was 12,681.

Kempten, identified with the Roman Campidunum, consisted in early times of two towns, the old and the new. The continual hostility that existed between these was intensified by the welcome given by the old town to the Reformed doctrine,—the new town, built round the Benedictine abbey erected in the 8th century, keeping the old faith. The abbey in 1860 had been promoted to the dignity of a prince of the empire by the emperor Charles IV., and the princely abbey only passed to Bavaria in 1808.

KEN, THOMAS (1637–1711), the most eminent of the non-juring bishops, and one of the fathers of modern English hymnology, was born at Little Derhampton, Dorset, in 1637. He was the son of Thomas Ken of Furrival's Inn, who belonged to an ancient stock,—that of the Kens of Ken Place, in Somersetshire; his mother was a daughter of the now forgotten poet, John Chalkhill, who is called by Walton an "acquaintance and friend of Edmund Spenser." It may be mentioned that Ken's sister, Anne, was married to Isaac Walton in 1646, a connexion which brought Ken from his boyhood under the refining influence of this gentle and devout man. In 1652 he entered Winchester College, and in 1656 became a student of Hart Hall, Oxford. He gained a fellowship at New College in 1657, and proceeded B.A. in 1661 and M.A. in 1664. He was for some time tutor of his college; but the most characteristic reminiscence of his university life is the mention made by Anthony Wood that in the musical gatherings of the time "Thomas Ken of New College, a junior, would be sometimes among them, and sing his part." Ordained in 1662, when he was twenty-five years old, he successively held the livings of Little Easton in Essex, Brightons (sometimes called Brinton) in the Isle of Wight, and East Woodhay in Hampshire. In 1672 he resigned the last of these, and returned to Winchester, being by this time a prebendary of the cathedral, and chaplain to the bishop, as well as a fellow of Winchester College. He remained there for several years.

¹ This mythical personage has been photographed, see *Auteurs prétendus de l'Imitatio*, by Abbé Delaunay.

acting as curate in one of the lowest districts, and fulfilling other duties in the city, but, above all, preparing his *Manual of Prayers for the use of the Scholars of Winchester College*, which was first published in 1674, and composing hymns. It was at this time that he wrote, primarily for the same body as his prayers, his morning, evening, and midnight hymns, the first two of which, beginning "Awake, my soul, and with the sun" and "Glory to Thee, my God, this night," are now household words wherever the English tongue is spoken. The latter is often made to begin with the line "All praise to Thee, my God, this night," but in the earlier editions over which Ken had control, the line is given as above.¹ In 1674 Ken paid a visit to Rome in company with young Isaac Walton, and this journey seems mainly to have resulted in confirming his regard for the Anglican communion. In 1679 he was appointed by Charles II chaplain to the Princess Mary, wife of William of Orange. While with the court at the Hague, he incurred the displeasure of William by insisting that a promise of marriage, made to an English lady of high birth by a relative of the prince, should be kept, and he therefore gladly returned to England in 1680, when he was immediately appointed one of the king's chaplains. He was once more residing at Winchester in 1683 when Charles came to the city with his doubtfully composed court, and his residence was chosen as the home of Nell Gwynne; but Ken stoutly objected to this arrangement, and succeeded in making the favourite find quarters elsewhere. We find him in August of this same year accompanying Lord Dartmouth to Tangiers as chaplain to the fleet, and Pepye, who was one of the company, has left on record some quaint and kindly reminiscences of him and of his services on board. The fleet returned in April 1684, and a few months after, upon a vacancy occurring in the see of Bath and Wells, Ken, now Dr Ken, was appointed bishop. It is said that, upon the occurrence of the vacancy, Charles, mindful of the high and pure spirit he had shown at Winchester, exclaimed, "Where is the good little man that refused his lodging to poor Nell?" and determined that no other should be bishop. The consecration took place at Lambeth, January 25, 1685; and one of Ken's first duties was to attend the death-bed of Charles, where his wise and faithful ministrations won the admiration of everybody except Bishop Burnet. In this year he published his *Exposition on the Church Catechism*, which is perhaps better known by its sub-title, *The Practice of Divine Love*. His public life as bishop is mainly remembered for the stand he took upon two memorable occasions. In 1688, when James resigned his "Declaration of Indulgence," Ken was one of the "seven bishops" who refused to publish it. He was probably influenced by two considerations:—first, by his profound aversion to Roman Catholicism, to which he felt he would be giving some episcopal recognition by compliance; but, second and more especially, by the feeling that James by his arbitrary action was compromising the spiritual freedom of the church. Along with his six brethren, Ken was committed to the Tower, June 8, 1688, on a charge of high misdemeanour; the trial, which took place on the 29th and 30th of the month, and which resulted in a verdict of acquittal, is matter of history. With the revolution which speedily followed this impolitic trial, new troubles encountered Ken; for, having sworn allegiance to James, he thought himself thereby precluded from taking the oath to William of Orange. Accordingly, he took his place among the non-jurors, and, as he stood firm to his

refusal, he was, in August 1691, superseded in his bishopric by Dr Kidder, dean of Peterborough. From this time he lived mostly in retirement, finding a congenial home with Lord Weymouth, his friend from college days, at Longleat in Somersetshire, and, though pressed to resume his diocese in 1703, upon the death of Bishop Kidder, he declined, partly on the ground of growing weakness, but partly no doubt from his love for the quiet life of devotion which he was able to lead at Longleat. His death took place there upon the 19th of March 1711.

Although Ken wrote much poetry, besides his hymns, he cannot be called a great poet, but he had that fine combination of spiritual insight and feeling with poetic taste which marks all great hymn-writers. As a hymn-writer he has had few equals in England, it can scarcely be said that even Kobbie, though possessed of much rarer poetic gifts, surpassed him in his own sphere (see HYMNS, vol. xii. p. 662). In his own day he took high rank as a pulpit orator, and even royalty had to beg for a seat amongst his auditors, but his sermons are now forgotten. He lives in history, apart from his three hymns, mainly as a man of unstained purity and invincible fidelity to conscience, weak only in a certain narrowness of view which is a frequent attribute of the intense character which he possessed. As an ecclesiast he was a High Churchman of the old school.

Ken's poetical works were published in collected form by W. Hawkins, his collector and executor, in 1721, and extended to four volumes, his prose works were issued in 1889 in one volume, under the editorship of J. R. Round. A brief memoir was prefixed by Hawkins to a selection from Ken's works which he published in 1713; and a life, in two volumes, by the Rev W. L. Dowles, appeared in 1830. But the standard biography of Ken is that of J. Lavett Anderson (*The Life of Thomas Ken, Bishop of Bath and Wells, by a Layman*, 1851; 2d ed., 1854).

KENDAL, KIRKBY-KENDAL, or KIRKBY-IN-KENDAL, a market town and parliamentary and municipal borough of Westmoreland, is picturesquely situated in a pleasant valley on the east bank of the Kent or Ken, 44 miles south of Carlisle (50 by rail), and 241 miles from London. The town, which is the largest and most populous in the county, is very irregularly built, but the white-walled houses with their blue-slatted roofs, and the numerous trees, give it a very attractive appearance. There are four leading streets, two of which together form a spacious thoroughfare a mile in length. The church of the Holy Trinity, whose oldest part dates from about 1200, is a Gothic edifice with five aisles and a square tower 72 feet high. Kendal contains numerous other churches, a town-hall, a mechanics' institution, a literary and scientific institution, a museum, and a chamber of commerce. Its charities include a hospital (founded 1870), an old maids' hospital, a girls' orphanage, almshouses, &c. The free grammar school is well endowed, and there are also in the town a well-endowed blue-coat school and hospital, a large national school, a school of science and art, and several Sunday schools, among which is the Greencoat Sunday school, founded in 1813. On an eminence to the east of the town are the ruins of Kendal Castle, attributed to the first barons of Kendal. It was the birthplace of Catherine Parr, Henry VIII's last queen. On the Castle-hill, an obelisk was raised in 1788 in memory of the revolution of 1688. The woollen manufactures of Kendal have been noted since the 14th century, when Edward III. established a colony of Flemish weavers in the town; and, although the coarse cloth known to Shakespeare as "Kendal green" is no longer made, its place is more than supplied by active manufactures of tweeds, linsey-wolsey, railway rugs, horse clothing, knitted woollen caps and jackets, worsted and woollen yarns, and similar goods. Other manufactures of Kendal are machine-made boots and shoes, cards for wool and cotton, agricultural and other machinery, paper, and, in the neighbourhood, gunpowder. There are also important marble-works. There is a large weekly market for grain, and annual horse and cattle fairs. The population in 1881 was 13,696, an increase of only 280 from 1871.

¹ The fact, however, that in 1712—only a year after Ken's death—his publisher, Drome, published the hymn with the opening words "All praise" has been deemed by such a high authority as Lord Selborne sufficient evidence that the alteration had Ken's authority.

Kendal was the head of a barony given by William the Conqueror to Ivo de Talhou. It has given the title of earl to various royal and other personages of English history. The town received its charter from Queen Elizabeth in 1575. A second, granted by Charles I., and confirmed by Charles II., was superseded by the Municipal Act of 1835, according to which the town is governed by six aldermen and eighteen councillors, who select a mayor from among themselves. Quarter sessions are held alternately at Appleby and Kendal. The Reform Act of 1832 assigned one member of parliament to Kendal.

KENILWORTH, a small town of Warwickshire, is pleasantly situated on a tributary of the Avon, on the railway from Coventry to Leamington, 5 miles distant from both towns, and 99 miles north from London. The town is only of importance from its antiquarian interest and the magnificent ruins of its old castle. The most probable derivation of its name, which in Domesday is written *Chineuorde*, is from *Censuif*, king of the Mercians, and *werthe*, a dwelling-place. The old royal residence of the Saxon kings was destroyed in the wars between Edward and Canute. The manor of Kenilworth was bestowed by Henry I. on Geoffrey de Clinton, afterwards lord chief-justice, who erected the earlier portion of the present castle. By his grandson Henry de Clinton it was given to King John, and it remained a royal residence until the time of Henry III., who granted it to Simon de Montfort, earl of Leicester. After the battle of Evesham, 14th August 1265, at which Simon de Montfort was slain, the rebel forces rallied at the castle, when it sustained a siege of six months, but finally capitulated to Henry III., who bestowed it on his son Edmund. After being used as the prison of Edward II. previous to his removal to Berkeley, it came into the possession of John of Gaunt, by whom it was greatly enlarged. On his son becoming king as Henry IV., it was made a royal residence, and it remained in the possession of the crown until Queen Elizabeth in 1562 granted it to Robert Dudley, earl of Leicester, who spent a large sum in restoring it, and whose splendid entertainments there to Elizabeth are described in Scott's novel of *Kenilworth*. During the civil war it was dismantled by the soldiers of Cromwell, and it was thenceforth abandoned to decay. Since the Restoration it has belonged to the house of Clarendon. The walls of the castle originally enclosed an area of 7 acres. The principal portions of the building still remaining are the gatehouse, now used as a dwelling-house; Caesar's tower, the only portion built by Geoffrey de Clinton now extant, with massive walls 16 feet thick; the Merwyn's tower of the novel of *Kenilworth*; the great hall built by John of Gaunt with windows of very beautiful design; and the Leicester buildings, which are in a very ruinous condition. Not far from the castle are the remains of an Augustinian monastery founded in 1122, and afterwards made an abbey. Adjoining the abbey is the parish church of St Nicholas, restored in 1865, an old structure of mixed architecture, and containing a fine Norman doorway, which is supposed to have been the entrance of the former abbey church. The town, which possesses large tanneries, is under the government of a local board. Population in 1871, 5860, in 1881, 4150.

KENNEDY, THOMAS FRANCIS (1788-1879), a distinguished Scottish Liberal politician, was born near Ayr in 1788. He studied for the bar and passed advocate in 1811. But, having been elected M.P. for the Ayr burghs in 1818, he devoted the greater part of his life to the promotion of those political reforms which the long misgovernment of Scotland by the Tory party had rendered necessary. In this patriotic work he was greatly assisted by Lord Cockburn, then Mr Henry Cockburn, and a volume of correspondence published by Kennedy in 1874 forms a curious and interesting record of the consultations of the two friends on measures which they regarded as requisite for the political regeneration of their native country. 'One

of the first measures of improvement to which he directed his attention was the withdrawal of the power of nominating juries from the judges, and the imparting of a right of peremptory challenge to prisoners.' It cost Kennedy several years of persistent urgency upon the legislatures before this most reasonable demand was conceded, but at length his energy and perseverance succeeded. Among other subjects he directed his attention to the improvement of the parish schools, of pauper administration, and of several of the corrupt forms of legal procedure which then prevailed. To him also was in a great measure due the freedom which the Scottish people obtained from the domination of certain aristocratic families which had long proved a dead weight on the progress of Liberal principles in Scotland. In the construction of the Scottish Reform Act Kennedy took a very prominent part, and indeed he and Lord Cockburn may almost be regarded as its authors. After the accession of the Whigs to office in 1832 he held various important offices in the ministry, and most of the measures of reform for Scotland, such as burgh reform, the improvements in the law of entail, and the reform of the sheriff courts, owed much to his sagacity and energy. In 1837 he went to Ireland as paymaster of civil services there, and immediately set himself with his accustomed energy to the promotion of various measures of reform. One or two of the blue books published during the period of his administration exhibit with an amusing vividness the sleuth-hound-like keenness and tenacity, characteristic of the man, with which he hunted out several of the abuses and scoundrelisms that he found prevailing. Kennedy retired from public life in 1854, but he never ceased to take the keenest interest in political affairs, and up to the time of his death took a great part in both county and parish business. One of the chief features of his character was a strong, almost stern, love of justice, and a determined hatred of every thing savouring of jobbery or dishonesty. All through his career he preserved the simple straightforwardness and unselfishness of the earlier Liberalism. He died in 1879, having attained the almost patriarchal age of ninety-one. He had married in 1820 the only daughter of Sir Samuel Romilly.

KENNET, WALTER (1680-1728), bishop of Peterborough, a theological writer and learned antiquarian, was born at Dover in 1680. He was educated at Westminster school and at Oxford, where, while still an undergraduate, he published several translations of Latin works, including Erasmus *On Folly*, Pliny's *Trifles*, and Cornelius Nepos. About the year 1685 he became vicar of Amersden. A few years afterwards he returned to Oxford as tutor and vice-principal of St Edmund's Hall, where he gave considerable impetus to the study of antiquities. In 1695 he published *Parochial Antiquities*. In 1700 he resigned the vicarage of Amersden to take charge of the parish of St Botolph, Aldgate, London, and in the following year he was preferred to the archdeaconry of Huntingdon. On account of his eulogistic sermon on the duke of Devonshire he was in 1707 recommended to the deanery of Peterborough. Although he afterwards changed to the Low Church party, strenuously opposed the Socinian movement, and in the Bangorian controversy supported with great zeal and considerable bitterness the side of Bishop Hoadly, his intimacy with the bishop of Norwich, who was high in favour with the king, secured him in 1718 promotion to the bishopric of Peterborough. He died at Westminster in September 1728. Kennet published in 1698 an edition of Sir Henry Spelman's *History of Sacrilege*, and he was the author of as many as fifty-seven printed works, chiefly tracts and sermons. His principal publication was a *Complete History of England*, 3 vols., 1706 (enlarged edition, 3 vols., 1719), chiefly a compilation from

other authors, but the part from Charles I. to Queen Anne was written by himself.

The Life of Bishop White Kennet, by the Rev. William Kennet, appeared in 1780. See also *Ken's Literary Anecdotes*, *Dissertation of Authors*, and *Dissertation of Authors*.

KENNICOTT, BENJAMIN (1718-1783), an eminent Hebraist, was born at Totnes, Devonshire, on April 4, 1718. His father was parish clerk and master of a charity school, in which latter situation Benjamin was chosen to succeed him at an early age. His talents and acquirements interested some rich friends in his behalf, and by their liberality he was provided with the means of studying at Oxford. Entering himself of Wadham College in 1744, he soon distinguished himself in Hebrew and divinity; and while still an undergraduate published two dissertations, *On the Tree of Life in Paradise*, with some *Observations on the Fall of Man*, and *On the Oblations of Cain and Abel*, which came to a second edition in 1747, and procured him the honour of a bachelor's degree before the statutable time. Shortly afterwards he was elected fellow of Exeter College, and in 1750 he took his degree of M.A. In 1767 he was appointed keeper of the Radcliffe library, and made D.D. He was also canon of Christ Church and rector of Cullum in Oxfordshire, and was subsequently presented to the living of Mythenyote, Cornwall, which however, being unable to visit it, he resigned two years before his death. He died of a lingering illness at Oxford, on September 18, 1783.

The great work with which his name continues to be associated in the annals of Biblical scholarship is the *Vetus Testamentum Hebraicum cum versione Lætinâ*, 2 vols. fol., Oxford, 1794-96. The course of the studies which resulted in it may be gathered from the nature of the publications by which it was preceded. Two dissertations entitled *The State of the Printed Hebrew Text of the Old Testament considered*, published respectively in 1768 and 1769, were expressly designed to combat the then current ideas as to the "absolute integrity" of the received Hebrew text. The first contains "a comparison of 1 Chron. xi. with 2 Sam. v. and xiii., and observations on seventy MSS., with an extract of mistakes and variant readings"; the second defends the claims of the Samaritan Pentateuch, assails the correctness of the printed copies of the Chaldee paraphrases, gives an account of Hebrew MSS. in the British Museum and in the libraries of Oxford and Cambridge. His labours provoked severe animadversion in some quarters, and even from such men as Warburton and Horne, but they at least had the effect of drawing public attention to the subject to which they related, and in 1766 he issued his proposals for collecting all Hebrew MSS. of date prior to the invention of printing which could be discovered either at home or abroad. Subscriptions to the amount of nearly £10,000 were obtained, and many learned men addressed themselves to the work of collation. Bruns of Heimsbüttel making himself especially useful as regards MSS. in Germany, Switzerland, and Italy. Between 1760 and 1769 ten "annual accounts" of the progress of the work were given; in the course of six hundred and fifteen MSS. and fifty-two printed editions of the Bible were either wholly or partially collated, and use was made (not infrequently very judiciously) of the quotations in the Talmud. The materials thus collected, when properly arranged and made ready for the press, extended to 80 vols. fol. The text finally followed in printing was that of Van der Hooght,—unprinted however, the points having been disregarded in collation, and the various readings were printed at the foot of the page. The Samaritan Pentateuch stands alongside the Hebrew in parallel columns. The *Dissertationes Generales*, appended to the second volume, contains an account of the MSS. and other authorities collated, and also a review of the Hebrew text, divided into periods, and beginning with the formation of the Hebrew canon after the return of the Jews from the exile. Kennicott's great work was in no sense a failure. It yielded no materials of value for the emendation of the received text, and by disregarding the vowel points overlooked the one thing in which some result (grammatical if not critical) might have been derived from collation of Massoretic MSS. But the negative result of the publication and of the *Variae Lectiones* of De Rossi, published some years later, was important. It showed that the Hebrew text can be amended only by the use of the versions aided by conjecture.

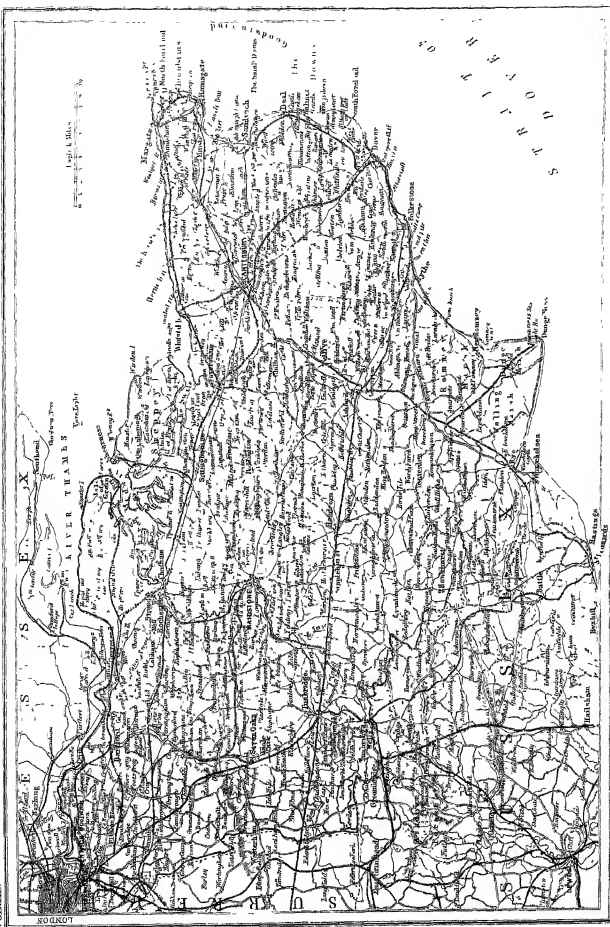
KENOSHA, chief city of Kenosha county, Wisconsin, U.S., is situated in a fertile district on Lake Michigan, about 30 miles south of Milwaukee, with which it is connected

by rail. It contains numerous schools, and carries on the manufacture of hardware, wooden wares, machines, and carriages. There are also in the city breweries, foundries, tanneries, planing mills, and other industrial establishments. It possesses a good harbour, and carries on trade in its manufactures and in country produce. The population in 1880 was 5639.

KENSINGTON, a western suburb of London in the parish of Kensington, parliamentary borough of Chelsea, and county of Middlesex, a mile and a half west of Hyde Park Corner. The parish includes the suburbs of Brompton, Earl's Court, part of Little Chelsea, the Gravel Pits, Notting Hill, and part of Keasel Green. Kensington palace and Kensington gardens, however, lie in the parish of St Margaret's, Westminster. The suburb of Kensington, which has developed out of the village of Kensington, lies to the west of Kensington gardens, and consists principally of a long and in places narrow street, the modern improvements of which with the surrounding additions have almost entirely obliterated all traces of the "old court suburb" associated with the distinguished personages of former times. From the High street others branch off at intervals, and the elevated ground to the north is almost wholly occupied with villas embosomed in woods. To the south of the High street is Kensington square, where at one time were the residences of many of the principal attendants on the court. The principal public buildings in the suburb are the parish church in the Decorated style, erected in 1869 at a cost of £35,000, the elegant new town-hall, the vestry hall, the grammar school, the Roman Catholic college, opened in 1874, several monasteries and convents, and various schools and charities. The site of Old Gore House, at one time the residence of Mr Wilberforce and afterwards of the Countess of Blessington, is now occupied by the Royal Albert Hall and the gardens of the Horticultural Society. These as well as Kensington gardens and the South Kensington museum with its national training schools fall to be noticed under the article LONDON. Kensington palace, a plain and irregular brick structure, originally surrounded by grounds extending to about 350 acres, was at one time the residence of Lord Chancellor Finch, afterwards earl of Nottingham, of whom it was bought by William III. Additions were made to it by William III., George I., George II., and the duke of Sussex. The palace was the birthplace of Queen Victoria. Kensington house, which stood near the palace gate, and was at one time the residence of the duchess of Portsmouth, mistress of Charles II., was pulled down in 1873 to make way for the mansion of Baron Albert Grant. The population of the registration subdistrict in 1871 was 91,664, which in 1881 had increased to 120,126. The population of the parish in 1881 was 162,924.

The manor of Kensington, which is written in Domesday book *Chenestricus*, has an area of 1140 acres. Some traces of the origin of the word to the old Saxon name for king, others to a family of the name of Cogen, others to "Cogen," the old name for wood. The manor was originally occupied by the great Middlesex forest, the trees of which were abundant in the time of Henry VIII. In Domesday it is mentioned as being held by Aubrey de Vere of the bishop of Coutances. Soon after this it became the absolute property of the De Veres, who were afterwards created earls of Oxford. In the reign of Elizabeth it passed into the possession of the Argylls, by whom it was sold to Sir Walter Cope, whose daughter married Henry Rich, earl of Holland. Holland House, in the Elizabethan style, the original mansion of the manor of Kensington, was erected by Sir Walter Cope in 1607, and enlarged and adorned by the third Lord Holland (see vol. xi. p. 100). The manor is at present held by Lord Kensington. See Penkman, *History and Antiquities of Kensington*, 1890; Leigh Hunt, *The Old Courts Suburb*.

KENT, a maritime county in the south-eastern corner Plate of England, lies between 50° 54' and 51° 31' N. lat., and between 0° 3' W. long. and 1° 27' E. long. It is bounded on the N. by the estuary and mouth of the Thames, E.



and S.E. by the English Channel, S.W. by Sussex, and W. by Surrey. Its greatest breadth north and south from Sheerness to Dungeness is 35 miles, its length north-west to south-east from London to Dungeness about 60 miles, and its length west to east from Surrey to North Foreland in Thanet 65 miles. The area is 1,004,984 acres, or 1870 square miles.

Coast Line.—About two-thirds of the boundary line of Kent is formed by tidal water. The estuary of the Thames may be said to stretch from London Bridge to Sheerness in the Isle of Sheppey, to the north-west of which the estuary of the Medway cuts off a tongue of land whose extremity is termed the Isle of Grain. Along the banks of the Thames the coast is low and marshy, embankments being in several places necessary to prevent inundation. In the estuary of the Medway there are a number of low marshy islands, but Sheppey presents to the sea a range of chalk cliffs from 80 to 90 feet in height. The marshes extend along the estuary of the Swale to Whitstable, whence stretches a low line of clay and sandstone cliffs, succeeded at the Isle of Thanet by the white chalk cliffs which extend southwards to Pegwell Bay. The coast from Sheppey round to the South Foreland is skirted by numerous flats and sands, the most extensive of which, the Goodwin sands, forming the breakwater of the well-known anchorage of the Downs, are said to have formed part of the estate of Earl Godwine, and to have been submerged as late as 1097. From Pegwell Bay to near Deal the outline of the coast is flat, but thence it rises again into chalk cliffs, which continue round the South Foreland to Folkestone, where they are succeeded by the flat shingly shore bordering Romney Marsh. A considerable portion of Romney Marsh has been reclaimed from the sea since the time of Julius Cæsar, but in nearly every other portion of the coast the sea has been gaining on the land.

Surface and Geology.—Kent abounds in beautiful and finely-wooded valleys with undulating and picturesque uplands. A tract from 7 to 8 miles broad lying to the south of the estuary of the Thames, and extending eastwards as far as Thanet, belongs to the London Tertiary basin, and is formed chiefly either of London or of plastic clay. The London Clay occupies the tongue of land between the estuaries of the Thames and Medway, as well as Sheppey and a district of country about 8 miles wide stretching southwards from Whitstable to Canterbury, and extending eastwards to the Isle of Thanet. It reappears at Pegwell Bay, and in the neighbourhood of London it rises above the plastic clay into the elevation of Shooter's Hill, with a height of about 450 feet, and a number of smaller eminences. The thickness of the formation near London is about 403 feet, and at Sheppey it reaches 480 feet. At Sheppey it is rich in various kinds of fossil fish and shells. The plastic clay, which rests chiefly on chalk, occupies the remainder of the estuary of the Thames, but at several places it is broken through by outcrops of chalk, which in some instances run northwards to the banks of the river. The Lower Tertiaries are represented by three different formations known as the Thanet beds, the Woolwich and Reading beds, and the Oldhaven and Blackheath beds. The Thanet beds resting on chalk form a narrow outcrop rising into cliffs at Pegwell Bay and Reculvers, and consist (1) of a constant base bed of olive greenish sand, seldom more than 5 feet in thickness; (2) of a thin and local bed composed of alternations of brown clay and loam; (3) of a bed of fine light buff sand, which in West Kent attains a thickness of more than 60 feet; (4) of bluish grey sandy marl containing fossils, and almost entirely confined to East Kent, the thickness of the formation being more than 60 feet; and (5) of fine light grey sand of an equal thickness, also fossiliferous. The middle series of the Lower Tertiaries,

known as the Woolwich and Reading beds, rests either on the Thanet beds or on chalk, and consists chiefly of irregular alternations of clay and sand of very various colours, the former often containing estuarine and oyster shells and the latter flint pebbles. The thickness of the formation varies from 15 to 80 feet, but most commonly it is from 25 to 40 feet. The highest and most local series of the Lower Tertiaries is the Oldhaven and Blackheath beds lying between the London Clay and the Woolwich beds. They consist chiefly of flint pebbles or of light-coloured quartzose sand, the thickness being from 20 to 30 feet, and are best seen at Oldhaven and Blackheath. To the south the London basin is succeeded by the North Downs, an elevated ridge of country consisting of an outcrop of chalk which near Westerham on the borders of Surrey reaches an elevation of 812 feet above sea-level, and at several other places more than 600 feet. It extends from Westerham to Folkestone, with an irregular breadth generally of from 3 to 6 miles, but expanding to nearly 12 miles at Dartford and Gravesend and also to the north of Folkestone. After dipping below the London Clay at Canterbury, it sends out an outcrop which forms the greater part of Thanet, and towards the sea is often broken off into precipitous escarpments. To the south of the Downs there is a narrow valley formed by the Gault, a fossiliferous blue clay. This is succeeded by an outcrop of the Lower Greensand, which extends across the country from west to east with a breadth of from 2 to 7 miles, and rises into the picturesque elevations of the Ragstone hills. These in several cases reach a height of over 600 feet, and have a steep slope southwards, overlooking the valley which extends from the borders of Sussex to Hythe. This low ground is occupied chiefly by the Weald clays, which contain a considerable number of marine and freshwater fossils. Along the borders of Sussex there is a narrow strip of country consisting of picturesque sandy hills, whose highest elevation is nearly 400 feet; and the south-west corner of the county is occupied by Romney Marsh, which within a comparatively recent period has been recovered from the sea.

The London Clay is much used for bricks, coarse pottery, and Roman cement. Lime is obtained from the Chalk and Greensand formations. Ironstone is found in the Wealden clays and calcareous ironstone in the Ashdown sand, but the industry has long been discontinued. The last Wealden furnace was put out in 1828.

Rivers.—The Thames, which forms the northern boundary of the county, receives the Ravensbourne at Deptford, and the Darent or Dart, which has a course of 18 miles, and becomes navigable at Dartford. The Medway, which has a course of over 60 miles, and with its tributaries drains a basin having an area of 680 square miles, is formed of several streams that rise in the neighbourhood of Tunbridge Wells, and of East Ginstead in Sussex. After passing Ashurst and Penhurst it receives the Eden from the west, and at Yalding in the Weald the Teise and Bault. At Chatham it widens into an estuary, the greater portion of its waters ultimately joining the Thames at Sheerness, and the other portion passing southwards to the sea through the Swale Channel. The river is tidal as high as Maidstone. The Stour, which has a course of nearly 50 miles, and with its tributary the Little Stour drains an area of about 380 square miles, has its origin in several streams which spring from the Lower Greensand and the Chalk, the two main branches, which have their source near Leamham and near Hythe respectively, uniting at Ashford. At Sarre the Stour separates into two branches which insulate the Isle of Thanet, the smaller portion flowing northward to the sea near Reculver, the other and main portion flowing eastward to Pegwell Bay. The stream is tidal and navigable.

able to Fordwich, near Canterbury. The Little Stour rises in the Lower Clank near Lyminge, and joins at Stourmouth that branch of the Stour which falls into the sea at Pegwell Bay. The Dour, a small stream which gives its name to Dover, has a course of little more than 3 miles from Ewell to the sea. The Rother, which has its source in Sussex, forms for some distance the boundary between that county and Kent, and along with several of its branches insulates the Isle of Oxney.

The only canals at all in use are that which runs along the borders of Romney Marsh, connecting the Rother with the sea at Hythe, but now partly filled up; and that between Gravesend and Rochester, which is partly occupied by a line of railway.

Climate, Soil, and Agriculture.—The insalubrity of certain portions of the country caused by extensive marshes has been almost wholly removed by draining. In the north-eastern districts the climate is a little uncertain, and damage is often done to early fruit blossoms and vegetation by cold easterly winds. In the large portion of the county sheltered by the Downs the climate is milder and more equable, and vegetation is somewhat earlier. The soil is very various in character, but on the whole rich and under high cultivation. The methods of culture and the kinds of crop produced are perhaps more widely diversified than those of any other county in England. Upon the London Clay the land is generally heavy and stiff, but very fruitful when properly manured and cultivated. The marsh lands along the banks of the Thames, Medway, Stour, and Swale consist chiefly of rich chalk alluvium. The chalk formation is in some cases overlaid by London Clay, alluvium, or brick-earth, but in the higher chalk districts the soil is often poor and thin, and in some places much mixed with flints. In the Isle of Thanet a light mould predominates, which has been much enriched by fish manure. The valley of the Medway, especially the district round Maidstone, which has been called the garden of England, is the most fertile part of the county, the soil being a deep loam with a subsoil of brick-earth. On the ragstone the soil is occasionally

thin and much mixed with small portions of sand and stone; but in some situations the ragstone has a thick covering of clay loam, which is most suitable for the production of hops and fruits. In the district of the Weald marl prevails, with a substratum of clay. The soil of Romney Marsh is a clay alluvium.

According to the agricultural returns (for 1881), the total area under crops comprehended 745,215 acres, a percentage of 73·9 instead of 71·7 in 1870, corn crops had an area of 224,211 acres, a percentage of 22·3 instead of 26·1 in 1870, green crops 85,614 acres, a percentage of 8·6 instead of 7·4, rotation grasses 53,421 acres, a percentage of 5·8 instead of 6·2, permanent pasture 327,079 acres, a percentage of 31·8 instead of 23·2. The area under permanent pasture thus exceeds that under corn crops by nearly a third. The area under woods in 1881 was 82,840 acres, under orchards 16,673, under market gardens 4221, and under nursery grounds 670. Of the corn crops the most largely grown is wheat, which in 1881 occupied 84,588 acres, oats coming next with 55,177 acres, and barley and bere occupying only a little less, 50,010 acres. Beans and peas were grown on 17,463 and 10,762 acres respectively, and rye on only 421 acres. In Thanet mustard, spinach, canary seed and a variety of other seeds are raised. Of green crops, turnips and swedes were grown on 27,254 acres, vetches and similar crops 12,178 acres, potatoes 37,816, mangolds 13,070, cabbage 6848, and carrots 452. Part of the area under green crops is occupied by market gardens, which are very numerous in the neighbourhood of London. The principal orchard districts are the valleys of the Darent and Medway, and the Tertiary soils overlying the Chalk, between Rochester and Canterbury. The county is especially famed for cherries and filberts, but apples, peaches, plums, gooseberries, and currants are also largely cultivated. In some cases apples, cherries, filberts, and hops—the special crop of the county—are grown in alternate rows. 41,476 acres were under hops in Kent in 1881, and in the United Kingdom only 64,848 acres; the principal hop districts are the country in East Kent lying between Canterbury and Faversham, the valley of the Medway in Mid Kent, and the district of the Weald. The area under hops in these several districts in 1881 was 11,718, 17,858, and 11,968 acres respectively—other districts contributing only 419 acres. Much of the Weald, which originally was occupied by a forest, is still densely wooded. There are many low woods scattered throughout the county, especially in the valley of the Medway, oak and beech being the trees principally grown. A large extent of woodland is ash and chestnut plantations—maintained for the growth of hop-poles. The following table gives a classification of the woods according to size as returned on the 25th June 1875 and the 4th June 1880, with the acreage of each class of holding for these years.—

Class of holding	50 Acres and under		50 to 100 Acres.		100 to 300 Acres.		300 to 500 Acres.		500 to 1000 Acres.		1000 Acres and upwards.	Total		
Years	1875.	1880.	1875	1880	1875.	1880.	1875	1880	1875.	1880	1875	1880	1880	
Number	6,790	7,281	1,895	1,861	1,814	1,848	868	876	118	110 <td>15</td> <td>12</td> <td>10,981</td> <td>10,990</td>	15	12	10,981	10,990
Area in Acres	29,987	85,288	95,768	95,611	211,388	229,974	130,071	142,295	76,542	70,648	28,467	18,950	726,114	744,548

About two-thirds of the holdings are less than 50 acres in extent, but the largest area—about two-fifths of the whole—is in farms between 100 and 300 acres.

The number of horses in 1881 was 29,450, an average of 8·9 to every 100 acres under cultivation, the average for England, and also for Great Britain being 4·4. The number of horses used for agricultural purposes was 24,177. The total number of cattle in 1881 was 73,409, an average of 19·9 (England 18·9, Great Britain 18·4) to every 100 acres under cultivation. The number of cows in milk or in calf was 39,485, and of other cattle 43,924. Cattle are grazed in large numbers on the marsh lands along the estuaries of the rivers, and of course dairy farms are very numerous in the neighbourhood of London. The number of sheep in 1881 was 952,611, an average of 128·9 (England 62·4, Great Britain 76·3) to every 100 acres under cultivation. The number one year old and upwards was 227,124, and below one year 325,187. A breed of sheep peculiar to the district, known as Kent's, is grazed on Romney Marsh, but Southdowns are the principal breed raised on the uplands. Pigs in 1881 numbered 56,596, or an average of 7·6 (England 7, Great Britain 6·8) to every 100 acres under cultivation.

According to the landowners' return, 1875-78, the land, exclusive of that in the metropolis, was divided between 44,638 proprietors, and its gross annual value was £23,357,067. Of the owners, 26,925, or more than 77 per cent., possessed less than 1 acre, and the average value per acre over all was £3, 10s 7d. There were four proprietors possessing above 10,000 acres each, viz., Viscount Melbourne, 15,102 acres; Lord Somers, 14,446; Sir R. Tulson, 13,689; and the Ecclesiastical Commissioners, Whitehall, 10,692. Other seventeen possessed more than 5000 acres each.

Manufactures and Trade.—At one time there were extensive iron-works in the Weald of Kent, and woollen cloth was also largely

manufactured, but the former industry is now wholly extinct, and the latter is only presented to a very small extent. Next to the occupations connected with the Government establishments at Deptford, Woolwich, Chatham, and Sheerness (see DOCKYARDS, vol. vii. p. 310), the most important industry of the county is that of paper, which is carried on on the banks of the Grey, Darent, Medway, and other streams in the west of the county. Shipbuilding by private firms is also prosecuted at Greenwich, Gravesend, Dover, Northfleet, and Ramsgate. At Greenwich there are engineering works, soap works, and chemical works; and the carriage and engine works of the South-Eastern Railway are situated at Ashford. Manufactories of silk, cotton, linen, wool, and ribbons give employment in various towns and villages. Bricks, tiles, pottery, and cement are fabricated, especially on the banks of the Swale and Medway. Lime-burning and whiting-making are also carried on. There are powder-mills at Dartford, Faversham, and Tunbridge. The principal ports besides those on the Thames and Medway are Whitstable, Herne Bay, Margate, Broadstairs, Ramsgate, Sandwich, Deal, Dover, and Folkestone. The watering-places are Reth, Greenhithe, Northfleet, Gravesend, Herne Bay, Margate, Westgate, Broadstairs, Ramsgate, Deal, Dover, Folkestone, and Sandgate. Tunbridge Wells is a favourite spa.

Fishing.—Deep-sea fishing is largely prosecuted all round the coast of Kent. Shrimps, soles, and flounders are caught in great numbers in the estuaries of the Thames and Medway and along the coast of Whitstable and Margate as well as at Ramsgate. The principal oyster beds are at Queenborough, Rochester, Milton, Faversham, and Whitstable, and whitest bait frequent the Thames in immense shoals below Greenwich.

Railways.—As the main pathway of communication between London and the Continent the Channel Ports, Dover, Folkestone, and

at a very early period enjoyed the advantage of railway intercourse; and it is now very closely connected with railway lines.

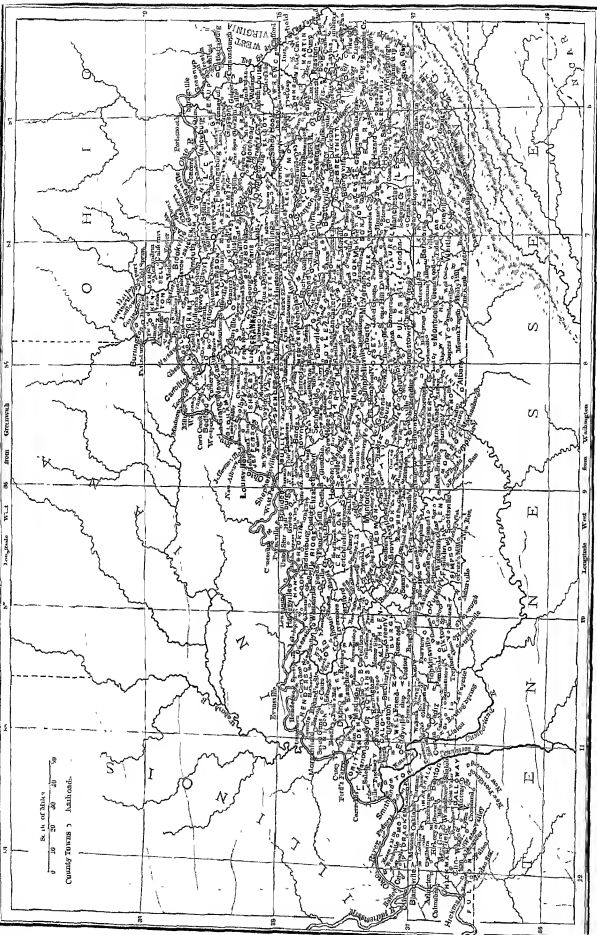
Administration.—Kent is divided into five lathes—a partition peculiar to the county, and dating from Anglo-Saxon times. The lathes are St Augustine, Sheppey, Borey, Aylesford, and Sutton-at-Hone. The county comprises 31 hundreds, the lowest of Tunbridge, the franchises and barony of Birchall, the liberty of the Isle of Sheppey, the liberty of New Romney, two cities, Canterbury (31,701) and Rochester (31,590), which are also municipal and parliamentary boroughs; one parliamentary borough, Chatham (48,606), five boroughs which are both municipal and parliamentary, viz., Dover (28,458), Gravesend (m. 28,576, p. 31,856), Hythe (m. 4,099, p. 25,066), Maidstone (m. 29,685, p. 89,662), Sandwich (m. 28,840, p. 15,560), part of the parliamentary borough of Greenhithe and five municipal boroughs, viz., Deal (8,422), Faversham (8,627), Folkestone (18,887), Margate (15,839), and Tenterden (8,630). The liberty of New Romney and all the municipal boroughs except Gravesend and Maidstone are included among the Cinque Ports. The Cinque Port districts in Kent are those of Sandwich, partly in Essex, Dover, Hythe, New Romney, and a portion of Rye, namely, Tenterden (see Cinque Ports, vol. v. p. 788). Until 1887 Kent was for parliamentary purposes formed into only two divisions, East and West Kent, but by the Local Government Act of that year West Kent was divided into West and Mid Kent. The city of Canterbury, which returns two members, Dover and Sandwich, which return two members each, and Hythe, which returns one member, are included in East Kent, which returns in all nine members. In Mid Kent are included the city of Rochester, returning two members, Maidstone, returning two members, and Chatham and Gravesend, returning one member each, it returns in all eight members. West Kent, which returns two members, includes part of the borough of Greenwich, which returns two members. The total representation of the county, including Greenwich, is thus twenty-one members. The county has one court of general sessions and two of quarter sessions, the number of sessional divisions is sixteen, exclusive of the liberty of Romney Marsh, which has petty and general sessions under its charters. The central criminal court has jurisdiction over certain parishes in the county. The county is divided into five hundred parishes, of Rochester, and the boroughs of Gravesend and Maidstone have commissions of the peace and separate courts of quarter sessions, as have also the ports and boroughs of Deal, Dover, Faversham, Folkestone, Hythe, Margate, Sandwich, and Tenterden. The ancient borough of Sandwich, governed by an old charter, has a recorder and a court of quarter sessions with a separate jurisdiction limited to misdemeanours. Summary cases are dealt with by the mayor and magistrates in petty sessions. With the exception of the portion included in the metropolitan police district, the whole for inland purposes belongs to the south-eastern circuit, and for police purposes is divided into twelve districts, which are generally identical with the petty sessional divisions. The cities of Canterbury and Rochester, the boroughs of Deal, Dover, Faversham, Folkestone, Gravesend, Hythe, Maidstone, Margate, Sandwich, and Tenterden, and the towns of Margate (23,005) and Tunbridge Wells (24,809) have their own police. Ecclesiastically, with the exception of portions of two parishes, Kent is within the dioceses of Canterbury and Rochester; and it contains thirty-seven civil parishes or places, as well as parts of other parishes extending into adjoining counties.

Population.—Since 1801, when it numbered 808,667, the population has been rapidly and unintermittently increasing. In 1821 it was 497,224, and in 1841 it had increased to 549,868, in 1861 to 733,331, in 1871 to 848,294, and in 1881 to 977,565, of whom 497,716 were males and 499,870 females.

History and Antiquities.—The Belgæ from Gaul had before the time of Cæsar's invasion taken possession of a large portion of southern Britain, including Kent. The remarkable cromlech, Kit's Cote House, near Aylesford, belongs to this early period, as do numerous earthworks, encampments, stone circles, and excavations on the coast which are now generally regarded as ancient chalk pits. The spot of Cæsar's landing was probably either some part of the coast between Walmer and Thanet—the neighbourhood of Deal finding most supporters—or the *Portus Lemannis* in Romney Marsh, which is identical with the town of Lympsæ. In his first invasion he did not penetrate farther than Kent, and the absence of insular inscriptions is regarded as evidence that the conquest was easily effected. The principal Roman road was the Welles Street, between *Dubris* (Dover) and London, which had much the same course as the present highway. This road was joined at *Durovernum* (Canterbury) by two others, one from the *Portus Lemannis* (Lympsæ) and the other the *Regia* or the main trunk of the road from the *Portus Lemannis* are still well marked throughout its whole extent, but agricultural operations have almost wholly obliterated the traces of that from *Regium*. Of two other Roman stations, *Durolevum* and *Vagniacæ*, the site cannot be absolutely determined; but most probably the former was near Faversham, and for the latter, which was somewhere between

Rochester and London, most opinions favour Springhead near Gravesend. There are still important remains of Roman fortresses at Dover, Richborough, Beaulieu, and Lympsæ; many traces of Roman villas have also been discovered; and portions of Roman structures have frequently been utilized in the construction of churches and other buildings. A great variety of Roman relics have been discovered in nearly every part of the county. The most remarkable are profane traces of extensive potteries of purple or black ware at Upchurch on the south bank of the Medway, London coffins elaborately ornamented, and glass and bronze vessels in various Roman cemeteries. The earliest Teutonic settlement under Hengest and Horsa, took place in Kent, and on the arrival of Augustine in 597, Canterbury became the Christian metropolis of the island. Separate kings appear to have occasionally ruled in East and West Kent, and a bishopric was established at Rochester in West Kent, as well as at Canterbury. Of this period of Kentish history the principal antiquarian remains are the cemeteries, from those at Sarre and Canagel in Thanet, and at Bilton, Barham, Bishopscourt, Gilton, and Sittingbourne, a large number of relics of various kinds have been obtained. Some old customs belonging to this period, including that of gavelkind in cases of intestacy, are still extant. Kent in 838 was united by Egbert to the kingdom of the West Saxons. In the 9th, 10th, and 11th centuries it suffered greatly from the ravages of the Danes. After the Conquest the earldom of Kent, which had been held by Godwine and afterwards by Harold, was bestowed by William on his brother Odo bishop of Bayeux. Among other events of historic importance the following may be mentioned—(1) the capture of Rochester by William Rufus in 1085, an incident connected with the rebellion of Odo, which was subdued in the same year, the murder of Thomas à Becket at Canterbury in 1170, the submission of King John to the pope's legate at Dover in 1215, the capture of Rochester Castle by King John in the same year, and of the *White Ship* by the dauphin of France in 1216, the greater part of Kent formally submitting to him with the exception of Dover Castle; Wat Tyler's insurrection in 1381 and that of Jack Cade in 1450, the encampment of Cornish insurgents at Blackheath in 1497, where they were surprised by Henry VII., the insurrection of Sir Thomas Cromwell in 1539, the capture of the city of Canterbury by the city of the Kentish insurrection by Fairfax at Maidstone, June 1, 1648, and the burning of certain ships at Chatham by the Dutch fleet under De Ruyter in 1687 after the port of Sheerness had been levelled by his guns.

From its position and its connection with the early history of England, and from its beauty and fertility, Kent possessed larger than average number of monastic foundations. The earliest were the priory of Christ's Church and the abbey of St Peter and St Paul now called St Augustine's, both at Canterbury, founded by Augustine, the monk who accompanied him to England. In the time of Henry VIII. the other principal religious houses were a priory at Rochester founded in 1085, a priory founded at Folkestone in 1100 on the site of a monastery originally founded in 880, a monastery of St Stephen at Canterbury, founded about 1100, a monastery at Minster in Sheppey built in 1180 on the site of a monastery which was founded in 676, but destroyed by the Danes, St Martin's Priory at Dover established in 1140 in place of one founded in 698 but afterwards dissolved, an abbey at Faversham founded in 1147, and numerals at Litchurch in Higham founded before 1151, at Davington founded in 1153, and at Malling founded in the time of William Rufus, the Black Canons possessed a priory at Leeds founded in 1119, an abbey at Westwood in the parish of Kent founded in 1178, a priory at Cornwell in Goudhurst founded in the reign of Henry II., a priory at Tunbridge founded in the same century, a priory at Binghamton founded in 1248, St Gregory's Priory at Canterbury, changed in 1254 into a priory of the Order of secular priests, originally founded in 1084; the White Canons led St Radegund's Abbey near Dover, founded in 1198, and an abbey at West Langdon, founded in 1192; houses belonging to the Carmelites existed at Aylesford and Newenden, both founded in 1240, and Sandwich founded in 1272, one belonging to the Dominicans was founded at Canterbury in 1291, the Franciscans having one at the same city founded in 1235, and the Eremites Priars also one at the same city founded in the time of Edward I. or Edward II., an abbey of Cistercian monks was founded at Boxley in 1146, a preceptory of Knights Templars at Swinfield near Dover, some time before 1180, a priory of Cistercian monks at Mottenden in the parish of Headcorn in 1254, a monastery of the order of St Augustine at Darford about 1265, a cell of Cistercian monks at Monks Horton in the time of Henry II., and a preceptory belonging to the knights of St John of Jerusalem at West Peckham in the time of Henry II. The priory of St Augustine at Canterbury, the priory of Christ's Church, Canterbury, adjoining the cathedral, the Dominican convent, Canterbury, St Radegund's Abbey near Dover, St Martin's Priory, Dover, Horton Priory, Malling Abbey, Aylesford Priory, and the abbey of Minster in Sheppey and Minster in Thanet. In addition to



(Mango), "dearest friend." As, however, the favour with which he was regarded by Servanus had awakened the animosity of his fellow pupils, he secretly made his escape, and ultimately found his way to Cathures (Glasgow), near a cemetery which had been long consecrated by St. Ninin. There he dwelt for some time with two brothers named Tulley and Anguen, when on account of the lame of his manner of life and his miraculous deeds the king and clergy of Cumbria, in order to restore the religion of Christianity to its former influence, called over a bishop from Ireland and caused Kentigen to be consecrated bishop. His cathedral seat he named Glasna, "the deer family," where he collected a number of friends and disciples who practised continence and lived after the manner of the primitive church. On his life being threatened, he journeyed to Menerva (St. Davids) in South Wales, where he founded the monastery of Llanely, afterwards St. Asaph's. When Roderick ascended the throne of Cumbria, Kentigen remained, and after establishing his see for some time at Eddam, Dumfriesshire, he settled finally at Glasgow. He is said to have died on a Sunday, and as his saint's day is the 13th January, he probably died in 603.

The fragment of a life of St. Kentigen, composed at the instance of Helbert, bishop of Glasgow, who died in 1164, and made use of by John of Fordun, is preserved in a manuscript of the British Museum. It was first printed by Cosmo Innes in the *Argonauts and Episcopus Glasguensis*. A life written by Jocelyn, a monk of Furness, about 1180, exists in two MSS, one in the British Museum, the other in the public library of the archbishop of Dublin bound along with a life of St. Servanus in a small quarto volume. An abridgement of the life by Jocelyn was published by Gough in *Novae Legende Anglie*. The British Museum MS was published by Pinkerton in the *Vita Antiquae Sententiarum Scriptorum*. The second MS has been published along with the anonymous fragment, and with translations of both, accompanied with learned notes by Bishop Forbes of Brechin, in vol. v of *The Historians of Scotland*, 1874. Principally on the earlier fragment have been founded the legends of St. Kentigen and his friends and disciples in the Aberdeen Breviary, which have been published with translations and notes by Rev. William Stevenson, 1874. See also Skene's *Celtic Scotland*, vol. ii, and Montalembert's *Monks of the West*.

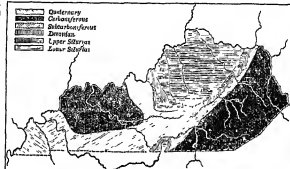
KENTUCKY

Copyright, 1882, by John B. Pate.

PLATE II **K**ENTUCKY, one of the central States of the United States of America, is situated between 35° 30' and 38° 6' N lat., and 82° and 89° 38' W long, and is bounded on the N. by Ohio, Indiana, and Illinois, on the W by Missouri, on the S by Tennessee and Virginia, and on the E. by Virginia and West Virginia. It extends from east to west 455 miles, and its greatest width from north to south is 171 miles.

The area of the State has been variously estimated at from 37,000 to 40,000 square miles. The surface is an elevated plateau sloping from the great Appalachian uplift on the south-east, to the Ohio and Mississippi rivers on the north and west. Only that portion of the State including and lying between the Pine or Laurel Mountain and the Cumberland range may be said to partake of the mountain structure. These parallel ranges have an elevation of from 2000 to 3000 feet above sea-level, whilst the mountains in the Cumberland valley between these ranges have an elevation of 3500 feet. The Cumberland river, near where it passes through a break in Pine Mountain, is at low-water mark 960 feet above the sea. Some of the hills immediately to the north are as high as Pine Mountain, gradually decreasing in height to the western edge of the Appalachian coal-field, where the greatest elevation is less than 1600 feet above the sea. The topography can be understood by reference to the accompanying sketch map of the geology of the State. The eastern coal-field, with an area over 10,000 square miles, has an elevation of 650 on the Ohio river to 1400 feet on the south-western

edge on the Tennessee line, and 3500 feet on the south-eastern border of the State. The great central or "Blue Grass region" (Lower Silurian on map) has an area of about 10,000 square miles, and an elevation of from 800 to 1150 feet. Although elevated several hundred feet above the drainage level, the surface is that of a gently undulating plateau, with a pleasing topography. The Upper Silurian and Devonian, with an area of about 2500 square miles, have an elevation of 450 on the north-west and 800 on the north-east, and to 1100 feet where these formations curve around the Lower Silurian on the south-west. In this region are wide stretches of very level country, often with insufficient drainage. Around this central region extends from the mouth of Salt river to the mouth of the Seneca a continuous ridge known as Muldrow's Hill, King's Mountain, Dig Hill, and other local names, having an abrupt escarpment on its inner circle, and sloping away from the central uplifted dome of the Blue Grass region, as a broken plateau on the east, and an almost level plateau on the west where the subcarboniferous limestone determines the topography. This range of hills is one of the prominent features in the State. The subcarboniferous has an area of about 10,000 square miles, with an elevation of from 350 to 600 feet on the south-western to 950 in the central region. In the



Geological Map of Kentucky

eastern portion of this formation the streams have cut deep gorges in the limestone, but in its central part only the larger streams are open to daylight, and most of the drainage is subterranean, which gives to that region a peculiar topography,—the surface being a series of slight round or oval depressions, through which the surface water escapes to the streams below. Whenever the small passage way leading downwards from one of these sinks becomes closed, a "pond" is formed. In this formation are the numerous caverns for which this State is noted. The western coal field has an area of about 4000 square miles and an elevation of from 400 feet along the Ohio river to 850 feet in its south-eastern portion. The Quaternary, with an area of about 2500 square miles, has an elevation of about 280 feet on the river bottom lands and from 350 to 450 on the uplands. The average elevation for the entire State is over 1000 feet above the sea, and the numerous streams penetrating all portions have cut their channels deep enough to secure ample drainage, and exemption from the dangers of floods, with the exception of very limited areas.

Rivers.—The State has a river boundary of 813 miles of navigable streams—the Chattanooga or Big Sandy on the east for 120 miles, the Ohio on the north for 643 miles, and the Mississippi on the west for 50 miles. The Chattanooga, Licking, Kentucky, Cumberland, and Tennessee rivers have their sources in the Appalachian coal-field, and flow through the State to the Ohio river. The Green and Tradewater rivers drain the western coal-field. Kentucky has many hundred miles of navigable rivers,

connecting with the Mississippi system, and furnishing a most advantageous means of cheap transport for coal, timber, &c. A system of river improvement, begun by the State some years ago, by which the Green and Barren rivers from Dowling Green downwards, and also the lower portion of the Kentucky river, were made continuously navigable, is being prosecuted still further by the United States Government. It is now possible to float down logs, rafts, flat boats, &c, from almost the fountain heads of the rivers.

Climate—The climate is very mild and salubrious. The mean annual temperature ranges in different parts of the State from 50° to 55° Fahr. The extreme range is less than in the States north and west. The lowest record at the United States Signal Service Station during the exceptionally cold months of December 1880 and January 1881 was 8°. During the very hot summer of 1881 the maximum temperature was greater as far north as Chicago than in Kentucky. Cattle remain upon pasture during the entire winter, but with little additional food, and there is seldom a dry, winter or summer, when a man may not perform a full day's work in the open air. The healthfulness of the climate is attested by the low death-rate and by the strength and vigor of the population. The tabulated measurements of the United States volunteers during the civil war show that the soldiers born in Kentucky and Tennessee exceeded all others in height, weight, circumference of head, circumference of chest, and ratio of weight to stature. The speed and endurance of the Kentucky horse, and the superior development of all kinds of domestic animals, are well known. The annual rainfall ranges in various parts of the State from 45 to 60 inches, and is probably still higher in the Cumberland Mountains.

Geology—With the exception of the more recent formations in the portion of the State west of the Tennessee river and along the valleys of some of the streams, Kentucky is composed entirely of Paleozoic strata, having present all of the various groups found in the Ohio valley, from the calciferous sandrock (3c of Dana's *Table of Formations*) to and including the carboniferous. The greatest thickness of the various groups is not in Kentucky,—probably not aggregating over 5000 feet. The entire State is included within the area of the great Appalachian uplift. In the south-east the disturbance is greater, the strata often being inclined at a high angle, the excessive warping generally diminishing toward the north-west. This disturbance in the south-east is emphasized by the Great Pine Mountain fault, extending parallel to the axis of the Appalachian uplift, entirely through the south-eastern portion of the State, and bringing to the surface in the Coal-measure rocks as low as the Clinton group of the Upper Silurian. The axis of the greatest geological elevation in the State is parallel to the above, and passes in a north-easterly and south-westerly direction through the counties of Montgomery, Clark, Madison, Garrard, Jessamine, and Boyle, shown on the map by the deflection of the Kentucky river from its general course towards the Ohio river. This uplift brings to the surface the lowest rocks exposed in the State,—the "bird's eye" limestone of the Trenton (4a of Dana), and the dolomite, known as "Kentucky river marble," including what is probably the equivalent of the calciferous sandrock of the New York section. These lower rocks of the Kentucky section form a triangular area having as its depressed apex north-west of Frankfort, and its elevated base in the counties named above. Through these formations, having a thickness of over 400 feet, the picturesque gorge of the Kentucky river has been cut. Next in ascending order we have 150 feet of blue, fossiliferous limestone, containing characteristic forms of the Trenton of New York, and 300 feet of limestone and shale containing the fossils of the Hudson river or Onondaga groups (4c of Dana). These groups make up the well-known "Blue Grass" region of Kentucky, celebrated for fertility of soil, high agricultural development, and superiority of the horses and other domestic animals produced. The soils of the most fertile portion of this region are derived from the 150 feet immediately above the bird's eye limestone. These rocks are very rich in phosphatic lime, and with careful tillage and proper rotation of crops the lands are not exhausted by cultivation. The blue limestones of central Kentucky are very prolific in fossil forms.

Surrounding this fertile form are the rocks of the Upper Silurian, averaging in thickness about 100 feet. East of Louisville this formation is about 25 miles wide, and in eastern central Kentucky about 10 miles wide, decreasing in thickness and in superficial extent toward the south-western portion. The rocks are mostly pure limestone. The soils of the Silurian, of which the most characteristic are the beautiful chert corals. The soils of this formation are less fertile than those derived from the blue shell limestone and marly shales of the Lower Silurian. Above the latter formation, and forming the eastern portion of the semicircular or irregular triangle extending around the great central uplift, are the carboniferous limestones of the Devonian (5c of Dana). The principal exposure is

seen at the falls of the Ohio below Louisville, at low water presenting probably the most beautiful and extensive natural cabinet of corals in the world,—a reef of corals, perfectly preserved in minutest structure, and of exquisite beauty. The soils derived from these rocks are of almost equal fertility to the best soils of the blue limestone, and the topography is equally pleasant to the eye. The next formation in order is the black shale (10c of Dana) of the Devonian, with a thickness of about 150 feet in the north-east, and decreasing gradually to the south and west. This formation is peculiar from the high percentage of petroleum contained in the shale. Before the discovery of oil-wells oil was distilled from these shales, and the oil in the productive wells of Kentucky is derived from the same source. Where this shale determines the topography the lands are generally flat, often with insufficient drainage, and are not so productive as analyses would seem to warrant. Doubtless underdrainage will increase the yield.

The Subcarboniferous rocks, consisting of the several groups identified by fossil remains with the Waverly, Kookab, Warrar, St. Louis, and Chester groups (18a, 13c, and 18c of Dana), composed of sandstones, shales, and limestones, with a total thickness of over 1000 feet, cannot here be described in detail. Muldrow Hill, representing the retreating escarpment of formations which formerly extended over the central Blue Grass region, is composed of these rocks, capped at Big Hill in Madison county with the carboniferous conglomerate. The subcarboniferous limestone region of western and southern Kentucky, drained by the Green and Cumberland rivers, is characterized for the most part by an excellent soil, well adapted to the growth of Indian corn, wheat, barley, and other cereals, producing a very fine quality of tobacco, and certain grasses in great perfection. This formation is noted for the numerous ovens of large size and great beauty,—the best known being the celebrated Mammoth Cave in Edmonson county, which is the largest known cavern in the world. Here many miles of subterranean passages have been excavated by the ebbing action of water charged with carbonic acid, assented in places by the action of the atmosphere. The ovens are beautified by columns and stalagmites formed by the deposition of carbonate of lime from the percolating waters, and by exfoliation of sulphate of lime, taking the form of flowers, rosettes, and other figures, rendered more beautiful by their power of reflecting light. See **MAMMOTH CAVE**.

The detailed survey of the Carboniferous strata of Kentucky is not yet completed, but enough is known to justify the assertion that the total area in the State is over 14,000 square miles,—10,000 square miles of the Appalachian region, and 4,000 square miles of the western or Illinois coal-field. In the eastern field two workable coals are found below and twelve above the carboniferous conglomerate. The eastern field is remarkable for the thickness of some of the coal strata and the purity of coals, for the large area of excellent canal coals, and for the fact that the most productive lands in the State are in the western coal-field. In the eastern field are very fertile valleys, and the uplands in the Cumberland valley are quite productive. Even the poorest of the Coal-measure soils are well adapted to certain grasses and fruits, and will yield good returns from intelligent culture.

There only remain to be noticed the Quaternary strata. The region west of the Tennessee river, and the level plains bordering the principal rivers and above high-water level, are composed of a homogeneous buff-colored siliceous loam known as the "bluff" or loess formation (20b of Dana). This is, with the exception of the alluvial "bottoms" along the rivers, the most recent formation in Kentucky. The deposit has a thickness of from 40 to 60 feet. Owing partly to the presence of numerous land and freshwater shells (*Helix*, *Cyclostoma*, *Pupa*, *Cyclops*, &c.), this formation is highly calcareous, giving from an average sample 0.6 per cent of lime, and the soils are of the richest fertility. It is a loam rests upon a coarse gravel, varying in size from 1/4 inch to 1/2 inch to 80 feet, composed mainly of water-worn pebbles from the carboniferous conglomerates, and slightly water-worn angular pebbles of chert and hornstones from the lower subcarboniferous carboniferous groups, and coarse angular sand. Intermingled throughout are silicified fragments of many of the Paleozoic fossils

to be found in the Ohio valley. In descending order are beds of white sand and clay and shales of the Eocene (Tertiary), only slightly exposed in the extreme western part of the State, where the streams have cut deepest. Nowhere in the State have evidences of glacial action been found. Over the uplifted Blue Grass region are often thick deposits of what has been called drift material, but such deposits are composed altogether of alluvial remains from the several formations above the Lower Silurian, and the evidences are conclusive that they are the remains of rocks decomposed *in situ*.

Minerals.—No precious metals have been discovered in Kentucky. The amount of coal mined has not been as large as the quantity and quality in the State would justify, but the increased facilities of transport have stimulated production, and the output will increase from year to year. In 1870 the amount mined was 150,832 tons, and in 1880 1,060,086 tons, a larger percentage of increase than in any other State in the Union. Iron ores of good quality abound in various parts of the State. In both country is a large deposit of Clinton ore similar to the red fossil ore occurring in this formation from New York to Alabama. The same ore probably is in position along the western base of Pine Mountain. Along the south-eastern border of the State it extends for many miles in Tennessee and Virginia with a thickness of from 18 inches to 7 feet, where the very near proximity to the excellent coaling coal of Kentucky renders it of peculiar value in determining the future development of that portion of the State. In the Cumberland valley of western Kentucky a high grade limonite is abundant about, and extensively used (*Pyritus angulatus*), the basis of a superior iron-ore rests upon the top of the St Louis group of this formation. Excellent carbonates and limonites abound in the eastern Coal-measures, and have been mined extensively in the western part of the State. In the Lower Coal-measures of western Kentucky are a number of iron-ore strata ranging in thickness from a few inches to 6 feet.

Galeas associated with sulphate of baryta occurs in veins in the lower members of the blue limestone of central Kentucky, and also in the subcarboniferous strata in the lower Cumberland valley, where it is associated with valuable deposits of fluor-spar.

Petroleum has been produced from wells in Barren county for a number of years. The oil is here derived from the Devonian black shale. Heavy lubricating oil is produced from the same formation in Wayne county. There is a wide area in the State where petroleum may be obtained by boring.

Salt-brine is obtained from wells in the eastern coal-field, and in the subcarboniferous limestone of western Kentucky.

Fire and pottery clays abound in the Coal-measures; pottery clays occur in the surface deposits in valleys of central Kentucky, and in the flat lands where the soil is derived from the decomposition of the Devonian shales, and the argillaceous shales of the Waverly group. In the Tertiary shales, below the gravel bed west of the Tennessee river, are pottery-clays, and fire-clays occur in great abundance.

Building stones of great variety abound in almost every section.

Forests.—Probably two-thirds of the State is yet covered by virgin forests of valuable timbers. At the time of the settlement of the State by the whites it was covered by forests excepting a portion of the south-western part known as the "Barrens," which was a prairie covered by tall grass known as "lucern-grass." Here only the roots of certain hardy trees had withstood the annual burning of the dry grasses; from these roots "sprouts" grew every year, only to be destroyed by fire, and the roots or base grew horizontally under the soil. When the country was settled and the fire checked, the saplings springing from these roots soon grew into trees, and the big woods was speedily covered with a dense growth; the prevailing timbers being black-jack oak (*Quercus nigra*), post oak (*Q. obtusiloba*), and black oak (*Q. heterocarpa*). The outline of these barrens was almost identical with the outline of the cavernous group of the subcarboniferous limestone. On the lower limestones and shales of the Subcarboniferous, the most valuable timbers remaining are yellow poplar (*Liriodendron tulipifera*), white oak (*Q. alba*), the hickories, and some black walnut (*Juglans nigra*). The several divisions of the Lower Silurian are characterized by a variation in the forest growth. On the lower rocks the most characteristic timbers are over-cup oak (*Q. macrocarpa*), white oak, small bark hickory (*Corys alba*), black walnut, and black ash (*Fraxinus sambucifolia*). The prevalent timbers on the best soils of this region are—sugar maple (*Acer saccharinum*), blue ash (*Fr. quadrangula*), black walnut, pig-nut hickory (*Q. glabra*), hackberry (*Celtis occidentalis*), mulberry (*Morus rubra*), buckeye (*Xanthoxylum glabra*), honey-loose (*Ailanthus glandulosa*), and sycamore (*Mycioides aceroides*), and Kentucky coffee-tree (*Gymnocladia*). On the soils derived from the siliceous member of the Cincinnati group, the prevalent timbers are yellow poplar, beech, white and red oak, and hickory. White oak is the prevailing timber on the upper portion. On the Upper Silurian lands the timbers are mostly white oak, of superior

quality, sweet gum (*Liquidambar styraciflua*), and water maple (*A. rubrum*). The growth on the coralline limestone is very similar to that on the best soils of the blue limestone, with the exception that beeches and yellow poplars are more numerous. On the black shale of the Devonian are over-cup oak, black oak, sweet gum, beech, and elm, and, in places where the soil is well drained, yellow poplar, wild cherry, and black walnut. The growth on the flat lands of the Waverly is elm, beech, sweet gum, and white oak, on the uplands chestnut, oak (*Q. Friesii*), and small hickories, and on the thin uplands the above timbers and yellow pine (*Pinus mitis*). The great stores of valuable timbers are in the Coal-measures. In eastern Kentucky there is an area of 10,000 square miles of virgin forests of white oak, ash, hickory, cherry, and other valuable timbers. On the outcrop of the conglomerate sandstone, on the western edge of the coal-field, and on the top and eastern slope of Pine Mountain, and the western slope of Cumberland Mountain, the prevailing timbers are chestnut, oak, and yellow pine, and hemlock (*Abies canadensis*) where the streams have cut deep in the rocks, with an undergrowth of rhododendrons and kalmias, and on the drier slopes azaleas. The above is also the growth where the conglomerate is thick on the eastern outcrop of the western coal-field. In the valley of Red river, on the conglomerate series, there is an area of about 40,000 acres, where the prevalent timber is white pine (*P. strobus*). There are fine forests remaining on the Quaternary west of the Tennessee river. On the lowlands are forests of large cypress (*Taxodium distichum*). In this region the *Catalpa speciosa* and pecan (*Carya oviformis*) abound, and cottonwood (*Populus angustata*) is the basis of a superior paper stock. Many valuable timbers, in addition to the above, are to be had in various parts of the State. Owing to the large demands for timber on the treeless prairies, and the rapid exhaustion of timbers in the States north of the Ohio river, the extensive forests of Kentucky have an especial value.

Soils and Agriculture.—With the exception of the area west of the Tennessee river, all the soils are derived from the decomposition of rocks *in situ*. The soils over an area of about 29,000 square miles are derived from the decomposition of limestones of various geological horizons. The soils of the Blue Grass region, derived from the decomposition of the Devonian shales, are the most fertile of a portion of the subcarboniferous limestone groups, are of great fertility, and are easily restored by a judicious rotation with clover and grasses.

The State was peopled almost exclusively by agriculturists from Virginia and Maryland, and agriculturists has remained the pre-eminence occupation. Out of a total population of 1,831,011 in 1870 only 44,197 were engaged in manufacturing, mechanical, and mining industries. The peculiarity of Kentucky agriculture is its great diversity. It will be seen from the United States census that in the early days of the present time the State ranked first in the production of one or more staple articles. Thus in 1840, though sixth in rank of population, it was the first in the production of wheat and hemp, and the second in the production of swine, Indian corn, and tobacco. In 1850 it ranked first in the production of Indian corn, flax, and hemp, and second in swine, mules, and tobacco. In 1870, when it was the eighth State in population, and the eighth in the total value of agricultural products (notwithstanding over one-half the area of the State was in virgin forests), it ranked first in the production of hemp and tobacco, sixth in Indian corn, and eighth in wheat. In 1880 it ranked first in the production of hemp and tobacco, and seventh in Indian corn and rye. The decline in the relative position in the production of Indian corn and wheat was not caused by a decreased production, but by the increased production of those cereals by States in the west where there are almost the exclusive crops. In Kentucky a more diversified agriculture is found to be more profitable. Exports are but few devoted to the importation and improvement of domestic animals, until the State has become the great centre for fine stock of all kinds. In arriving at this pre-eminence, the breeders have doubtless been assisted by the climate, the water, and the perfection of pastures. The blue grass (*Poa pratensis*) attains perfection in this region, making a beautiful turf; it grows in the shade of woodlands, and affords an excellent winter pasture. Virginia, in early times, imported choice horses from England (when the breeders there paid attention to endurance). The Kentucky breeders have kept these strains pure, and have from time to time added by importations from England, until the horses having endurance and speed is the result. Probably over 75 per cent of the winnings on the American turf is by Kentucky-bred horses. The attention of many of the Kentucky stock breeders of late years has been turned to breeding trotting horses, with very marked results. The production of the very fleet trotting horses of Kentucky is the result of illigant breeding under favorable conditions.

Kentucky is the principal tobacco-growing State in the Union. In 1870, of the total of 262,785,871 lb produced in the United States, Kentucky produced 105,805,869 lb, and in 1880, out of the total of 478,107,876 lb, Kentucky produced 171,121,184 lb. The ten principal tobacco-growing countries are:—

	b		b
Christiana	12,577,574	Bracken	8,120,088
Henderson	10,112,251	Ligon	8,030,953
Harlan	9,323,451	Todd	8,300,455
Greene	8,991,434	Trigg	8,140,841
Mason	6,901,383	Wen	8,067,148

The production of the principal cereals in Kentucky was as follows in 1870 and 1880 —

	1870	1880
Indian corn	30,001,000	73,077,829
Wheat	5,739,754	11,386,810
Oats	2,655,140	4,892,000
Hay	336,140	487,001
Hay	3,109,008	876,948

Hemp, since the early settlement of the State, has been a favourite crop, more especially in the Blue Grass region, contrary to an accepted opinion it has not here proved an exhausting crop where retted upon the land. Wheat succeeds almost as well after hemp as after clover soil. The yield of hemp for the year 1880 was about 15,000 tons. Cotton is grown only to a limited extent west of the Tennessee river, the total production amounting in 1880 to 1567 bales. The total number of farms in 1870 was 118,422, the average size being 158 acres. In 1880 the average size of farms was 227 acres, and in 1890 211 acres. Over 60 per cent. of the area returned as farms was unimproved or in timber. The area returned as improved or under fence was less than one-third the area of the State.

Manufactures.—Before the freeing of the slaves, domestic manufacturing on the farm was carried on to a large extent, and as late as 1870 the State ranked second in the value of domestic or home manufactures. The total value of manufactures was in 1860 \$21,712,110, in 1860, \$37,831,240, and in 1870, \$54,925,809. The increase since 1870 has been larger than before, and the State will soon rank high as a manufacturing State. There has been a great increase in the manufacture of corn whisky in the past few years. The total production for the year ending June 30, 1881, was 31,949,047 gallons. The amount of iron manufactured was 89,793 tons in 1870, and 128,751 tons in 1880.

Government.—The State Government was modelled after that of Virginia. The governor is elected for four years, and cannot be his own successor. One-half of the senate is elected every two years, and the members of the lower house are elected for two years. There are 117 counties, each presided over by a judge and a board of magistrates. The gross receipts for the fiscal year ending October 10, 1880, were \$2,445,401, and the gross expenditure \$2,379,848. About one million dollars per annum is given to public schools, which amount can be supplemented by local taxation in counties or school districts. The State tax is 46¢ cents on each \$100 worth of property, and as property is rated at a low valuation taxes are light. Of the above amount 25 cents are for the purpose of revenue, 30 cents for the public schools, and 1 cent for the State agricultural and mechanical college. The State is practically free from debt, owing but \$180,000, and having on deposit an amount more than enough to pay that sum when the State bonds may fall due. The State has in addition about \$760,000 worth of productive assets.

The population in 1880 was 1,648,708 (882,016 males, 816,963 females), and of this number 59,468 were foreign born. There were 41 persons to the square mile. The following table shows the population at each census, 1790-1880 —

Census Years.	Whites.	Free Coloured.	Slaves.	Total.
1790	61,138	114	19,430	73,777
1800	70,877	118	40,458	111,453
1810	921,937	1,718	80,851	1,004,511
1820	441,414	2,769	129,712	573,895
1830	517,765	3,081	165,915	686,761
1840	630,223	7,917	129,528	777,668
1850	771,419	15,011	210,881	1,007,311
1860	1,018,481	15,082	215,428	1,248,991
1870	1,208,892	22,210	1,091,011	1,332,113
1880	1,277,167	27,511	1,046,708	1,331,386

The following cities had in 1880 a population exceeding 5000:—

Louisville	129,845	Paducah	8,376
Covington	39,790	Frankfort (State capital)	5,908
Norport	18,656	Marysville	4,230
Lexington	18,656		

Railways.—In 1831-32 a railway was made from Frankfort to Lexington, being one of the earliest lines constructed west of the Alleghenies. On January 1, 1881, there were 1698 miles of railway in operation in the State. The number of miles constructed since 1870 has been greater than before for the same length of time, and many new roads are projected.

History.—The region now known as Kentucky was embraced in the grant to the colony of Virginia by the British crown, and in the early part of the last century was an unknown region "beyond the mountains," included in Augusta county, Virginia. This region was in 1778 formed into a separate county called Kentucky county. Previous to this the land had been somewhat explored by adventurous hunters, the most notable being Daniel Boone, who led a small party from North Carolina in 1769. Virginia had given bounties of lands to men troops for services in the French Indian war, and the glowing accounts brought from beyond the mountains induced many expectations for surveying and locating lands. Kentucky was at this time a favourite hunting ground for the various tribes of Indians of the north and south, and the occupation by the whites was resisted by all the means known to Indian warfare. The first settlement was made at Harrods station, now Harrodsburg, in 1774. In the year following Boone and many built a group of rude block houses, called a fort, on the banks of the Kentucky river, at Boonesboro', and in 1776 other "stations" were built in central Kentucky, and the work of clearing and cultivating the land began. In the midst of Indian forays and border wars, the traditions of law prevailed, and a court of quarter sessions was established at Harrodsburg in 1776. Col. G. Rogers Clark, the hero of early Kentucky, planned an expedition in 1778 against the British forts in the north-west; marching swiftly, with less than 200 men, through miles of wilderness, he captured Kankakea and Vincennes, and secured to Virginia the imperial territory of Illinois.

Separated by several hundred miles of uninhabited forest from the "settlements" in Virginia, and feeling the necessity of a government that would enable them to make a vigorous defence against the Indians, the people held many conventions and petitioned for a separate government, which was granted by Virginia, and in 1792 Kentucky was admitted as a State into the Federal Union. Virginia had granted large bounties of land to her soldiers of the war for independence, and also treasury land warrants in redemption for her depreciated currency. The lands were located in Kentucky, and a large emigration from Virginia and Maryland was the result. The population in 1790 was 73,697, of whom 81,188 were white, 114 free coloured, and 12,480 slaves. From 1790 to 1800 the population increased 800 per cent. In the second war with England, which broke out in 1812, the Kentuckians marched to the defence of the north-west, and suffered heavy losses in the reverse at the river Mian; but afterwards 4000 volunteers, under Governor Shelby, participated in the victory on the banks of the river. As early as 1827 the State began a system of internal improvements under which many miles of macadamized roads were made, and the navigation of the rivers improved. The State expended for these purposes, independent of the county and individual subscriptions, amounting to more than \$6,000,000.

On the outbreak of the war with Mexico in 1846, the governor of Kentucky called for 5000 men, and 18,700 quickly answered the call. In that war the Kentucky troops bore a conspicuous and honourable part. The finding of gold in California, the granting of lands in the west, the aid in the construction of railways, and the consequent fever for speculation in western lands, were a severe drain on the productiveness of the State. The lines of railway connecting the sea-board cities with the great west crossed the mountains north of Kentucky. This and the disinclination to compete with slave labour earned the great tide of immigration and commerce north of Kentucky. When the great civil war began in 1861, Kentucky was a slave State; most of the productions of the State found remunerative markets in the cotton-growing States, and there were many business and social ties binding the State with the south. Whilst sympathizing with the Southern States, the majority of the people loved the Union, and the State determined to assume a position of armed neutrality, and if possible act as a mediator between the sections. The governor of the State refused (April 1861) to furnish the quota of men demanded by the Federal Government, a refusal approved by the State legislature by an almost unanimous vote. Arms were sent into Kentucky by the Federal Government, and camps established. The Confederates first moved into the State on September 3, and the Federal on September 7. The governor, in obedience to a resolution of the legislature, demanded the withdrawal of the Confederates, as violations of the neutrality of the State. Their refusal to do so except on condition that the Federals should also withdraw, led to an outbreak of hostilities, in which the people of the State were divided, many joining both armies. The Federal forces held the State almost continuously during the war, and 31,900 men were recruited in it for the Union armies, including 8704 home guards or militia called into active service, and about 11,000 coloured volunteers. On the other hand, about 40,000 Kentuckians went south and joined the Confederate forces. When the war ended, and the Kentucky soldiers from the two armies returned to their homes, laws passed under the excitement of civil war were repealed, fraternal peace followed quickly, and the people of the State, accepting the new conditions, entered upon a new era, with hope for a peaceful and prosperous future. (J. R. F.)

¹ Including 10 Chinese and 50 Indians.

KENYON, LORD KENYON, LORD (1732-1802), an English lawyer and lord chief justice of England, was descended by his father's side from an old Lancashire family, and his mother was the daughter of a small proprietor in Wales. He was born at Gredington, Flintshire, 5th October 1732. After studying five years at Rutlin grammar school, he was in his fifteenth year articled to an attorney at Nantwich, Cheshire. In 1750 he was entered a student of Lincoln's Inn, London, and in 1756 was called to the bar. As for several years he was left almost unemployed, he utilized his leisure in taking notes of the cases argued in the court of Queen's Bench, which he afterwards published. Through answering the cases of his friend John Dunning, afterwards Lord Ashburton, he gradually became known to the attorneys, after which his success was so rapid that in 1780 he was made king's counsel, his promotion being assisted to some extent through his friendship with Thurlow. He manifested conspicuous ability in the cross-examination of the witnesses at the trial of Lord George Gordon, but his speech was so deficient in tact that the verdict of acquittal was solely due to the extraordinary and brilliant effort of Erskine, the junior counsel. Through the influence of Lord Thurlow, Kenyon in September 1780 entered the House of Commons as member for Hindon, and in April 1783 he was, through the same friendship, appointed attorney-general in Lord Buckingham's administration, an office which he also continued to hold under Pitt. In 1784 he received the mastership of the rolls, and was created a baronet. His position at the bar had been achieved chiefly by hard work, a good knowledge of law, and several lucky friendships. As an advocate he was not only deficient in manner and in ability of statement, but frequently made striking blunders from want of tact. As his rough and irritable temper had also gained him several enemies, his elevation in 1788 to the lord chief-justiceship as successor to Lord Mansfield was by no means popular with the bar. The same year he was raised to the peerage as Baron Kenyon of Gredington. On the bench he not infrequently displayed a capricious and choleric temper towards both the pleaders and his brother judges. Still he proved himself, not only an able lawyer, but a judge of rare and inflexible impartiality. The decisions of no other judge in the court of Queen's Bench have been more seldom overruled, but, as they were accompanied with only a very imperfect and short statement of his reasons, his judgments are of little value as expositions of the principles of law. He died at Bath, 4th April 1802. See *Life* by Hon. G. T. Kenyon, 1873.

KEOKUK, chief city of Lee county, Iowa, U.S., occupies a lofty site on the west bank of the Mississippi, 2 miles above the mouth of the Des Moines tributary, and about 200 miles above St. Louis. It is situated in the extreme south-east corner of the State (whence its name "gate city"); its streets are spacious, and its houses handsome, although mostly of brick. Keokuk contains several churches, a medical college (founded in 1849), a good system of public schools, and a public library. Pork-packing, iron-founding, and smaller industries are carried on. The city is at the junction of seven railways, which, with its advantages of water communication, bring it an important trade. A canal, 9 miles in length, round the lower rapids of the Mississippi, which formerly obstructed the navigation, has been constructed by the United States Government at a cost of \$8,000,000. Keokuk has been a port of entry since 1854. Population in 1880, 12,117.

KEPLER, JOHN (1571-1630), one of the founders of modern astronomy, was born, December 27, 1571, at Weil, in the duchy of Würtemberg, of which town his grandfather was burgo-master. He was the eldest child of an ill-assorted and ill-starred union. His father, Henry Kepler, was a

reckless soldier of fortune; his mother, Catherine Guldenmann, the daughter of a small proprietor of Leonberg, had a violent temper, unmitigated by even the incidents of culture. Under these circumstances her husband found campaigning in Flanders under Alva a welcome relief from domestic life, and, after having lost his fortune by a forfeited security and tried without success the trade of tavern-keeping in the village of Elmenningen, he finally, in 1589, severed an irksome tie by the desertion of his family. The misfortune and misconduct of his parents were not the only troubles of young Kepler's childhood. He recovered from small-pox in his fourth year with crippled hands and eyesight permanently impaired; and a constitution enfeebled by premature birth had to withstand successive shocks of severe illness. His schooling began at Leonberg in 1577—the year, as he himself tells us, of a great comet; domestic bankruptcy, however, occasioned his transference to field-work, in which he was exclusively employed for several years. Bodily infirmity, combined with mental aptitude, were eventually considered to indicate a theological vocation; he was accordingly, in 1584, placed at the seminary of Adelberg, and thence removed, two years later, to that of Maulbronn. A brilliant examination for the degree of bachelor procured him, in 1588, admittance on the foundation to the university of Tübingen, where he laid up a copious store of classical erudition, and imbibed Copernican principles from the private instructions of his teacher and life-long friend, Michael Maestlin. As yet, however, he had little knowledge of, and less inclination for, astronomy; and it was with extreme reluctance that he turned aside from the more promising career of the ministry to accept, early in 1594, the vacant chair of that science at Gratz, placed at the disposal of the Tübingen professors by the Lutheran states of Styria.

The best-recognized function of German astronomers in that day was the construction of prophesying almanacs, greedily bought by a credulous public, and quickly belied by the future they pretended to disclose. Kepler thus found that the first duties required of him were of an astrological nature, and set himself with characteristic alacrity to master the rules of the art as laid down by Ptolemy and Cardan. He, moreover, sought in the events of his own life a verification of the theory of planetary influences, and it is to this practice that we owe the summary record of each year's occurrences which, continued almost to his death, affords for his biography a slight but sure foundation. His thoughts, however, were already working in a higher sphere. He early attained to the settled conviction that for the actual disposition of the solar system some abstract intelligible reason must exist, and thus, after much meditation, he believed himself to have found in an imaginary relation between the "five regular solids" and the number and distances of the planets. His notes with exultation July 9, 1596, as the date of the pseudo-discovery, the publication of which in *Prodromus Dissertationum Cosmographicarum seu Mysterium Cosmographicum* (Tübingen, 1596) procured him much fame, and a friendly correspondence with the two most eminent astronomers of the time, Tycho Brahe and Galileo.

Soon after his arrival at Gratz, Kepler contracted an engagement with Barbara von Muhelek, a wealthy Styrian heiress, who, at the age of twenty-three, had already survived one husband and been divorced from another. Before her relatives could be brought to countenance his pretensions, Kepler was obliged to undertake a journey to Würtemberg to obtain documentary evidence of the somewhat obscure nobility of his family, and it was thus not until April 27, 1597, that the marriage was celebrated. In the following year the archduke Ferdinand, on assuming the government of his hereditary dominions, issued an edict

of banishment against Protestant preachers and professors. Kepler immediately fled to the Hungarian frontier, but, by the favour of the Jesuits, was recalled and reinstated in his post. The gymnasium, however, was deserted; the nobles of Styria began to murmur at subsidizing a teacher without pupils, and he found it prudent to look elsewhere for employment. He first turned to his native country; but his refusal to subscribe unconditionally to the rigid formula of belief adopted by the theologians of Tübingen permanently closed against him the gates of his *alma mater*. His embarrassment was relieved by a letter from Tycho Brahe offering him the position of assistant in his observatory near Prague, which, after a preliminary visit of four months, he accepted. The arrangement was made just in time; for on August 7, 1600, he received definitive notice to leave Graz, and, having leased his wife's property, departed with his family for Prague, September 30. His relations with Tycho were not of an entirely agreeable character. The Danish astronomer, though benevolent, was haughty and overbearing, Kepler's natural irritability was aggravated by prolonged fever, by pecuniary anxieties, and by domestic mismanagement. Nevertheless, after one violent quarrel, smoothed over by mutual concessions, they maintained an amicable intercourse, unexpectedly terminated by Tycho's death, October 24, 1601.

A brilliant and prosperous career seemed by this event to be thrown open to Kepler. The emperor Rudolph II. immediately appointed him to succeed his patron as imperial mathematician, although at a reduced salary of 500 florins; the invaluable treasure of Tycho's observations was, after some futile opposition on the part of his heirs, placed at his disposal; and the laborious but congenial task was entrusted to him of completing the tables to which the grateful Dane had already affixed the title of *Rudolphine*. The first works executed by him at Prague were, however, a homage to the astrological proclivities of the emperor. In *De fundamentis astrologia certioribus* (Prague, 1602) he declared his purpose of preserving and purifying the grain of truth which he believed the science to contain. Indeed, the doctrine of "aspects" and "influences" fitted excellently with his mystical conception of the universe, and enabled him to discharge with a semblance of sincerity the most lucrative part of his professional duties. Although he strictly limited his prophetic pretensions to the estimate of tendencies and probabilities, his forecasts were none the less in demand. Shrewd sense and considerable knowledge of the world came to the aid of stellar lore in the preparation of "prognostics" which, not unfrequently hitting off the event, earned him as much credit with the vulgar as his cosmical speculations with the learned. He drew the horoscopes of the emperor and Wallenstein, as well as of a host of lesser magnates; but, though keenly alive to the unworthy character of such a trade, he made necessity his excuse for a compromise with superstition. "Nature," he wrote, "which has conferred upon every animal the means of subsistence, has given astrology as an adjunct and ally to astronomy." He dedicated to the emperor in 1603 a treatise on the "great conjunction" of that year (*Judicium de trigono igneo*); and he published his observations on a brilliant star which appeared suddenly, September 30, 1604, and remained visible for seventeen months, in *De stella nova in pede Serpentarii* (Prague, 1606). While sharing the opinion of Tycho as to the origin of such bodies by condensation of nebulous matter from the Milky Way, he attached a mystical significance to the coincidence in time and place of the sidereal apparition with a triple conjunction of Mars, Jupiter, and Saturn.

The main task of his life was not meanwhile neglected. This was nothing less than the foundation of a new

astronomy, in which physical cause should replace arbitrary hypothesis. A preliminary study of optics led to the publication, in 1604, of his *Astronomia pars optica*, containing important discoveries in the theory of vision, and a notable approximation towards the true law of refraction. But it was not until 1609 that, the "great Martian labour" being at length completed, he was able, in his own figurative language, to lend the captive planet to the foot of the imperial throne. From the time of his first introduction to Tycho he had devoted himself to the investigation of the orbit of Mars, which, on account of its relatively large eccentricity, had always been especially recalcitrant to theory, and the results appeared in *Astronomia nova atriologyphe, seu Physica celestis tradita commentariis de motibus stellæ Martis* (Prague, 1609). In this, the most memorable of Kepler's multifarious writings, two of the cardinal principles of modern astronomy—the laws of elliptical orbits and of equal areas—were established;¹ important truths relating to gravity were enunciated, and the tides ascribed to the influence of lunar attraction; while an attempt to explain the planetary revolutions in the then backward condition of mechanical knowledge produced a theory of vortices closely resembling that afterwards adopted by Descartes. Having been provided, in August 1610, by Ernest, archbishop of Cologne, with one of the new Galileian instruments, Kepler began, with unspeakable delight, to observe the wonders revealed by it. He had welcomed with a little essay called *Dissertatio cum Nuncio Sidereo* Galileo's first announcement of celestial novelties; he now, in his *Dioptrice* (Augsburg, 1611), expounded the theory of refraction by lenses, and suggested the principle of the "astronomical" or inverting telescope. Indeed the work may be said to have founded the branch of science to which it gave its name.

The year 1611 was marked by Kepler as the most disastrous of his life. The death by small-pox of his favourite child was followed by that of his wife, who, long a prey to melancholy, was at last, July 3, carried off by typhus. In his review of their conjugal life, remorse for frequent outbursts of impatience towards his shiftless though well-meaning helpmate took the place of regret for her loss. Public calamity was added to private bereavement. On the 23d of May 1611 Matthias, brother of the emperor, assumed the Bohemian crown in Prague, compelling Rudolph to take refuge in the citadel, where he died on the 20th of January following. Kepler's fidelity in remaining with him to the last did not deprive him of the favour of his successor. Payment of arrears, now amounting to upwards of 4000 florins, was not, however, in the desperate condition of the imperial finances, to be hoped for; and he was glad, while retaining his position as court astronomer, to accept (in 1612) the office of mathematician to the states of Upper Austria. His residence at Linz was troubled by the harsh conduct of the pastor Hitzler, in excluding him from the rites of his church on the ground of supposed Calvinistic leanings—a decision confirmed, with the addition of an insulting reprimand, on his appeal to Württemberg. In 1613 he appeared with the emperor Matthias before the diet of Ratisbon as the advocate of the introduction into Germany of the Gregorian calendar; but the attempt was for the time frustrated by anti-papal prejudice. The attention devoted by him to chronological subjects is evidenced by the publication about this period of several essays in which he sought to prove that the birth of Christ took place five years earlier than the commonly accepted date.

Kepler's second courtship forms the subject of a highly characteristic letter addressed by him to Baron Stralendorf,

¹ See ASTRONOMY, vol. II. p. 752.

in which he reviews the qualifications of eleven candidates for his hand, and explains the reasons which decided his choice in favour of a portless orphan girl named Susanna Reutlinger. The marriage was celebrated at Linz, October 30, 1613, and seems to have proved a happy and amiable one. The abundant vintage of that year drew his attention to the defective methods in use for estimating the cubical contents of vessels, and his essay on the subject (*Novae Stereometriae Doctrina*, Linz, 1613) entitles him to rank among those who prepared the discovery of the infinitesimal calculus. His observations on the three comets of 1618 were published in *De Cometis*, contemporaneously with the *Harmonice Mundi* (Augsburg, 1619), of which the first lineaments had been traced twenty years previously at Graz. This extraordinary production is memorable as having announced the discovery of the "third law"—that of the sesquialterate ratio between the planetary periods and distances. But the main purport of the treatise was the exposition of an elaborate system of celestial harmonies depending on the various and varying velocities of the several planets, of which the sentient soul animating the sun was the solitary auditor. The work exhibiting this fantastic emulation of extravagance with genius was dedicated to James I. of England, and the compliment was acknowledged with an invitation to that island, conveyed through Sir Henry Wotton. Notwithstanding the distracted state of his own country, however, he refused to abandon it, as he had previously, in 1617, declined the post of successor to Magini in the mathematical chair of Bologna.

The insurmountable difficulties presented by the lunar theory forced Kepler, after an enormous amount of fruitless labour, to abandon his design of comprehending the whole scheme of the heavens in one great work to be called *Hyparchia*, and he then threw a portion of his materials into the form of a dialogue intended for the instruction of general readers. The *Epytoma Astronomiae Copernicanae* (Linz and Frankfurt, 1618-21), a lucid and attractive textbook of Copernican science, was remarkable for the prominence given to "physical astronomy," as well as for the extension to the Jovian system of the laws recently discovered to regulate the motions of the planets. The first of a series of ephemerides, calculated on these principles, was published by him at Linz in 1617; and in that for 1620, dedicated to Napier, he for the first time employed logarithms. This important invention was eagerly welcomed by him, and its theory formed the subject of a treatise entitled *Chilias Logarithmorum*, printed in 1624, but circulated in manuscript three years earlier, which largely contributed to bring the new method into general use in Germany.

His studies, were, however, interrupted by a painful family trouble. The restless disposition and unbridled tongue of Catherine Kepler his mother created for her numerous enemies in the little town of Leobenurg; while her unguarded conduct exposed her to a species of calumny at that time but too readily circulated and believed. As early as 1615 suspicions of sorcery began to be spread against her, which she, with more spirit than prudence, met with an action for libel. The suit was, by the connivance of the judicial authorities, purposely protracted, and at length, August 5, 1620, the unhappy woman, then in her seventy-fourth year, was arrested on a formal charge of witchcraft. Kepler immediately hastened to Württemberg, and devoted a whole year to the zealous advocacy of her cause. It was owing to his indefatigable exertions that, contrary to general expectation, she was acquitted after having suffered thirteen months' imprisonment, and endured with undaunted courage the formidable ordeal of "tertion," or examination under the imminent threat of

torture. She survived her release only a few months, dying April 13, 1622.

Kepler's whole attention was now devoted to the production of the new tables. "Germany," he wrote, "does not long for peace more anxiously than I do for their publication." Financial difficulties, however, combined with civil and religious convulsions, long delayed the accomplishment of his desires. From June 24 to August 29, 1626, Linz was besieged, and its inhabitants reduced to the utmost straits by bands of insurgent peasants. The pursuit of science needed a more tranquil shelter; and accordingly, on the raising of the blockade, Kepler obtained permission to transfer his types to Ulm, where, in September 1627, the *Rudolphine Tables* were at length given to the world. Although by no means free from errors, their value appears from the fact that they ranked for a century as the best aid to astronomy. Appended were tables of logarithms and of refraction, together with Tycho's catalogue of 777 stars, enlarged by Kepler to 1005.

The work of Kepler's life was now virtually completed, but not so his vicissitudes. His claims upon the insolvent imperial exchequer amounted by this time to 12,000 florins. The emperor Ferdinand II., too happy to transfer the burden, countenanced an arrangement by which Kepler entered the service of the duke of Friedland (Wallenstein), who assumed the full responsibility of the debt. In July 1628 Kepler accordingly arrived with his family at Sagan in Silesia, where he applied himself to the printing of his ephemerides up to the year 1636, and whence he issued, in 1629, a *Notice to the Curious in Things Celestial*, warning astronomers of approaching transits. That of Mercury was actually seen by Gessendi in Paris, November 7, 1631 (being the first passage of a planet across the sun ever observed), that of Venus, predicted for the 6th of December following, was invisible in western Europe. Wallenstein's promises to Kepler were but imperfectly fulfilled. In lieu of the sums due, he offered him a professorship at Rostock, which Kepler declined, being unwilling to compromise his claim. An expedition to Ratisbon, undertaken for the purpose of representing his case to the Diet, terminated his life. Shaken by the journey, which he had performed entirely on horseback, he was attacked with fever, and died at Ratisbon, November 15 (N. S.), 1630, in the fifty-ninth year of his age. An inventory of his effects found among his papers showed him to have been possessed of no inconsiderable property at the time of his death. It is true that he had often been severely straitened; but there is reason to believe that his complaints on the subject were to some extent exaggerated. By his first wife he had five, and by his second seven children, of whom only two, a son and a daughter, reached maturity.

The character of Kepler's genius was one of which it is especially difficult to arrive at a just estimate. His irreducible tendency towards mystical speculation formed a not less fundamental quality of his mind than his strong grasp of positive scientific truth. Without assigning to each element its due value, no sound comprehension of his modes of thought can be attained. His idea of the universe was essentially Pythagorean and Platonic. He started with the conviction that the arrangement of its parts must correspond with certain abstract conceptions of the beautiful and harmonious. His imagination, thus kindled, animated him to those fervent labours of which his great discoveries were the fruit. His demonstration that the planes of all the planetary orbits pass through the centre of the sun, coupled with his clear recognition of the sun as the moving power of the system, entitles him to rank as the founder of physical astronomy. But the fantastic relations imagined by him of planetary movements and distances to musical intervals and geometrical constructions seemed to himself discoveries no less admirable than the achievements which have secured his lasting fame. Outside the boundaries of the solar system, the metaphysical side of his genius, no longer held in check by experience, fully asserted itself. The Keplerian like the Pythagorean cosmos was threefold, consisting of the centre, or sun, the surface, being the sphere of the fixed stars, and the intermediate space, filled with

chereal matter. It is a mistake to suppose that he regarded the stars as so many signs. He quotes indeed the opinion of Giordano Bruno to that effect, but with dissent. Among his heavy objections may be mentioned that of the sun's ill rotation, postulated by him as the physical cause of the revolutions of the planets, and soon after confirmed by the discovery of sun-spots, the suggestion of a periodical variation in the obliquity of the ecliptic, and the explanation as an effect of a solar atmosphere of the radiance observed to surround the totally eclipsed sun.

It is impossible to consider without surprise the colossal amount of work accomplished by Kepler under numerous disadvantages. His health was uncertain, his powers of calculation indifferent, his interruptions numerous, his curve at times over-whelming. But his iron industry counted no obstacles, and secured for him the highest triumph of genius, that of having grown to mankind the best that was in him. In private character he was amiable and affectionate, his generosity in recognizing the merits of others secured him against the worst slanders of envy, and a life marked by numerous disquietudes was cheered and ennobled by sentiments of sincere piety.

Kepler's extensive literary remains, purchased by the empress Catherine II in 1724 from some Frankfort merchants, and long unaccountably deposited in the observatory of Pulkova, have at length been completely brought to light, under the able editorship of Dr Ch. Fraenkel, in the first complete edition of Kepler's works. This important publication (*Johannis Kepleri opera omnia*, Frankfurt, 1856-71, 8 vols 8vo) contains, besides the works already enumerated and several minor treatises, a posthumous scientific satire entitled *Joh. Kepleri Conspirationes* (first printed in 1684), and a vast mass of his correspondence. A careful biography is appended, founded mainly on his private notes and other authentic documents.

The reader may also usefully consult *Bencke, Kepler und die Astronomie*, Frankfurt, 1851; *Gmelin, Geogr. Kepler's astronomische Anschauung*, Halle, 1871; *Apoll. Johann. Kepler's astronomische Weltanschauung*, Leipzig, 1849; *Brüschweiler, Johann Kepler's Leben und Wirken*, Stuttgart, 1881; *W. Forster, Johann Kepler und die Harmonie der Sphären*, Berlin, 1865; *U. Wolf, Geschichte der Astronomie*, Munich, 1877.

KERAK, a town of Syria, situated about 10 miles east of the southern end of the Dead Sea, on the summit of a rocky hill some 3000 feet above sea-level. It stands upon a platform forming an irregular triangle with sides of 800 to 1000 yards in length, and separated by deep ravines from the higher encircling ranges on all sides except one, where a narrow neck connects it with a neighbouring hill. The whole place was formerly surrounded by a wall with five towers, with only two entrances through tunnels in the side of the cliff. The town is an irregular mass of about six hundred flat mud-roofed houses. The Christian quarter contains the Greek church of St George; and the present mosque still bears marks of its Christian origin. On the north-west is the tower or castle of Bibars (see vol. vi. p. 755), with an inscription bearing his name. The great castle at the southern angle was built as a crusading fortress about 1181. Relics of the Roman occupation of Kerak have been found. The inhabitants are estimated at 8000, of whom about one-fourth are Greek Christians. They are fierce and truculent; and, though they were formerly renowned for hospitality, their rapacious treatment of their European visitors has brought them into very bad repute.

Kerk is the ancient Kir-Harosheth or Kir-Mach (3 Kings xii. 25; Isa. xv. 1, xvi. 7). The name Kerk (Syriac *Kerk*, fortress) is as old as 2 Mac. xii. 17. In crusading times Kerk was a highly important point. In 1138 it was captured by Saladin (vol. vi. p. 755), and under his dynasty the town prospered. In the early part of the present century Kerk was governed by a powerful sheikh, paying nominal homage to the Wahabiy kingdom; it is now the residence of a Turkish official and garrison under the wily of Jerusalem, but the authority of the government is weak. A considerable trade is carried on by merchants from Hebron.

See Burckhardt's *Syria*, 1822, p. 877 *sg.*; *Tristram's Land of Moab*, 1873; *Bader's Syria's Handbook*; *Le Quen, Or. Chr.* ii. 730.

KERBELA, or **MEHNEH-DORAN**, a town of Asiatic Turkey, in the vilayet of Baghdad, is situated in a fertile and well-cultivated district about 60 miles south-west of Baghdad, and about 20 miles west of the Euphrates, from which a very ancient canal extends to it. It is surrounded by a dilapidated brick wall 24 feet high, and contains a fine market-place, with one broad street leading to

the governor's residence. The other streets are narrow and dirty. Of the five mosques in the town the largest is the mosque of Hosein with a large gilded dome and minarets; it contains the tomb of Hosein, son of the caliph 'Ali (see *ARABIA*, vol. ii. p. 258), whose sanctity makes Kerbelah in the eyes of Shiites less sacred only than Mecca. Some 200,000 pilgrims from all parts of Islam journey annually to Kerbelah, many of them carrying the bones of their relatives to be buried in its sacred soil. The moulahs, who fix the burial fees, derive an enormous revenue from the faithful. At one time Kerbelah was an inviolable sanctuary for criminals, but it has ceased to be so since 1843, when the inhabitants revolted against the Turks, and were reduced with great slaughter. The enormous influx of pilgrims naturally creates brisk trade in Kerbelah and the towns on the route thither,—a fact which makes the Turkish Government anxious not to divert the stream elsewhere, as some years ago was partially done by sanitary and other regulations. The population, necessarily fluctuating, was estimated in 1878 at 60,000, Mr Clements Markham, writing in 1874, put it at 20,000.

KERGUELEN'S LAND, **KERGUELEN ISLAND**, or **DESOLATION ISLAND**, an island in the Southern Ocean, to the south-east of the Cape of Good Hope and south-west of Australia, and nearly half-way between them. To the south is Heard Island, and west-north-west the Crozets and the Marion Group. Kerguelen lies between 48° 39' and 49° 44' S. lat., and 68° 42' and 70° 35' E. long. Its extreme length is about 85 miles, and its extreme breadth 79, but the area is only about 2050 square miles. The island is throughout mountainous, presenting from the sea in some directions the appearance of a series of jagged peaks. The various ridges and mountain masses are separated by steep-sided valleys, which run down to the sea, forming deep fjords, so that no part of the interior is more than 12 miles from the sea. The chief mountain peaks are Mount Ross (6120 feet), Mount Richards (4000), Mount Crozier (3268), Mount Wyville Thomson (3160), Mount Hooker (2600), Mount Moseley (2400). The coast-line is extremely irregular, many of the fjords being bounded by long, steep rocky promontories. These, at least on the north, east, and south, form a series of well-sheltered harbours; as the prevailing winds are westerly, the safest anchoring ground is on the north-east. Christmas Harbour on the north and Royal Sound on the south are noble harbours, the latter with a labyrinth of islets interspersed over upwards of 20 miles of landlocked waters. The scenery is generally magnificent, and often singularly picturesque. A district of considerable extent in the centre of the island is occupied by snowfields, whence glaciers descend east and west to the sea. The whole island, exclusive of the snowfields, abounds in freshwater lakes and pools in the hills and lower ground. Hidden deep mudholes are frequent.

Kerguelen's Land is of undoubted volcanic origin, the prevailing rock being basalt, sometimes intersected by trap, and indeed an active volcano and hot springs are said to exist on the south-west of the island. Judging from the abundant fossil remains of trees, the island must at one time have been thickly clothed with woods and other vegetation, of which it has no doubt been denuded by volcanic action and submergence, and possibly by change of climate. It presents evidences of having at one time been subjected to powerful glaciation, and to subsequent immersion and immense denudation. The soundings made by the "Challenger" and "Guano," and the affinities which in certain respects exist between the islands, seem to point to the existence at one time of an extensive land in this quarter, of which Kerguelen, Prince Edward's Islands, the Crozets, St Paul, and Amsterdam are the remains. The Kerguelen plateau rises in many parts to within 1500 fathoms of the surface of the sea. Beds of coal and of red earth are found at some places. The summits of the flat-topped hills about Betsy Cove, in the south-east of the island, are formed of caps of basalt. Sir J. D. Hooker points out that the vegetation of Kerguelen's Land must be of great antiquity, and may have originally reached it from the American continent; it has no affinities with Africa. The present climate is not favourable

to permanent vegetation: the island lies within the belt of rain of all seasons of the year, and is reached by no drying winds, its temperature is kept down by the surrounding sea of ice; and it lies within the line of the cold Antarctic drift. The temperature is, however, very equable. During the transit expedition, the lowest winter temperature was seldom less than 32° while the summer temperature occasionally approached 70°. Tempests and squalls are frequent, and the weather is rarely calm. On the lower slopes of the mountains a rank vegetation exists, which, from the conditions just mentioned, is constantly saturated with moisture. A rank grass, *Festuca Cookii*, grows thickly in places up to 500 feet, with *Asorella*, *Chola plumosa*, &c. Sir J. D. Hooker enumerates twenty-one species of flowering plants, and seven of ferns, *Lycopodium*, *Characeae*; at least seventy-four species of mosses, twenty-five of *Hepaticae*, and sixty-one of lichens are known, and there are probably many more. Several of the mosses and many species of freshwater algae are peculiar to the island. The characteristic feature of the vegetation, however, is the Kerguelen cabbage (*Pringlea antiscorbutica*), a perennial cruciferous plant, in appearance somewhat like the garden cabbage. This cabbage and *Asorella* are found growing at a height of 1000 feet, while on the higher rocks a very handsome conspicuous lichen (*Neurogrypa Taylori*), of a mingled bright sulphur-yellow and black colour, is found abundantly. Fur seals are still found in Kerguelen, though their numbers have been greatly reduced by reckless slaughter. One of the most characteristic animals of the island is the sea elephant (*Macrorhinus lewinii*), which is found in considerable abundance even far up the streams that flow into the fjords. The sea-leopard (*Ogmarhinus leptogus*) is pretty abundant on the coasts. All parts of the coast and even the lower slopes are covered with penguins of various species, mainly the Johnny penguin (*Pygoscelis kermadec*), rock-hopper (*Eudyptes scottii*), and king penguin (*Adelmodulus leucorhynchos*). A seal (*Quadrifida latens*) peculiar to Kerguelen and the Crozets is also found in considerable numbers, and crowds of petrels, especially the giant petrel (*Diapryops giganteus*), *Halaehana cerulea*, and *Puffinus pacificus* frequent the island, as also albatrosses, gulls, shearwaters (*Chroicochroa minor*), terns (*Sterna bergii*), and skuas (*Phalacrocorax serratus*), and Cape pigeons. The island shelters a considerable variety of insects, many of them with remarkable peculiarities of structure, and with a predominance of forms incapable of flying. The island is frequented by seals and whales, but has no permanent human habitation. The island was first discovered by the French navigator Kerguelen Tremerec (born 1748, died 1797), on February 13, 1772, and partly surveyed by him in the following year. It was subsequently visited by Captain Cook, and also by Sir James C. Ross in 1840 in the "Erebus" and "Terror." It has occasionally been a refuge for shipwrecked sailors. The "Challenger" spent some time at the island, and its staff visited and surveyed various parts of it in January 1874. Later in the same year it was occupied for several months (October 1874 to February 1876) by the expeditions sent from England, Germany, and the United States to observe the transit of Venus. Still the interior is all but unexplored, and we have only vague notions of a considerable part of the coast. The Admiralty chart is based chiefly on mining surveys and information obtained from whalers.

Literature.—Narrative of the voyages of Kerguelen, Cook, and Sir James Ross, *Narrative of the Voyage of the "Erebus" on the Island of Erebus*, edited by W. D. Clarke, M.D., Hooker's *Flora Antarctica*; *Phil. Trans.*, vol. 168, containing account of the collection made in Kerguelen by the English transit of Venus expedition in 1874-75; articles by Sir Wyville Thomson in *Good Words*, November and December 1874; H. N. Kennedy's *Notes on a Naturalist on the "Challenger"*; Lord George's *Notes on the "Challenger"*; W. J. Berry's *Notes of the "Challenger"*; *Illustr.* G. J. Perry's *Notes of a Voyage to Kerguelen*.

KERKUK, or **KERKUKO**, a town of Asiatic Turkey, in the vilayet of Baghdad, is situated on the right bank of the Khass Tahl, about 140 miles north of the city of Baghdad. A suburb, Mishallo, on the left bank of the stream, which is spanned by a bridge, contains the residence of the pasha. The citadel stands east of the river upon an artificial mound, 130 feet high, which in Niebuhr's time was still surrounded by an earthen rampart. The citadel hill is the residence of the old Nestorians, now adherents of the Church of Rome. Round the foot of this hill run the dirty, crooked, and narrow streets of the lower town, with their flat-roofed, ugly houses, built partly of wood and partly of stone. The only large building is occupied by the bazaar, with passages one hundred paces long. Owing to its position at the junction of several routes, Kerkuk has a brisk transit trade in hides, Persian silks and cottons, colouring materials, fruit, and timber, on the way from Sulisamieh to the north. The natural warm springs at Kerkuk are used to supply baths. The surrounding country is fertile and well-cultivated; the petroleum and

naphtha springs near the town are its most valuable commercial resources. Till lately the petroleum was used as fuel by the Turkish steamers on the Tigris; but English coal has now superseded it. The official designation of Kerkuk is Shahar Zal. The inhabitants, from twelve to fifteen thousand in number, are chiefly Mohammedan Kurds; there is a Jewish quarter beneath the citadel. The reputed sarcophagi of Daniel and the Hebrew children are shown in one of the mosques.

Kerkuk is the ancient metropolis city Karkā' n' Beth Sikk ("fortress of the house of Sabaia.") See G. Hoffmann, *Syr. Akten Pers. Maripriv*, Leipzig, 1880.

KERMAN. See **KIRMAN**.

KERMANSEH. See **KIRMANSHAHAN**.

KERMES (Arabic, *kermes*), a crimson dye, now superseded by cochineal, obtained from *Coccus ciliatus*, L. (*Coccus vermilio*, G. Planchon), an hemipterous insect found in Spain, Italy, the south of France, and other parts of the Mediterranean region, feeding on *Quercus coccifera*, a small shrub from 2 to 5 feet high. The discovery of the animal nature of kermes is due to Eméril, Garidel, and Cestoni. Until the year 1714 it was thought to be a gall or excrement.

Like other members of the group to which it belongs, the female kermes insect is wingless, and furnished with a beak or sucker attached to its breast, by which it fixes itself immovably on its food plant, and through which it draws its nourishment. The male insect is unknown, two insects mistaken for it being, according to Planchon, parasitic hymenoptera of the chalcidoid group, living in the kermes grains. In the month of May, when full grown, the insects are globes, 6 to 7 millim. in diameter, of a reddish-brown colour, and covered with an ash-coloured powder. They are found attached to the twigs or buds by a circular lower surface 2 millim. in diameter, and surrounded by a narrow zone of white cottony down. At this time there are concealed under a scaly, formed by the apposition of the abdominal wall of the insect to the dorsal one, thousands of eggs of a lively red colour, and smaller than poppy seed, which are protruded and ranged regularly beneath the insect. At the end of May or the beginning of June the young escape by a small orifice, near the point of attachment of the parent. They are then of a fine red colour, elliptic and convex in shape, but rounded at the two extremities, and bear two threads half as long as their body at their posterior extremity. At this period they are extremely active, and swarm with extraordinary rapidity all over the food plant, and in the course of two or three days attach themselves to fissures in the bark or buds, but rarely to the leaves. In warm and dry summers the insects breed again in the months of August and September, according to Eméril, and then they are more frequently found attached to the leaves. Usually, however, they remain immovable and apparently unaltered until the end of the succeeding March, when their bodies become gradually distended and lose all trace of abdominal rings. They then appear full of a reddish juice resembling discoloured blood. In this state, or when the eggs are ready to be extruded, the insects are collected. In some cases the insects from which the young are ready to escape are dried in the sun on linen cloths—say being taken to prevent the escape of the young from the cloths until they are dead. The young insects are then sifted from the shells, made into a paste with vinegar and dried on skins exposed to the sun, and the paste packed in skins is then ready for exportation to the East under the name of "pâte de carlate."

In the pharmacopoeia of the ancients kermes triturated with vinegar was used as an outward application, especially in wounds of the nerves. From the 9th to the 16th

century this insect formed an ingredient in the "confectio alkermes," a well known medicine, at one time official in the London pharmacopoeia as an astringent and corroborant in doses of 20 to 60 grains or more. Syrup of kermes was also prepared. Both these preparations have now fallen into disuse, the latter being replaced by the syrup of cochineal.

To dye spun worsted with kermes, the material is first boiled for half an hour with bran in water, and then for two hours in a fresh bath containing one-fifth of Roman alum and one-fifth of tartar, to which "sour water" is commonly added. It is then taken out and laid in a linen bag for some days in a cool place. In order to obtain a full colour it is then put in a warm bath as at the first boiling, the bath containing as much kermes as is equal to three-fourths or even the whole weight of the worsted used. For cloth one-fourth less of the salt and kermes was required. The colour imparted by kermes has much less bloom than the scarlet made with cochineal, hence the former has fallen into disuse.

Mineral kermes is an amorphous tersulphide of antimony, prepared by a variety of processes, and containing a variable proportion of teroxide of antimony and sometimes a little alkaline antimonite. The oldest method consists in boiling the finely powdered sulphide with a solution of an alkaline carbonate and leaving the hot filtered solution to cool, the kermes being deposited on cooling. In another method dilute nitric acid was added to the alkaline solution to precipitate the kermes mineral. Mineral kermes is a brown red powder becoming blackish-grey when washed with boiling water. By fusion and slow cooling it is converted into a clay-like mass devoid of crystalline structure, in which it differs essentially from the pure amorphous sulphide.

See G. Planchon, *Le Kermes du Chêne*, Montpellier, 1864; *Watts's Dictionary of Chemistry*, i. p. 330-33, iii. p. 446; *Gmelin, Handbook of Chemistry*, iv. p. 340-49; *Levy, Materia Medica*, 1784, pp. 71, 365; *Memorias sobre la granja Kermes de España*, Madrid, 1788; *Adams, Pausius Agnata*, iii. 180; *Bookman, History of Insects*.

KERNER, JUSTINUS ANDREAS (1786-1862), a German poet and medical writer, was born in Ludwigsburg, Württemberg, on the 18th of September 1786. He received his early education in the Latin school of Ludwigsburg and in the cloister school of Maulbronn. After the death of his father, who was an upper bailiff and government councillor in Ludwigsburg, Kerner was obliged to accept a position in a cloth manufactory; but in 1804, aided by Pastor Conz, who had some reputation as a poet, he was able to enter the university of Tübingen, where he studied medicine. At Tübingen he made the acquaintance of Uhland, who was about his own age; and the two young men encouraged each other in their first efforts in poetry. Having completed his studies in 1809, Kerner spent some time in travel. In 1815 he received a medical appointment in Gaildorf, and in 1819 was transferred to Weinsberg, where he spent the rest of his life. Weinsberg is a pretty little town in Württemberg, and was formerly a free imperial city. Here the emperor Conrad III. is said to have besieged the castle of Count Welf; and, according to the well-known legend, the women, having obtained permission to retire with their most valuable possessions, stumbled out, each with her husband on her back. Kerner built a house under the shadow of the castle ("Weibertreue"); and through his exertions measures were taken for the preservation of the ruins and the laying out of the surrounding grounds in public gardens. He also occupied himself with the history of the town, and published a work in two volumes describing *The Storming of Weinsberg* in 1525. He was troubled with an affection of the eyes, and becoming almost blind he resigned his office and medical practice

in 1851. He died on the 21st of February 1862. Kerner takes rank as one of the best of the Swabian school of poets, who had in some respects a close affinity to the Romantic school, but aimed at greater simplicity and clearness.

He attracted attention by his *Rezenchen von dem Schattenspiel* (1811), and co-operated with Uhland, Schubarth, and other writers in producing the *Poetischer Almanach* (1812) and the *Deutscher Dichtersaal* (1818). In 1826 he issued a collection of his poems, to which he added many new lyrics in subsequent editions. He also published two other volumes of poetry, *Der letzte Blüthenstrauss* (1855) and *Winterkinder* (1856). His lyrics are remarkable for the intermingling of quaint humour and delicate pathos, while in his ballads, which are written with great spirit and in a thoroughly popular tone, he prefers to represent such scenes of horror and mystery as the romantic school delighted in. He devoted much study to abnormal conditions of the brain, and wrote several popular works on animal magnetism and kindred subjects. Of more importance than these labours were his investigations on the influence of solenoid acid on animal organisms, and his work *Das Willkür im Königreich Württemberg*. In his *Bilderbuch aus meiner Knabenzeit* he gave a vivid and interesting description of the circumstances of his youth. See E. Mayer in the *Album Schwäbischer Dichter*, and D. Strauss, *Kleine Schriften*.

KERRY, a maritime county of Ireland, in the province of Munster, between 51° 41' and 52° 23' N. lat., and between 9° 7' and 10° 30' W. long., bounded on the W. by the Atlantic Ocean, N. by the estuary of the Shannon, which separates it from Clara, E. by Limerick and Cork, and S.E. by Cork. Its greatest length from north to south is 60 miles, and its greatest breadth from east to west 58 miles. The area comprises 1,159,358 acres, or 1811 square miles.

Geology.—Kerry, with its combination of mountain, sea, and plain, possesses some of the finest scenery of the British Islands. The portion of the county south of Dingle Bay consists of mountain masses intersected by valleys formed by narrow bands of carboniferous rocks. These masses are composed chiefly of red and green sandstones, grits, and slates, with beds of conglomerate in which are sometimes found pebbles of bright red jasper. The formation is almost entirely unfossiliferous, but on the Geological Survey maps it is marked as Old Red Sandstone. At one time the mountains were covered by a great forest of fir, birch, and yew, which was nearly all cut down to be made use of in smelting iron, and the constant pasturage of cattle prevents the growth of young trees. In the north-east, towards Killarney, the formation rises abruptly from the Carboniferous Limestone rocks into the rugged range of Moelligiondy's Reeks, the highest summit of which, Carnat, has a height of 3414 feet. The next highest summit is Capser, 3200 feet, and several others are over 2500 feet. Lying between the precipitous sides of the Tomies, the Purple Mountains, and the Reeks is the famous gap of Dunloe. A small portion of country at the south-west of the Dingle promontory is occupied by Upper Silurian strata, which in the middle of the promontory are covered by vast strata of grits, slates, and sandstones known as the Dingle beds, but of unknown age. This formation attains at Brandon Hill a height of 3127 feet. Resting unconformably on these beds are the Old Red Sandstone strata which occupy the remainder of the promontory and also a small tract of country at Kerry Head. The remainder of Kerry is occupied by the Coal-measures which are separated from the mountain masses of Old Red Sandstone by a narrow and irregular band of Carboniferous Limestone or Carboniferous Slate, which abounds in fossils. The Coal-measures, which rest conformably on the Carboniferous Limestone, form a succession of undulating hills rising sometimes to a height of over 1000 feet. All the three measures of coal are represented, but the seams of coal are very thin, and the workable portions are outside the limits of the county. In the upper part of the Kenmare valley

some copper veins occur in the Old Red Sandstone, but they are workable only when they enter the limestone. Silver with zinc and lead with zinc are found in a few places. In the coal formation there are some veins both of iron and lead. The Valentia flags and slates are largely exported to England. Amethysts were at one time obtained near Kerry Head.

Coast Line.—The sea-coast, which for the most part is wild and mountainous, is much indented by inlets, the largest of which, Tralee Bay, Dingle Bay, and Kenmare River, lie in synclinal troughs, the antichlinal folds of the rocks forming extensive promontories. Between Kenmare River and Dingle Bay the land is separated by mountain ridges into three valleys. The extremity of the peninsula between Dingle Bay and Tralee Bay is very precipitous, and Mount Brandon, rising abruptly from the ocean, is skirted at its base by a road from which magnificent views are obtained. From near the village of Ballybunion to Killybeg Point near the Shannon there is a remarkable succession of caves, which have evidently been excavated by the sea. The principal islands are the picturesque Skelligs, Valentia Island, and the Blasket Islands.

Rivers and Lakes.—The principal rivers are the Blackwater, which, rising in the Dunkerron mountains, forms for a few miles the boundary line between Kerry and Cork, and falls into the Kenmare River; the Ruaughty, which with a course resembling the arc of a circle falls into the head of the Kenmare River; the Inny and Forta, which flow westward, the one into Ballinskellig Bay and the other into Valentia Harbour; the Flesk, which flows northward through the lower lakes of Killarney, after which it takes the name of the Laune, and flows north-westward to Dingle Bay, the Cara, which rises in the mountains of Dunkerron, and after forming several lakes falls into Castlemaine Harbour; the Maine, which flows from Castle Island south-westwards to the sea at Castlemaine Harbour, receiving in its course the northern Flesk, which rises in the mountains that divide Cork from Kerry; and the Feale, Gale, and Brick, the junction of which forms the Cashin, a short tidal river which flows into the estuary of the Shannon. The lakes of Kerry are not numerous, and none of them are of great size, but those of Killarney form one of the most important features in the striking and picturesque mountain scenery amidst which they are situated. (See KILLARNEY.) The other principal lakes in the county are Lough Currane near Ballinskellig, and Lough Cara near Castlemaine Harbour. Near the summit of Mangerton Mountain an accumulation of water in a deep hollow forms what is known as the Devil's Panchbowl, the surplus water, after making a succession of cataracts, flowing into Lough Kittane at the foot of the mountain. There are chalybeate mineral springs near Killarney, near Valentia Island, and near the mouth of the Inny, sulphurous chalybeate springs near Dingle, Castlemaine, and Tralee; and a saline spring at Magheraghy in Corkaguiney, which bursts out of clear white sand a little below high water mark.

Climate and Agriculture.—Owing to the vicinity of the sea, and the height of the mountains, the climate is very moist and unsuitable for the growth of cereals, but it is so mild even in winter that the pasturage on the mountains retains perpetual greenness. Arbutus and other trees indigenous to warm climates grow in the open air, and several flowering plants are found which are unknown in England. In the northern parts of the county the land is generally coarse and poor, except in the valleys, where a rich soil has been formed by rocky deposits. In the Old Red Sandstone valleys there are many very fertile regions, and several extensive districts now covered by bog admit of easy reclamation so as to form very fruitful soil, but other tracts of boggy land scarcely promise a profitable return for labour expended on their reclamation. The lower slopes of the mountains afford a very rich pasturage for cattle even in winter, while large flocks of sheep and goats graze on the upper ridges.

According to the classified summary of owners for 1876 there were

no fewer than twenty-eight proprietors who possessed upwards of 10,000 acres, and ten possessed upwards of 5,000 acres, viz., Thomas C. Bland, 26,676, Sir Edward Denny, Baronet, 24,470; Robert Drummond, 20,780; Edward Boucher Hartopp, 24,222; Henry A. Herbert, 47,238; Earl of Kenmare, 61,080; marquis of Lansdowne, 84,983; Earl of Lonsdale, 25,964; Richard Mallesbury, 20,773; Lord Ventry, 68,639. Altogether the number of owners was 1,110, possessing 1,153,378 acres, at an annual valuation of £268,108. Of the owners 687, or 67 per cent., possessed less than 1 acre, the total possessed by those owners being only 172 acres. The average annual valuation was 4s. 10d. per acre.

The following table shows the number of the various classes of holdings in 1850 and 1880—

	1 Acre	Between 1 and 8 Acres	Between 8 and 15 Acres	Between 15 and 30 Acres	30 Acres and upwards	Total
1850	699	1,074	8,071	4,881	9,608	18,011
1880	1,678	1,207	2,696	9,545	10,068	18,747

In some of the larger farms the best modern systems of agriculture are practised, but especially on the small farms the primitive form of heavy-bulldoze is that almost wholly in use, with alternate crops of oats and potatoes. The total area under crops in 1881 was 165,568 acres, 14·2 per cent. of the acreage of the county. In 1880 there were 588,604 acres (50·6 per cent.) under grass, 18,848 were woods, 105,864 bogs, 248,808 mountain, and 59,892 water, roads, and fences. There has been an increase in the area under crops since 1850 of 16,684 acres, but this is wholly due to an increase of 87,908 in the area under meadow and clover, which in 1881 was 90,068, while between 1851 and 1880 the area under grass increased by 135,459, or more than a fourth. The area under cereals in 1881 was 33,109 acres, a decline of 18,849, or more than a third since 1850, wheat declining from 4502 to 1038, and oats from 80,190 to 27,538. Between 1850 and 1880 the diminution has been very slight in the area under green crop, from 48,129 acres to 41,998, that under potatoes increasing from 85,968 to 81,179, but that under turnips declining from 10,484 to 8728. Flax occupied 800 acres in 1850, and only 68 in 1881.

Horses have increased from 18,129 in 1850 to 15,807 in 1881. The number of horses used for agricultural purposes in 1881 was 11,159. Mules between 1850 and 1881 increased from 1871 to 2811, while asses increased from 8417 to 8765. Cattle in 1850 numbered 147,748, and in 1881 had increased to 209,738. Cows numbered 104,971, dairy farming being very largely followed. The Kerry breed of cattle—small finely-shaped animals, black or red in colour, with small untanned horns—are famed for the quality both of their flesh and milk, and are now in considerable demand for the parks surrounding Shannon House. The deer, which once between the Kerry and an unknown breed, is larger but without its fine qualities. Sheep between 1850 and 1871 had risen from 56,981 to 129,618, but in 1881 they had declined to 82,928. Little regard is paid to the breed, but those in most common use have been crossed with a merino breed from Spain. Goats, which share with sheep the sweet pasturage of the higher mountain ridges, have increased between 1850 and 1881 from 17,892 to 28,449. Pigs since 1850 have increased from 86,246 to 45,630. Poultry have more than doubled in numbers, increasing from 183,116 to 450,070.

Ferns Nature.—As may be supposed from the wild and mountainous character of a great part of Kerry, ferns are numerous, and others and badgers are not uncommon. The alpines here is very abundant. The red deer inhabits the mountains round Killarney. The golden eagle was at one time frequently seen in the higher mountain regions, but is now rarely met with. The sea eagle haunts the lofty marine cliffs, the mountains, and the rock islands. The osprey is occasionally seen, and also the peregrine falcon. The merlin is common. The common owl is indigenous, the long-eared owl resident, and the short-eared owl a regular winter visitor. Rock pigeons breed on the sea-cliffs, and the turtle dove is an occasional visitor. The common quail is becoming rare. The grey geese sail so found in Brandon and Dingle Bays.

Manufactures.—At the beginning of the century there was a considerable linen trade in Kerry, but this is now nearly extinct, the chief manufactures being that of coarse woollens and linens for home use. At Killarney a variety of articles are made from the wood of the chesnut. A considerable trade in agricultural produce is carried on at Tralee, Dingle, and Kenmare, and in slate and stone at Valentia.

Fisheries.—The number of vessels engaged in the deep sea and coast fisheries is about 600, employing about 2600 men and boys. From the passing of the Act 37 and 38 Vict. up to 31st Dec. 1880 the total amount of money advanced on loan for fishery purposes in Kerry has been £10,877, and up to the same date the repayments have amounted to £2975. The loans during the year 1880 amounted to £10,447. This sum advanced for Kerry fisheries is more than one-third of the whole sum advanced for all Ireland. Fisheries on the coast are the fishing localities so numerous.

rovi, or such fish as herring, mulchards, cod, hake, and hugg so abundant. There is, however, a great want of boats, tackle, and nets, although the stations of Dingle and Kinnaree are prosperous and well provided. Fine salmon are obtained in the rivers and in some of the larger lakes. The shellfish are large and abundant.

Railways.—A branch of the great southern and western line passes by Killarney to Tralee.

Administration.—The county comprises nine baronies, and contains eighty-five civil parishes and two parts of parishes, and 2682 townlands. There are six poor-law unions wholly within the county, viz., Cahirciveen, Dingle, Kinnaree, Kilmaree, Listowel, and Tralee, and part of one, namely Glenties, the remaining portion being in Limerick. The county includes one parliamentary borough, Tralee, which in 1881 had a population of 9884, the township of Kilmaree, and the towns of Dingle and Listowel. There are in the county twenty-four petty sessions districts and one part of a petty sessions district. Assizes are held at Tralee, and quarter sessions are held in the towns of Dingle, Kinnaree, Kilmaree, Listowel, and Tralee. The county is within the Cork military district, and there is a barracks station at Tralee. The headquarters of the constabulary force is at Tralee, and sub-stations are stationed at Cahirciveen, Dingle, Kinnaree, Kilmaree, and Listowel. Provision is made by the Union the county retaining eight members to parliament, two for the county, and two for each of the boroughs of Tralee, Dingle, and Ardara. At the Union the number was reduced to three, two for the county and one for the borough of Tralee.

Population.—At the census of 1856 the population of Kerry was 5990, of whom 7824 were Irish and 666 English. De Buge estimates it at 53,028 in 1790, and the census of 1821 gives it as 516,185. In 1841 it had increased to 294,095, but in 1851 had diminished to 238,619, in 1861 to 201,800, and in 1871 to 196,586. The increase to 200,448 in 1881, notwithstanding that Kerry has suffered severely from a general distress, is sufficiently accounted for by an increase in the number of the smaller class of holdings. The number of males in 1881 was 100,716, and of females 96,783. The annual rate of marriages in 1880 to every 1000 of estimated population was 3.4, of the 27 6, of deaths 17 6, and of emigration 38 4. The total number of marriages contracted from 1st May 1851 to 31st December 1880 was 121,392. The number of persons not of Irish birth in Kerry at the census of 1841 was 616, and in 1871 it was 1104. The number in 1871 who could speak Irish only was 1209, and the number who could speak Irish and English 69,969. The number of Roman Catholics in 1881 was 158,517, of Protestant Episcopalians 5767, of Presbyterians 224, of Methodists 271, and of all other persuasions 264.

History.—The county is said to have derived its name from Clar, who, along with his tribe the Clarrachide, is stated to have inhabited about the beginning of the present era the territory lying between Tralee and the Shannon. That portion lying south of the Maure was at a later period included in the kingdom of Desmond. Kerry suffered frequently from invasions of the Danes in the 8th and 10th centuries, until they were finally overthrown at the battle of Clontarf in 1014. In 1172 Dermot MacCarthy, king of Cork and Desmond, made submission to Henry II. on certain conditions, but was nevertheless gradually compelled to retire within the limits of Kerry, which was made shire ground in 1210. An English adventurer Raymond le Gros received from this MacCarthy a large portion of the county round Lixnaw. Thomas grandson of Raymond, and king's sheriff in the counties of Cork, Waterford, and Kerry, was in 1385 made lord chief-justice of Ireland. Of his two sons John the oldest was created earl of Kildare, and Maurice in 1329 became earl of Desmond, and with certain exceptions received all the royal liberties which the king had in the county of Kerry. After the attainder of Thomas in 1461, Desmond in 1469, his grandson took up arms against the English, until at last the king was glad to guarantee the earl's elder son the full possession of his father's privileges. In consequence, however, of the rebellion of Gerald the sixth earl, the estates of the Desmonds, 674,828 acres in extent, were in 1583 forfeited to the crown, and parcelled into manors and seignories of 13,000, 8000, 6000, and 4000 acres, which were granted among English noblemen and gentlemen. The Irish took advantage of the disturbed state of England at the time of the Puritan revolution to attempt the overthrow of the English rule in Kerry, and ultimately obtained possession of Tralee, but in 1652 the rebellion was completely subdued, and a large number of estates were afterwards confiscated.

Antiquities.—There are remains of a round tower at Aghadoe near Kilmaree, another, a small cell at Lough Currane, and a third, one of the finest and most perfect specimens of the round tower in Ireland, at Baskin, near the Ballinacorney. On the summit of a hill to the north of Kinnaree River is the remarkable stone fortresses known as Slieve Fort. There are several stone cells in the principal Skellig island, where at one time there were monastic remains which have now been swept away by the sea. The principal groups of sepulchral stones are those on the summits of the Benne mountains, stone forts at Cahirciveen, a small stone fort with cromlech in the parish of Tuosist, and others with

inscriptions near Dingle. The most notable monastic ruins are those of Innisfallen, founded by St. Finian, a disciple of St. Columba, and the fine remains of Muckross Abbey, founded by the Franciscans, but there are also monastic remains at Ardara, Castlemao, Derrynane, Kilmalee, Lisahilly, and O'Dorney. Among old ruined churches of interest may be mentioned those of Aghadoe, Kilmalee, Lough Currane, Derrynane, Kilmalee, and Muckross. The cathedral of Ardara, founded probably in 1268, was partly destroyed during the Cromwellian wars, but was restored in 1881. Some interesting portions of the old building still remain. There are a large number of old feudal castles.

See Smith, *Ancient and Present State of the Counties of Cork, Waterford, and Kerry*, Dublin, 1748-49; Coskun, *History of the Kingdom of Kerry*, 1881.

KERTCH, the ancient Panticapæon, a seaport town of Russia in the government of Taurida, situated at the eastern extremity of the Crimea, on the Cimmarian Bosphorus (Strait of Yenikale or Strait of Kerch). It is 133 miles north-east of Simferopol and 50 miles from Theodosia, in 45° 21' N. lat. and 36° 30' E. long. Like most towns built by ancient Greek colonists, it occupies a beautiful situation clustering round the foot and climbing the sides of the hill (now named after Mithradates) on which stood the ancient acropolis. In 1876 it contained twelve churches (including one Catholic and one Armenian), two synagogues, and a mosque, a local bank, two hospitals (one at Yenikale), three prisons, two gymnasia, and a "noble madams' institute." The church of John the Baptist, which, according to an inscription, was founded in 717 A.D., presents a good example of the purely Byzantine style of architecture. The church of Alexander Nevski was formerly the famous Kerch museum of local antiquities, founded in 1828. The more valuable objects were afterwards removed to the Hermitage at St. Petersburg, and those which remained were wantonly scattered during the English occupation of the town. The present "museum" is a small collection in a private house.

Among the products of local industry are leather, tobacco, cement, beer, stored waters, lime, candles, and soap. Fish-curing is carried on, and there are steam saw-mills and flour-mills. Previous to the deepening of the Strait of Yenikale so as to admit vessels drawing 17 feet of water (1876), the harbour was visited by a large number of vessels which now pass on to the Azoff ports. The imports comprise coal, wine, olive oil, &c.; and grain, fish, linseed, rapeseed, wool, and hides are exported. The harbour was improved by dredging at the same time as the strait. A promenade extends along the sea-wall, and beyond the town lie public gardens. About 6 miles to the north-east is the town and old Turkish fortress of Yenikale, which is united with Kerch to form a separate administrative circle or mayoralty, including, according to the surveys of 1843-44, an area of 42,103 acres. In 1876 the population of Kerch, exclusive of the temporary garrison of 13,746, amounted to 21,211.

The Greek colony of Panticapæon was founded about the middle of the 6th century B.C., by the people of Miletus. From about 488 B.C. till the conquest of this region by Mithradates the Great about 100 B.C., the town and territory formed the so-called kingdom of the Bosphorus, ruled over by an independent dynasty. Phrazer, the son of Mithradates, became the founder of a new line under the protection of the Romans, which continued to exist till the middle of the 4th century A.D., and extended their power over the maritime parts of the Tauria. After this time the town—which had already begun to be known as Bosphorus or Bospore—passed into the hands of the Eastern empire, of the Khazars, and of various barbarian tribes. In 1818 the Tartars, who had come into possession in the previous century, ceded the town to the Genoese, who soon raised it into new importance as a commercial centre. They usually called the place *Kerch*, by a corruption of the Russian name *Kritschak* (whence *Kerch*), which appears in the 13th century inscription of Tmutarokan. Under the Turks, whose rule dates from the end of the 16th century, Kerch was a military port; and as such it plays a part in the Russo-Turkish wars. Captured by the Russians under Dolgoroukoff in 1771, it was ceded to them along with Yenikale by the peace of Kerchuk-Katmandji, and it became a great centre of Russian naval activity. Its importance

The next species deserving of notice is that of America, *T. sparverius*, commonly known in Canada and the United States as the "Sparrow-Hawk"—a beautiful little bird, though not more conspicuous than the rest of its relations. Various attempts have been made to recognize several species, more or less in accordance with locality, but the majority of ornithologists seem unable to accept the distinctions which have been elaborated chiefly by Mr Sharpe (*et supra*) and Mr Ridgway (*North American Birds*, iii. pp. 159–175), the former of whom recognizes six species, while the latter now admits but three, *T. sparverius*, *T. leucophrys*, and *T. sparveroides*, with five geographical races of the first, viz., the typical *T. sparverius* from the continent of North America, except the coast of the Gulf of Mexico; *T. australis* from the continent of South America, except the North Atlantic and Caribbean coasts; *T. isabellinus*, inhabiting continental America from Florida to Cayenne; *T. dominicensis* from the Lesser Antilles as far northwards as St Thomas; and lastly *T. cinnaomimus* from Chili and Western Brazil. *T. leucophrys* is said to be from Hispaniola and Cuba; and *T. sparveroides* peculiar to Cuba only. This last has been generally allowed to be a good species, though Dr Gundlach, the best authority on the birds of that island, in his latest work, published in 1876 (*Contribución a la Ornithología Cubana*, p. 48) will not allow its validity. More recently it has been found (*Ibid.*, 1881, pp. 547–564) that *T. australis* and *T. cinnaomimus* cannot be separated, that Mr Ridgway's *T. leucophrys* should properly be called *T. dominicensis*, and his *T. dominicensis* *T. antillarum*, while that gentleman has recorded the supposed occurrence of *T. sparveroides* in Florida. Of other Kestrels it remains to say that *T. noliensis* is widely spread throughout the islands of the Malay archipelago, while *T. cenchoides* seems to inhabit the whole of Australia, and has occurred in Tasmania (*Proc. Roy. Soc. Tasmania*, 1876, pp. 7, 8). No Kestrel is found in New Zealand, but an approach to the form is made by the very peculiar *Hierocleus* (or *Harpe*) *novae-zelandiae* (of which a second race or species has been described, *H. brunnea* or *H. ferax*) the "Sparrow-Hawk," "Quail-Hawk," and "Bush-Hawk" of the colonists—a bird of much higher courage than any Kestrel, and perhaps exhibiting the more generalized and ancestral type from which both Kestrels and Falcons may have descended. (A. N.)

KESWICK, a market-town of Cumberland, is situated on the left bank of the Greta, close to Derwentwater or Keswick Lake, about 30 miles south of Carlisle, and 300 miles from London by rail. It is one of the centres for visitors to the Cumberland lakes, and is the point whence the ascent of Skiddaw is usually begun. In the parish church of Crosthwaite, three quarters of a mile off, there is a monument to the poet Southey, whose residence for many years, Gretna Hall, stands at the end of the main street, close by the river. Keswick was formerly noted for its manufacture of lead pencils; and the plumbago (locally wad) used to be supplied by the mines in Borrowdale. Lead is still found in the neighbouring hills. Char, caught in the neighbouring lakes, are potted at Keswick in large quantities during the season, and sent to all parts of England. The population in 1881 was 3230.

KESZTHELY, a market-town in the trans-Danubian county of Zala, Hungary, is picturesquely situated near the western extremity of Lake Balaton, about 97 miles south of Pozsony (Pressburg), in 46° 47' N. lat., 17° 18' E. long. Keszthely is chiefly noted for its well-organized agricultural institute, founded by Count George Festetics, and known as the "Georgicon." At the source of the

¹ The absence of any species of Kestrel from Jamaica is a most curious fact, considering the abundance of the former in other parts of the West Indies.

Hévíz brook there is a warm sulphur spring. The trade is principally in grain, fruit, and wine. The population at the end of 1880 was 5341, mostly Magyars by nationality, and Roman Catholics by creed.

KETCHUP, a sauce or relish prepared principally from the juice of mushrooms and of many other species of edible fungi, salted for preservation and variously spiced. The term ketchup, written also catsup and katchup, is said to be of Japanese origin. The following may be taken as a typical example of the ingredients and method of preparation of ordinary ketchup. Freshly gathered mushrooms are placed in a wooden vessel and sprinkled with salt. They are left for two or three days, during which time they are repeatedly stirred and turned over. The juice is then squeezed out, and to every gallon of the juice there is added of crushed cloves and mustard seed half an ounce each, and of black pepper, ginger, and all-spice each an ounce. The mixture is boiled gently, decanted, and left to macerate for about two weeks, after which it is strained off and bottled. Should it show any tendency to putrefaction it is again boiled with the addition of salt and spices. It is of the utmost consequence to avoid copper, lead, and pewter vessels or implements in the preparation of ketchup; as far as possible glazed earthenware vessels alone should be used. The juices of various fruits, such as cucumbers, tomatoes, and especially green walnuts, are used as a basis of ketchup, and shell-fish ketchup, from oysters, mussels, and cockles, is also made; but in general the term is restricted to sauces having the juice of edible fungi as their basis.

KETI, a town and port in Kurrachee district, Sind, India, situated on the Hajamro branch of the Indus, in 24° 8' 30" N. lat., 67° 28' 30" E. long. Population (1872), 3199. The town is a large seat of river trade, and ranks next to Kurrachee among the ports of Sind. The sea-going exports comprise grain, pulses, oilseeds, wool, cotton, drugs, dyes, saltpetre, and firewood. The imports include coconuts, cotton piece goods, metals, sugar, spices, coin, and shells.

KETERING, a market-town of Northamptonshire, is built on a slope near the Ise, a tributary of the Nen, 14 miles north-east of Northampton, and 76 miles north-west of London. The principal buildings are the church of SS. Peter and Paul, a good specimen of the Perpendicular style, with a tower and spire, the church of St Andrew, built in 1870, in the Decorated style, the town-hall and corn-exchange; the temperance hall; and the union workhouse. The water-works were erected in 1872 at a cost of £12,000. The chief manufactures of Kettering are boots, shoes, brushes, staves, clothing, and agricultural implements. There are iron-works in the immediate neighbourhood. The privilege of market was granted in 1227 by a charter of Henry III. The population in 1881 was 11,093.

KEUNJHAR, or KEUNJUA, a petty state in Orissa, India, lying between 21° 1' and 22° 9' 30" N. lat., and 86° 14' and 88° 24' 35" E. long, with an area of 3096 square miles, and a population in 1872 of 181,871. The state originally formed part of Morbhanj, but about two hundred years ago the tribes of this part, finding it a great hardship to travel through the perilous forests of Morbhanj to obtain justice from their prince, separated themselves, and set up the brother of the Morbhanj rājā as their independent ruler. The last prince rendered good service during the Kol rebellion in 1857, and was rewarded with the title mahārājā. A Government elephant establishment is maintained at Keunjhar.

KEUNTHAL, a petty hill state in the Punjab, India, between 30° 55' 30" and 31° 6' N. lat., and 77° 10' and 77° 28' E. long., with an area of 116 square miles, and an estimated population of 50,000. The chief, a Rajput,

received the title of rájá in 1857. After the Gurkha war, a portion of Kounthal, which had been occupied by the Guikhas, was sold to the maharaja of Patiala, the remainder being restored to its own chief. In consideration of this, no tribute is paid by the Kounthal rájá. In 1823 the district of Puna was added to the Kounthal state. The rájá exercises rights of lordship over the petty states of Kothi, Theog, Madhan, and Batsah.

KEW, a village and parish in the county of Surrey, England. The village is pleasantly situated on the south bank of the Thames, 6 miles by road west-south-west of Hyde Park corner. It has communication with London by steamer and by several railway routes. By a stone bridge of seven arches, erected in 1780, it is connected with Brentford on the other side of the river. The village consists chiefly of a row of houses with gardens attached, situated on the north side of a green, to the south of which is the church and churchyard, and at the west the principal entrance to Kew gardens. In the vicinity there are many fine villas. From remains found in the bed of the river near Kew bridge it has been conjectured that the village is an old British settlement. The name first occurs in a document of the reign of Henry VII, where it is spelt Kaythoughe. The free school originally endowed by Lady Capel in 1721 received special benefactions from George IV, and the title of "the king's free school."

The estate of Kew House about the end of the 17th century came into the possession of Lord Capel of Tewkesbury, and in 1721 of Samuel Molyneux, secretary to the prince of Wales, afterwards George II. After his death it was leased by Frederick, prince of Wales, son of George II, and it continued to be the residence of members of the royal family until the estate was purchased about 1789 by George III, who devoted his chief leisure to its improvement. The old house was pulled down in 1802. Dutch House, adjoining Kew House, afterwards sold by Robert Dudley, earl of Leisester, to Sir Hugh Portman, a Dutch merchant, was purchased by George III as a nursery for the royal children. It is a plain brick structure, and is now known as Kew Palace. The Royal Botanic Gardens of Kew originated in the exotic garden formed by Lord Capel and greatly extended by the princess dowager, widow of Frederick, prince of Wales, and by George III, aided by the skill of the Aitons and of Sir Joseph Banks. In 1840 the gardens were adopted as a national establishment, and transferred to the department of woods and forests. The gardens proper, which originally contained only about 11 acres, have been increased to 75 acres, and the pleasure grounds or arboretum adjoining extend to 270 acres.

A catalogue of the plants in the exotic garden of Kew was published by Dr Hill in 1769, 2d ed. 1769, and in 1788 William Aiton published *Hortus Kewensis*, in 3 vols. 8vo. See *Obert's Guide to the Royal Botanic Gardens and Pleasure Grounds, Kew*, 28th edition, 1891.

KEW-KEANG FOO, a prefecture and prefectural city in the province of Keang-se, China. The city, which is situated on the south bank of the Yang-tze Keang, 15 miles above the point where the Kan Keang flows into that river from the Po-yang lake, stands in 39° 42' N. lat. and 116° 8' E. long. The north face of the city is separated from the river by only the width of a roadway, and two large lakes lie on its west and south fronts. The walls are from 5 to 6 miles in circumference, and are more than usually strong and broad. As is generally the case with old cities in China, Kew-Keang has repeatedly changed its name. Under the Tsin dynasty (265-420 A.D.) it was known as Sin-Yang, under the Leang dynasty (602-587) as Keang Chow, under the Suy dynasty (659-618) as Kew-Keang, under the Sung dynasty (960-1127) as Ting-Keang, and, under the Ming dynasty (1368-1644) it assumed the name it at present bears. Kew-Keang has

played its part in the history of the empire, and has been repeatedly besieged and sometimes taken. The last time this worst fate overtook it was in February 1853, when the Tai-ping rebels gained possession of the city. After their manner they looted and utterly destroyed it, leaving only the remains of a single street to represent the once flourishing town. The position of Kew-Keang on the Yang-tze Keang and its proximity to the channels of internal communication through the Po-yang lake, more especially to those leading to the green-tea-producing districts of the provinces of Keang-se and Gan-hwuy, induced Lord Elgin to choose it as one of the treaty ports to be opened under the terms of his treaty (1861). Unfortunately, however, it stands above instead of below the outlet of the Po-yang lake, and the 15 miles which separate it from that channel form one of the swiftest parts of the lower Yang-tze Keang. This has proved to be a decided drawback to its success as a commercial port, but nevertheless the customs returns show a steady annual increase in the trade carried on. The immediate effect of opening the town to foreign trade was to raise the population in one year from 10,000 to 40,000, and at the present time the census declares it to be peopled by 48,000 souls. The foreign settlement extends westward from the city, along the bank of the Yang-tze Keang, and is bounded on its extreme west by the P'u river, which there runs into the Yang-tze. The bund, which is 500 yards long, was erected by the foreign community at a cost of 1700 taels. The climate is considered to be good, and though hot in the summer months is invariably cold and bracing in the winter. According to the latest customs returns the value of foreign imports into Kew-Keang in 1878 was 2,614,302 taels as against 2,954,288 in 1880; during the same period native imports showed an increase from 640,109 taels to 982,384 taels; and the value of exports declined from 8,924,436 taels to 8,824,966 taels. 1853 piculs of opium were imported in 1878, and 2290 in 1880, and the revenue returns show that while the duties levied in 1873 amounted to 585,883 taels, in 1880 the sum received from the same source was 764,671 taels.

KEY WEST (Spanish, *Cayo Hueso*, Bone Roaf), a coral island, 7 miles long, from 1 to 2 miles broad, and 11 feet above sea-level, lies 60 miles south of Cape Sable, the most southerly point of the mainland of Florida. It belongs to Monroe county, Florida, and forms one of the Florida Keys. The soil is thin, but supports a tolerably dense tropical vegetation, including various fruits. In the absence of fresh springs, the water supply is derived from rain and distillation. The healthy climate attracts an annually increasing number of invalids from the north. The inhabitants are chiefly of Cuban and Bahaman extraction, and speak a Spanish patois.

KEY WEST, chief city of Monroe county, covers nearly one-half of Key West island. It has broad streets, arranged on the rectangular plan; and the houses, almost all wooden, are picturesquely surrounded by tropical shrubs and plants. The chief buildings are the Government naval and judicial edifices, the masonic hall, and the opera house. There is also a convent, and several churches and schools. The position of Key West in relation to Cuba, the Gulf of Mexico, and the coast of the United States gives it commercial advantages that are seconded by the possession of one of the finest harbours in the Union south of the Chesapeake. Key West shows much the largest tonnage in Florida of vessels clearing and entering; and it has frequent and good steam communication with the mainland. Described as being "to Cuba what Gibraltar is to Genoa, to the Gulf of Mexico what Gibraltar is to the Mediterranean," Key West is one of the chief naval stations of the United States, and is strongly fortified. The

principal manufacture is that of cigars, began in 1867, and steadily prospering. Previous to 1874, when a hurricane destroyed the works, 30,000 bushels of salt were annually produced on the island by solar evaporation. Fishing, sponge-gathering, and turtle-catching occupy many of the inhabitants; and a large number of small vessels are employed in "wrecking," i.e., in saving goods and rendering assistance to vessels that have failed to clear the dangerous Florida reef. The population of the city in 1880 was 9890.

KHABAROVKA, the chief town of the Maritime Province, in eastern Siberia, is situated on high crags, on the right bank of the Amur, amidst wide forests and marshes, at the confluence of the Ussuri. It was but a poor settlement with 700 inhabitants when it took the place of Nikolaevsk as the seat of the military administration of the Maritime Province and of the various establishments connected with the Amur fleet. Since its foundation in 1857 it has always been the chief centre for the trade in furs, purchased yearly from the aborigines to the average amount of 20,000 pieces, and sent to Irkutsk and to Russia.

KHAIRABAD, or KHYRABAD, the chief town of Sítápur district, Oudh, India, situated 5 miles south of Sítápur civil station and cantonment, 27° 31' 30" N. lat., 80° 47' 35" E. long. It is the fifth largest town in Oudh, with a population in 1889 of 10,677, made up of Hindus and Mohammedans in about equal numbers. The town contains forty mosques and thirty Hindu temples, besides a beautiful group of sacred Mohammedan buildings. A large fair is held here in January, lasting ten days, and attended by an average of 60,000 persons. A second fair is held at the *Dussehra* festival, attended by about 15,000 persons. The annual value of *Madar* sales is about £34,000.

KHAIRPUR, or KHYRPOOR, a native state in Sind, India, lying between 26° 10' and 27° 46' N. lat., and 68° 14' and 70° 18' E. long., bounded on the N. by Shikárpur district, S. by Jálálmír state, E. by Hydrabad district, and W. by the Indus river, with an area of 6109 square miles. Like other parts of Sind, Khairpur consists of a great alluvial plain, very rich and fertile in the neighbourhood of the Indus and the irrigation canals, the remaining area being a continuous series of sand-hill ridges covered with a stunted brushwood, where cultivation is altogether impossible. A small ridge of limestone hills passes through the northern part of the state, being a continuation of a ridge known as the Ghar, running southwards from Rohri. The state is watered by five canals drawn off from the Indus, besides the Eastern Nár, a canal which follows an old bed of the Indus. In the desert tracts are pits of *natron*, forming a source of revenue to the chief, as many as a thousand camel loads are annually exported to northern and central India, as well as to the seaboard, each load being taxed at rs.

A census taken in 1872 returned the population at 180,850, or 21 per square mile. The Moslems chiefly belong to the Rájput tribe. The Hindus are principally Rájputs of the Soda Thákur clan, who inhabit the extreme eastern part of the state. They are a well-built and sturdy race, of nomadic habits, their wealth consisting in herds of camels, oxen, sheep, and goats. The principal food grain crops are *Jowar* (*Holcus sorghum*), *bírd* (*Holcus spurius*), wheat, gram, and pulses. Indigo is largely cultivated, and cotton to a less extent. Fruits consist of the mango, mulberry, apple, pomegranate, date, &c. Several varieties of forest trees are grown in the Mir's game preserves. The annual value of the export trade is estimated at about £28,000, and the imports at £26,000. Cotton and silk fabrics, silver ware, lacquered wood-work, boots, shoes, horse trappings, swords, matchlocks, and pottery are the chief manufactures. A small quantity of salt and saltpetre is also manufactured. The revenue of the state, which is collected in kind, the Mir receiving one-third of the produce, is estimated to amount to about £50,000. The climate is agreeable during about four months of the year, and fiercely hot during the remaining eight. The principal diseases are fever, ophthalmia, and cutaneous affections.

The chief or Mir of Khairpur belongs to a Baluchi family, known as the Tálpur, which rose on the fall of the Kalhor dynasty of Sind. About 1813, during the troubles in Cabul incidental to the establishment of the Bárákzá dynasty, the Mirs were able to refuse the tribute which up to that date had been somewhat irregularly paid to the rulers of Afghanistan. In 1832 the independence of the Khairpur state was recognized by the British Government in a treaty, under which the use of the river Indus and the roads of Sind were secured. When the first Cabul expedition was doomed on, the Mir of Khairpur, Aíl Murád, cordially supported the British policy; and the result was that, after the battles of Miani and Dera had put the whole of Sind at the disposal of the British, Khairpur was the only state allowed to retain its political existence under the protection of the paramount power.

KHÁMGAON, a town in Akola district, Berar, India, in 20° 42' 30" N. lat., 76° 37' 30" E. long., with a population in 1887 of 9432. The cotton market—the largest in the province—was established about 1820. A branch line of 8 miles, opened in 1870, connects Khámgaon with the Great Indian Peninsula Railway. In fair seasons above 100,000 bullock-loads of cotton are brought into Khámgaon on the weekly market day. To the east of the town is a large enclosed cotton-market. The factories of the Betár Mining Company and the Mofussil Pressing Company possess steam machinery for full-pressing cotton.

KHÁNDESH, or CANDREH, a district of Bombay Presidency, India, lying between 20° 15' and 22° N. lat., and 73° 37' and 76° 24' E. long., bounded on the N. by the Sátapura hills, E. by Berar, S. by the Sámála or Ajanta hills, S.W. by Násik district, and W. by Baroda territory, with an area of 10,162 square miles. The chief town is Dhulia. The principal natural feature is the Tapti river, which enters at the south-east corner of the district, and flows in a north-westerly direction, dividing Khándesh into two unequal parts. Of these the larger lies towards the south, and is drained by the river Gíma. Northwards beyond the alluvial plain, which contains some of the richest tracts in Khándesh, the land rises towards the Sátapura hills. In the centre and east the country is level, save for some low ranges of barren hills, and has in general an arid, unfruitful appearance. Towards the north and west, the plain rises into a difficult and rugged country, thickly wooded, and inhabited by wild tribes of Bhlús, who chiefly support themselves on the fruits of the forests and by the profits of wood-cutting. The drainage of the district centres in the Tapti, which receives thirteen principal tributaries in its course through Khándesh. None of the rivers are navigable, and the Tapti flows in too deep a bed to be made use of for irrigation. The district on the whole, however, is fairly well supplied with surface water. Khándesh is not rich in minerals. A large area is under forest; but the jungles have been robbed of most of their valuable timber. Wild beasts are numerous. As late as 1858 tigers abounded; but since then they have been very closely hunted, and driven almost entirely out of the plains into the rough hilly country.

The census of 1872 returned the population at 1,028,842 (males 580,610, and females 448,032).—Hindus, 648,278; Musálmáns, 79,869; Páris, 61; Christians, 517; Jews, 80; Sikhs, 69; "others," 881. Of the aboriginal tribes the Bhlús are the most important. They number 152,093, and formerly were a wild and lawless robber tribe. Since the introduction of British rule, the efforts made by kindly treatment, and by the offer of suitable employment, to win the Bhlús from their disorderly life have been most successful. Many of them are now employed in police duties and as village watchmen. The total area of Government cultivable land is returned at 3,458,549 acres, of which 2,218,365 acres were under cultivation in 1875-76. Food grains take up 62 per cent.; pulses, 62 per cent.; flax, 28 per cent.; oil seeds, 11 per cent.; miscellaneous crops, 81 per cent. of the cultivated area. Irrigation is more extensively practised in Khándesh than in the Deccan and the southern Maráthra country. Owing to the liability of the district to river-floods, almost every year is marked by some failure of the crops. The chief exports are food grains, oil seeds, butter, indigo, wax, and honey; and the imports salt, spices, metal, piece goods, cotton yarn, and sugar. There are ten steam cotton presses, and one steam spinning and

weaving factory. Many Bombay mercantile houses have established agencies in the district; and towards the east, in the rich Tapi valley, Jalgaon and Bhudawal are rising into important centres of trade. The trunk road from Bombay to Agra and the Great Indian Peninsula Railway intersect the district, and of late years roads have been made all along the chief lines of traffic. The total revenue in 1876-77 amounted to £459,291, of which £308,704 was made up of the land tax. The same year there were 272 schools, with 16,249 pupils. The average annual rainfall for the five years ending 1875-76 was 26 inches. Fevers and cutaneous affections are the prevailing diseases.

KHANDPÁRA, a petty state in Orissa, India, lying between 20° 11' and 20° 26' N. lat., and 85° 1' and 85° 25' E. long., with an area of 244 square miles, and a population in 1872 of 80,877, mostly Hindus. Khandpara originally formed a part of the neighbouring state of Nayágarh, and was separated from it about two hundred years ago by a brother of the Nayágarh rájá, who established his independence. The present chief, a Rájput by caste, is the eighth in descent from the founder. The country forms a very valuable territory, and is one of the best cultivated of the Orissa states. Fine *sal* timber abounds in the hilly parts, and magnificent banana and mango trees stud the plain. It is intersected by the Kuariá and Deuka rivers, small tributaries of the Mahánadí. The estimated annual revenue of the chief is £2268; tribute to the British government, £421.

KHANDWA, or **CUNDWA**, the chief town and headquarters station of Nimár district, Central Provinces, India, 21° 50' N. lat., 76° 23' E. long. Population (1877), 14,118. Khandwa is perhaps the most rising town in the Central Provinces. It is the station on the Great Indian Peninsula Railway, where the whole traffic of Central India towards Bombay meets the line. It has entirely superseded Burhanpur, the ancient centre of trade between Mála, the Nerbudda valley, and the Deccan. Extensive barracks have been built for the relays of troops which pass through in the cold season, and there is also a good travellers' bungalow with a spacious *sardí* or native rest-house.

The Arabian geographer, Al Biruni (circa 1000 A.D.), mentions Khandwa, and a century later, it was a great seat of Jain worship. The mound on which the town stands has supplied many finely carved pillars, cornices, and other remains of the old Jain buildings, which have been built into Brahmanical temples, the walls of the Marhattá fort, and other structures. It also formed a quarry for the Sivráo temple surrounding the four *kunds* or water reservoirs, one of which is on each side of the town, that on the west side bearing the date 1132 A.D.

KHARKOFF, a government of European Russia, surrounded by those of Kursk, Poltava, Ekaterinoslaw, and Voronezh, and belonging partly to the basin of the Don and partly to that of the Dnieper. The area is estimated at 21,035 square miles. In general terms the government may be described as a table-land with an elevation of from 300 to 460 feet traversed by deep-cut river valleys. The soil is for the most part of high fertility, about 47 per cent. of the surface being arable land and 30 per cent. natural pasture; and though the winter is rather severe the summer heat is sufficient for the ripening of grapes and melons in the open air. The bulk of the population is engaged in agricultural pursuits, and the breeding of sheep, cattle, and horses, though various manufacturing industries have also received a rapid development, more especially since the middle of the present century. The ordinary cereals, maize, buckwheat, millet, hemp, flax, tobacco, poppies, and beetroot are all grown, and bee keeping and silk-worm rearing are of considerable importance. In 1879 the horses numbered 353,711, the cattle 476,217, the sheep 1,069,996, of which 376,777 were of fine-fleeced varieties. Beetroot sugar factories, cotton mills, woollen factories, iron-works, and tanneries are the leading industrial establishments; their whole production

in 1879 was estimated at 23,939,147 roubles (about £3,790,000). The mass of the people are Little Russians, but there are also Great Russians, Cossacks, Germans, Jews, and Gipsies. In 1867 the total population was 1,981,486, and in 1879 2,036,949—4119 of these being Rascolniks (dissidents), 1990 Roman Catholics, 2752 Protestants, and 3079 Jews. The government is divided into eleven districts—Kharkoff, Akhtuika, Bogodukhoff, Izyum, Kupyansk, Lebelyin, Zmief, Starobelsk, Sumai, Vailki, and Volschansk. In 1879 there were eight towns with populations above 5000—Kharkoff, Izyum (16,741), Starobelsk (12,681), Volschansk (11,207), Vlavansk (10,558), Tselisgeff (9418), Vailki (7001), Zolotcheff (5038). Ecclesiastically the government is a separate eparchy or diocese of the Greek Church. The Roman Catholics are subject to the bishop of Tiraspol in Kherston.

KHARKOFF, the chief town of the above government, is situated in 56° 37' N. lat. and 28° 5' E. long., in the valley of the Donets, 462 miles from Moscow and 137 miles from Kursk. It has railway communication northward by Kursk and southward to Mariupol on the Sea of Azoff and to Odessa by Poltava and Belta. The four annual fairs are among the busiest in Russia, more especially the Kreschtsenskaya or Epiphany fair, which is opened on the 6th (18th) January. The turn-over is estimated at from £3,000,000 to £4,000,000. Thousands of houses are bought and sold. At the Trinity (Troitsa) fair in June an extensive business (£2800,000) is done in wool. A great variety of manufactured goods are produced in the town—linen, felt, sugar (especially from beetroot), tobacco, brandy, soap, candles, cast-iron. Besides a flourishing university, instituted in 1805, and attended in 1879 by 720 male and 163 female students, Kharkoff possesses an observatory, a large veterinary college, a botanical garden, a theological seminary, and several important institutions of beneficence. The university building was formerly a royal palace. The library contained in 1878 98,000 volumes; and the zoological collections are especially rich in the birds and fishes of southern Russia. Extensive barracks are maintained in the town. Public gardens occupy the site of the ancient military works; and the Government has a model farm in the neighbourhood. Of the Orthodox churches one has the rank of cathedral. The population of Kharkoff was 59,968 in 1867, and 101,175 in 1879.

The foundation of Kharkoff is assigned to the year 1650, and the name is at least popularly connected with that of Khariton, the Cossack originator of the settlement; but there is an archaeological evidence of a much earlier occupation of the district, if not of the site. The Cossacks of Kharkoff remained faithful to the czar during the rebellions of the latter part of the 17th century, in return they secured a variety of privileges, and continued to be a strong advance guard of the Russian power, till the final subjugation of all the southern region. Along with other military settlements Kharkoff was placed on a new footing in 1785; and at the same time it became the administrative centre of the Ukraine. It has been the government town from the establishment of the government in 1789. For plan see *Russia, Géographie Universelle*, vol. v. p. 807.

KHARPUT (officially *MA'KURAN-UL-'AZIZ*), a town of Armenia, the seat of a mutassarif, is situated about 80 miles north of Diarbekir on the highway to Siwas, and occupies a peculiarly picturesque position on a rocky eminence rising above the great plain through which the waters of the eastern Euphrates describe a devious passage. Besides the imposing ruins of the castle on the height, it possesses an ancient Jacobite church and convent, and is the seat of an important American missionary college and school. The population may be estimated at 25,000 or rather more, as there are 6000 households in the town 370 Jacobites, 500 Armenians, and the rest Turkish.

There is epigraphic evidence for the existence of a town on this site in the time of Nero (see Morinmann in *Zermes*, 1880), and by some it is identified with *Garethosenta*, the capital of the province of Sophone. Kharput (Armanian, *Kharputi*, i.e., Castle Rock; *Xaprove* of Oederus; Arabic, *Kharabun*) appears in the oldest Arabic literature as Hiss Ziyad. It is the Quart Port or Quait Pierre of William of Tyre, the scene of the tragical story of the imprisonment of Baldwin II. by the emir Balak. See Tisser, *Turkish Armenia*, &c., London, 1881.

KHARTUM or **KHARTOUM** (erroneously Kartum), the chief town of the Egyptian Sudd, situated in 16° 37' N. lat., and 23° 54' E. long., on the peninsula formed by the junction of the White and the Blue Nile. The level of the stream just below the town is 1240 feet. The principal landing-place and the dockyards are on the Blue river. The surrounding country is flat and open, the forest described by the first European visitors having disappeared for a considerable distance up the river, but there are many gardens within and around the town planted with date-palms, fig and orange trees, &c. The town, though consisting chiefly of mean mud-built huts, has a considerable number of substantial modern buildings, the most imposing of which is the stone-faced palace of the governor. As the centre of the great caravan routes from the interior of Africa, Khartum carries on a good legitimate trade, but the inhabitants have always shown a preference for slave traffic when the governor has proved indulgent or inefficient. Khartum is the seat of a Roman Catholic mission founded by Pope Gregory XVI. in 1846, and long conducted by Dr Ignaz Knoblecher, of Protestant missions, and of several European consulates. The British consulate, established in 1849, and latterly held by Petherick, was abolished in 1884 under circumstances which gave rise to much comment. The population amounts to 50,000, including in addition to the natives the usual medley elements of an Egyptian town.

Khartum was founded by Mohammed Ali in 1828. In 1859 the population was estimated at 40,000. In 1899-70 the disturbed state of the country had brought the number down to 15,000, but since then the recovery has been rapid. See Lord Prebue in *Journal of the Geog. Soc.* 1892; G. Melly, *Khartoum*, &c., 1861; Hergin, *Reise n. Aboesman*, 1868; Schweinfurth, *Heart of Africa*, 1878; Hansal, *Briefe aus Khartum*, 1886 and 1880. Details regarding the Roman Catholic mission will be found in the last work; in *Jahresberichte of the Marienverein*; and in *Seidner's ally Briefe*, 1886 and 1881.

KHÁSI AND JÁINTIA HILLS, a district in Assam, India, lying between 26° 1' and 26° 14' N. lat., and 90° 47' and 92° 53' E. long., and bounded on the N. by Kámrup and Mowkong districts, E. by Cachar and the Nágá Hills, S. by Sylhet, and W. by the Gáo Hills. Its approximate area is 6187 square miles.

The district consists of a succession of steep ridges running east and west, with elevated table-lands between. On the southern side, towards Sylhet, the mountains rise precipitously from the valley of the Báká. The first plateau is about 4000 feet above sea-level. Further north is another plateau, on which is situated the station of Shillong, 4900 feet above the sea; behind lies the Shillong range, of which the highest peak rises to 6449 feet. On the north side, towards Kámrup, are two similar plateaus of lower elevation. The general appearance of all these table-lands is that of undulating downs, covered with grass, but destitute of large timber. At 3000 feet elevation the indigenous pines predominate over all other vegetation, and forms almost pure pine forests. The highest ridges are clothed with magnificent clumps of timber-trees, which superposition has preserved from the axe of the woodcutter. The characteristic trees in these sacred groves chiefly consist of oaks, chestnuts, magnolias, &c. Beneath the shade grow rare orchids, rhododendrons, and wild cinnamon. The streams are merely mountain torrents. As they approach

the plains, they form rapids and cascades, and many of them pass through narrow gorges of wild beauty. From time immemorial, Lower Bengal has drawn its supply of lime from the Khási Hills, and the quarries along their southern slope are literally inexhaustible. Coal of excellent quality crops out at several places, but has not yet been remuneratively worked. Ironstone exists in abundance, and in former days the Khásis were renowned as smelters of iron. Among other natural products may be mentioned beeswax, lac, and castor-oil. Wild animals abound, including the elephant, rhinoceros, tiger, buffalo, *mukh* or wild cow, and many varieties of deer.

Both as regards history and administration the Khási (Khánsá or Cossyn) and Jántia or Jyntia Hills constitute two separate tracts. The Khási Hills are occupied by a collection of petty states, each governed by an elective ruler. The chiefs have not been brought completely under British administration, and still retain marks of semi-independence. The headquarters of the British political agent for the Khási Hills is at Cháin Páin (Cherra Pooncy). The Jántia Hills, on the other hand, are purely British territory. The inhabitants call themselves Syntangs, and first became British subjects in 1856 (see JÁINTIA HILLS, vol. xii. p. 654).

An enumeration in 1873 disclosed a total population in the Khási and Jántia Hills of 141,888—aboriginal tribes, 141,888; Hindus, 865, Mohammedans, 62, Christians, 128. The two races of Khásis and Syntangs have succeeded in preserving to the present day their primitive isolation, free from the interference of Hinduism. They have only given way somewhat to Hindu prejudices as regards purity of food. The Khásis have no written character or literature, nor even any traditions of their own. The most curious of their social customs is the importance attached to female descent and female authority. The husband marries into the wife's family, the wife or her mother is regarded as the head of the household, and all property descends in the female line. The survival of the polyandrous institutions still kept up in full force by the Nairs, and other non-Aryan tribes of India. The ashes of the dead are buried under cromlechs consisting of four upright slabs of stone, covered over by a fifth slab. The only places in the Khási and Jántia Hills above the rank of hamlets are Shillong, the headquarters station, Jowai, and Cháin Páin.

The principal cereal crop is rice, but even of this they do not grow sufficient for their own consumption. Sugar cane, cotton, and potatoes are also grown; and fruits such as oranges, limes, and pine-apples are raised in large quantities for export to Calcutta. The land is under the absolute property of the chiefs, and the rent or revenue either to the British Government or to their own chiefs. Blights, floods, and droughts are almost unknown. Of a total area of 6187 square miles, only 288 are estimated as under cultivation, but other 2898 are returned as available for tillage. The trade of the hills is considerable. The estimated exports in 1876-77 were valued at £180,000, chiefly potatoes, limestone, cotton, stick-lac, bay leaves, oranges, and betel nuts. The imports were valued at £157,000. By far the greater portion of the trade is conducted at a row of markets along the southern foot of the hills, of which Cháitak in Sylhet district is the most important.

The Khási and Jántia Hills constitute a political agency, independent of the ordinary jurisdiction. The Khási petty states, twenty-five in number, are presided over by elective chiefs, having jurisdiction over their own subjects in all cases except homicide. The British Government undertakes the management of the natural products of the country, such as lime, coal, timber, and elephants, and pays over to the chiefs a half share of the profits. Their other sources of revenue are market dues, court fines, and various cesses. Their aggregate income is approximately estimated at £6000, of which £2800 is derived from lime quarries. The total revenue of the district to the British Government in 1875 was £13,888, of which the larger portion came from royalties on lime quarries and the house tax, the expenditure was £2992. Education is conducted through the agency of the Welsh Calvinistic mission, and in 1874-75 there were seventy-three schools open, attended by 1006 pupils. Female education is making progress among the Khásis. The climate of the district is mild and equable, though in some parts excessively humid. At Shillong the thermometer rarely exceeds 80° Fahr., and falls as low as 38°. Shallow water occasionally freezes, but snow never falls. The rainfall at Cháin Páin is the heaviest recorded in the world. The average during the three years ending 1876 is returned at 868.41 inches; and 806 inches are said to have fallen in 1861, including 806 inches in the single month of July. At Shillong the annual rainfall declines to about 85 inches; and at Jowai, which occupies an intermediate position, the average is 120 inches. The district is liable to shocks of earthquakes. Generally speaking, the climate is healthy, but the prevalence of malarial fevers never prevails, unless directly imported from the plains.

KHATMANDU, the capital of the kingdom of Nepal, India, situated on the bank of the Vishnumati river at its junction with the Baghmati, 27° 36' N. lat., 85° 24' E. long. The town, which is said to have been founded by Raja Gunakamdeva about 723, now contains a population estimated at about 50,000, occupying 5000 houses made of brick, and usually from two to four stories high. Many of the houses have large projecting wooden windows or balconies, richly carved. The maharaja's palace, a huge, rambling, ungainly building, stands in the centre of the city, which also contains numerous handsome temples. The streets are extremely narrow, and the whole town very dirty. A British resident, with a small staff and escort, is stationed about a mile to the north of the city.

KHAZARS. This vanished people, who appear also as Chozars, as *Χαζάρων* or *Χαζάρων* in Byzantine writers, as Khazirs in Armenian and Khwalissee in Russian chronicles, Ugrî Bieli in Nestor, and Kosa (?) in Chinese, occupied a prominent place amongst the secondary powers of the Byzantine state-system. In the epic of Ferdowsi "Khazar" is the representative name for all the northern foes of Persia, and legendary invasions long before the Christian era are vaguely attributed to them. But the Khazars are an historic figure upon the borderland of Europe and Asia for at least nine hundred years (100-1100 A.D.). The three hundred and fifty years 600-950 A.D. mark the epoch of their greatness, but their rise can be traced for four centuries before, and their decline for one hundred and fifty years to follow. Their home was in the spurs of the Caucasus and along the shores of the Caspian—the "sea of the Khazars"; and their cities, all of them populous and civilized commercial centres, were *Til*, the capital, upon the delta of the Volga, the "river of the Khazars," *Semender* (Tarkhn), the older capital, *Khamidje* or *Khalendoch*, *Belendischer*, the outpost towards Armenia, and *Sarkel* on the Don. They were the Venetians of the Caspian and the Euxine, the organizers of the transit between the two basins, the universal carriers between East and West; and *Til* was the meeting-place of the commerce of Persia, of Byzantium, of Armenia, of Russia, and of the Bulgarians of the middle Volga. The tide of their dominion ebbed and flowed repeatedly during their history, but the normal Khazaria may be taken as the territory included between the Caucasus, the Volga, and the Don, with the outlying province of the Crimea or "Little Khazaria." The southern boundary never greatly altered; it did at times reach the Cyrus and the Amxes, but on that side the Khazars were confronted by the great powers of Byzantium and Persia, and were for the most part restrained within the passes of the Caucasus by the fortifications of Darius. Amongst the nomadic Ugrians and agricultural Slavs of the north their frontier fluctuated widely, and in its zenith Khazaria extended from the Dnieper to Bolgar upon the middle Volga, and along the eastern shore of the Caspian to Asterabad.

Ethnology.—Few points have been more disputed than the origin of this interesting people; and there is still no consent amongst authorities upon the subject. They are assigned to the Turkish stock by Latham and Howorth, to the Ugric by Kleproth and Vivien St Martin, and have even been claimed as Jews on account of their use of the Hebrew character and the profession of the Hebrew faith amongst them. But their geographical position, their history, and the contemporary witness we have as to their physical character, their language, and their own national tradition, may be accepted as conclusive proof that the Khazars were an indigenous people of the Caucasus, and near akin to the Armenians and the Georgians.

Their king Joseph, in answer to the inquiry of the Rabbi Chasael Ibn-Shimon of Cordova (c. 938) stated that his people sprang from Thogamah, grandson of Japhet, and the supposed ancestor of the other peoples of the Caucasus. The Arab geographers who knew the Khazars best connect them either with the Georgians (Ibn al-Ashir) or with the Armenians (Ibn Khordadbeh, ed. de Munk, p. 245);

whilst Ahmed ibn Fadlan, who passed through Khazaria on a mission from the caliph Muktadir (922-3), possibly asserts that the Khazar tongue differed not only from the Turkish, but from that of the bordering nations, which were Ugric.

Nevertheless there are many points connected with the Khazars which indicate a close connexion with Ugric or Turkish peoples. The oldest titles recorded by the *Psallia* are those in use amongst the Tartar nations of that age, whether Huns, Bulgarians, Turks, or Mongols. The names of their cities can be explained only by reference to Turkish or Ugric dialects (Kleproth, *Idem*, *sur les Khazars*, i. Howorth, *Khazars*). Some too amongst the medieval authorities (Ibn Haskal and Ischidori) note a resemblance between the speech in use amongst the Khazars and the Bulgarians, and the modern Magyar—a Ugric dialect—can be traced back to a tribe which in the 9th century formed part of the Khazar kingdom. These characteristics, however, are accounted for by the fact that the Khazars were at one time subject to the Huns (448 A.D. *et seq.*), at another to the Turks (c. 560), which would sufficiently explain the signs of Tartar influence in their polity, and also by the testimony of all observers, Greeks, Arabs, and Russians, that there was a double strain within the Khazar nation. There were *Khazars* and *Kara* (black) *Khazars*. The "Khazars" were fair-skinned, black-haired, and of a remarkable beauty and stature; their women adorned were sought as wives equally at Byzantium and Baghdad, while the "Kara Khazars" were ugly, short, and were reported by the Arabs almost as dark as Indians. The latter were indubitably the Ugric nomads of the steppes, akin to the Tartar invaders of Europe, Huns, Bulgarians, and Hungarians, who filled the annals and conveyed the servants of the ruling caste. But the Khazars proper were a true commercial people, the founders of cities, remarkable for somewhat elaborate political institutions, for persistence, and for good faith—all qualities foreign to the Hunnic character.

They are identified with good reason (by Zeuss, V. St Martin, Howorth, Latham) with the "Ard-Gyry" or *Ak-Khazars*, "White Khazars" who appear upon the lower Volga in the Byzantine annals, and thence they have been deduced, though with less convincing proof, either from the *Ar-Adipura* or the *Kartlapa* of Herodotus, iv. 104 (Latham, V. St Martin). There was throughout historic times a close connexion between the Khazars and the political identity between the Khazars and the Bursiloms (the *Parada* of Moses of Cherson) who occupied the delta of the Volga, and the Bursiloms can be traced through the pages of Ptolemy (*Geog.*, v. 8), of Pliny (v. 20), of Strabo (vii. p. 806), and of Papposinos Male (c. 1, p. 119) to the so-called *Koy-Soyles*, *Sakia*, *Sasajans*, and so very known to the Greek colonies upon the Euxine, and whose political superiority and commercial enterprise led to this rendering of their name. Such points, however, need not here be further pursued than to establish the presence of this white race ("La Race Blanche" of Kleproth) around the Caspian and the Euxine throughout historic times. They appear in European history as White Huns (Ephthalites), White Ugrians (Saragurs), White Bulgarians. They were the carriers between Europe and the farther East. Owing to climatic causes (see Asia) the first they occupied was slowly drying up. They were the outposts of civilization against the encroaching desert, and the Tartar nomadism that advanced with it. They held in precarious subjection the herds whom the conditions of the climate and the soil made it impossible to supplant. They bore the brunt of each of the great waves of Tartar conquests, and were eventually overwhelmed.

History.—From out of the mass of this white race of the steppes the Khazars can be first historically distinguished at the end of the 2d century of our era. They burst into Armenia with the Bursiloms, 198 A.D. They were repulsed and attacked in turn, but thereonforth Khazar was occupy a prominent place in the Armenian annals for eight hundred years. The presence of the nomads of the steppes, the quest of plunder and conquest, these were the only motives of these early expeditions, but in the long struggle between the Roman and Persian empires, of which Armenia was not seldom the battlefield, and eventually the prize, the attitude of this powerful people of the Caucasus assumed political importance. Armenia inclined to the civilization of Rome and to the Christianity of Rome, whilst her Arasid princes maintained an inveterate feud with the Sassanids of Persia. It became therefore the policy of the Persian kings to call in the Khazars to neutralize or to chastise the efforts of the Armenians in every collision with the empire (290-360). During the 4th century, however, the growing power of Persia, ultimized in the annexation of eastern Armenia, the Khazars, endangered by so powerful a neighbour, passed from under Persian influence into that remote alliance with Byzantium which thenceforth characterized their policy, and they aided Julian in his invasion of Persia (363). Simultaneously with the approach of Persia to the Caucasus the terrible empire of the Huns arose up among the Ugrians of the northern steppes. The Khazars strained on every side against a massive wall the danger ultimized in the invasion of Attila (454). The emperor Theodosius, with reason turned left for his defence, sent envoys to bribe the Khazars (*Ardr-Lepi*) to attack the Huns from the empire by an attack upon their

KHELAT, the capital of Baluchistan, and the residence of the reigning khan, is situated, at an elevation of 6800 feet above the sea, in 29° N. lat., and 66° 40' E. long., in a narrow valley, which is bounded to the east by the mountain ranges extending to the province of Cutch Gandava, to the west is the Sha Miran, on the northern slope of which hill the town is built, to the south the valley is closed by low hills, while to the north it is of sufficient breadth to allow space for two or three small villages. Through the centre of this valley runs a mountain torrent, which is generally dry, but after heavy rain pours down a considerable body of water. The town is surrounded by a mud wall about 30 feet in height, which is pierced by three gateways. The houses are built of mud, and number from three to four hundred, the streets are narrow and tortuous; it possesses a tolerably well supplied bazaar. A miri or citadel, having an imposing appearance, dominates the town, and contains within its walls the palace of the khan. It was in an upper room of this residence that Merab Khan, then ruler of Baluchistan, was killed during the storming of the town and citadel by the British troops at the close of the first Afghan war in 1839. The suburbs of Kelat are comparatively extensive, and contain from 10,000 to 12,000 inhabitants, which number, however, fluctuates according to the season, as well as with the political events passing in the country. There are to be found both in the town and suburbs residents representing many of the countries of Asia, viz., Hindus, Brahmins, Dehwars, Babes, Afghans, Persians, and Baluchis. The Hindu community forms the principal trading class, a fair proportion of which, however, includes the Babes tribe, while agriculture is almost entirely in the hands of the Dehwar tribe. The town is well supplied with excellent water, principally from a spring situated in the eastern side of the valley; this water is also used for irrigating the numerous enclosed gardens situated about, in which are grown most of the fruit trees to be found in European climates, including the vine, apricot, apple, and mulberry; vegetables of all descriptions thrive to perfection. The climate of Kelat is peculiarly dry and pure, nor is there heat during the summer months that can be called oppressive. The citadel, although offering an imposing appearance, has in reality no military value, and could offer no resistance to the artillery in use at the present day. It is quite impossible to give an idea of the period of the building of Kelat, though there can be no doubt that it is of very ancient origin, long prior to the Mohammedan era; but, as political events have now brought England into close friendly relations with the Baluchi state, we may look forward to the unravelling of many traditions which now surround and obscure the history of Baluchistan and its capital.

KHERI, a district of Oudh, India, lying between 27° 41' and 28° 42' N. lat., and 80° 4' 30" and 81° 28' E. long., bounded on the N. by the river Mohan, separating it from Nepal, E. by the Kauria river, separating it from Bhardich district, S. by Sitapur district, and W. by Shahjahanpur district in the North-Western Province, with an area of 2963 square miles.

Kheri district consists of a series of fairly elevated plateaus, separated by rivers flowing from the north-west, each of which is bordered by a belt of alluvial land. The rivers are, commencing from the east, the Kauria, Suheli, Dahawar, Chauka, Ul, Jamwari, Kathma, Gumti, and Sukheta. North of the Ul, the country is considered very unhealthy. This tract probably formed in ancient times the bed of a lake, through which flow two rivers, the Kauria and Chouka, changing their courses constantly, so that the whole surface is seamed with deserted river beds much below the level of the surrounding country.

The vegetation is very dense, and the stagnant waters are the cause of endemic fevers. The people reside in the neighbourhood of the low ground, as the soil is more fertile and less expensive to cultivate than the forest-covered uplands. South of the Ul, the scene changes. Between every two rivers or tributaries stretches a plain, considerably less elevated than the tract to the north. There is very little slope in any of these plains for many miles, and marshes are formed, from which emerge the head-waters of many secondary streams, which in the rains become dangerous torrents, and frequently cause devastating floods. The general drainage of the country is from north-west to south-east. Several large lakes exist, some formed by the ancient channels of the northern rivers being five sheets of water, from 10 to 20 feet deep and from 5 to 4 miles long, in places they are fringed with magnificent groves. In the south there are some other large natural lakes. The whole north of the district is covered with vast forests—occupying an area of 550 square miles, of which 423 square miles are now Government reserves. *Sal* occupies about two-thirds of the whole forest area. *Kankar* (nodular limestones) of good quality is met with, and salt-petre is manufactured in large quantities. The wild animals include tigers, leopards, black buck, spotted deer, hogdeer, and *Nilgai*.

At the census of 1869 the population was returned at 749,350 (males 408,887, females 340,463)—Hindus, 671,084, Mohammedans, 74,307; Christians, 96, "others," 261. Allowing for recent transmigrations, the latest return (based on the above census) gives the population at 739,288. All the towns now existing are of recent foundation, none dating earlier than the 18th century. Of their origin, one common tale is told. The Mussulman or Rajput founder came through the woods and marshes, and seated upon the slight hills or hummocks upon which some *Pua* or *Ahr* patriarch ruled over a few mud huts. The rightful owner died deeper into the forest, and the intruder built a brick house or a brick fort to guard against his return. Only three towns in 1869 contained upwards of 5000 inhabitants, namely, Kheri, Mulhumdi, and Oel, with an aggregate population of 19,067. Luckimpur, the civil station, is the only municipality in the district. The area under the chief agricultural products is returned as follows:—rice, 166,811 acres; wheat, 125,081; other food grains, 851,188; oil-seeds, 29,880; sugar-cane, 41,066; cotton, 8789; tobacco, 8265; vegetables, 6844; fibres, 419 acres. *Poppy* and indigo are also cultivated. District manufactures are confined to weaving and cotton printing for local requirements. Goods of all kinds are exported, as also are turmeric, tobacco, amber, sugar, syrup, hides, bullocks, and *gha*. *Catechu* is made in large quantities throughout the north of the district, from the *Khar* tree (*Acacia Catechu*), the heart-wood of which is chopped out and boiled down by a caste called *Kharis*. *Khasia* (*Andropogon squarretum*), the roots of which are used for making *fats* screens, is exported in large quantities to Benares and Patna. Two great annual religious trading fairs are held at Gola Gokaranath—once in January attended by about 50,000 people, and the other in February, lasting about fifteen days, at which 150,000 persons are said to assemble. The great fair is increasing rapidly in importance, goods to the value of about £15,000 being sold annually by traders from all parts of India. The imports, which consist mainly of cotton, salt, country cloth, and English piece goods, considerably exceed the exports in value. The district revenue in 1870 amounted to £74,132, of which £22,471 was derived from the land-tax. In respect of education, Kheri is the most backward district in Oudh. The mean annual temperature is about 79° Fahr., the mean rainfall during the eleven years ending 1874 was 47·8 inches.

The present district only dates its history as an administrative unit from 1868. At the time of the mutiny of 1857 it was divided between the districts of Mulhamdi and Mallapur, and was not constituted a separate district till the reorganization of the province on the pacification of the country.

KHERSON, a government of European Russia, on the borders of the Black Sea, and continuous with Bessarabia, Podolia, Kieff, Ekaterinoslaw, and Taurida. The area is estimated at 27,455 square miles. Especially in the south the general aspect of the country is that of an open steppe, and almost the whole government is destitute of forest. The Dniester marks the western and the Bug, the Ingul, and several minor streams traverse the intermediate

territory. Along the shore lie a number of extensive lagoons. Chalk, saltpetre, salt, sandstone, and a limestone conglomerate largely used for building are the principal minerals. Besides the ordinary cereals, maize, hemp, flax, tobacco, and mustard are pretty commonly grown; the fruit trees of general cultivation include the cherry, the plum, the peach, and the mulberry, and gardening receives a large amount of attention. The agricultural condition of the government has been greatly improved by the presence of numerous German colonies. Cattle-breeding, horse-breeding, and sheep farming are pursued on a large scale. Some of the sheep farmers have as many as 30,000 or 40,000 merinos, and only a very small proportion of the 2,500,000 sheep in the government are of unimproved varieties. The value of the total industrial production has been estimated at upwards of £2,500,000,—the more important departments being the manufacture of wool, hemp, leather, and flour. The ports of Kherson, Otchakoff, Nikolaieff, and more especially Odessa are among the great outlets of Russian commerce; and Bersialf, Alexandriya, Elizabethgrad, Voznesensk, Olviopol, and Tiraspol play an important part in the inland traffic. In 1871 the total population of the government was 1,661,892; and besides Great and Little Russians it comprised Roumanians, Servians, Poles, Greeks, Germans, Gipsies, while no fewer than 44,107 were returned as Roman Catholics, 48,092 as Protestants, 3183 as Armenians, and 128,812 as Jews. There are six administrative districts—Alexandriya, Ananieff, Elizabethgrad, Kherson, Odessa, and Tiraspol. The towns with more than 5000 inhabitants are Odessa (184,820 in 1873), Nikolaieff (82,800), Elizabethgrad (35,200), Tiraspol (16,700), Ananieff (16,000), Alexandriya (10,520), Novo-Georgievsk or Krutloff (10,235), Voznesensk (9450), Bersialf (8080), Bobrnetz (7150), Grehopol, Dubosart, Novo-Mirgorod, Olviopol, and Otchakoff.

KHERSON, the chief town of the above government, is situated on the right bank of the Dniester, about 19 miles from its mouth. Founded by Prince Potemkin in 1778 as a naval station and seaport, it had become by 1786 a place of 10,000 inhabitants, and, although its progress was checked by the rise of Odessa and the removal (in 1794) of the naval establishments to Nicolaieff, it has still a population of more than 48,000. The Dniester at this point breaks up into several arms, forming islands overgrown with reeds and bushes; it is difficult to maintain a deep navigable channel, and vessels of burden must anchor at Stanslavskoe Selo, a good way down the stream. Of the traffic on the river the largest share is due to the timber trade, and wool-dressing is the only extensive local industry. Kherson is a substantial and regular town. The cathedral is interesting as the burial-place of Potemkin, and near the church of the Assumption lie the remains of John Howard, the English philanthropist. The fortifications have fallen into decay. The name Kherson was given to the town from the supposition that the site had formerly been that of Chersonesus Heracleotica, the famous Greek city founded by the Dorians of Heraclea.

KHIVA, an independent Uzbeg khanate of Turkestan, which occupies the fertile oasis stretching in a band of varying width along the left bank of the lower Oxus between Pitsniak and the Sea of Aral. The inhabited district, which lies between 41° and 48° N. lat., and 59° and 61° 30' E. long., and practically forms the limits of the khanate, is about 200 miles in length and has an average breadth of 25 to 30 miles—an area therefore of some 5000 to 6000 square miles.

This tract of territory is but a meagre relic of the great kingdom which under the name of Chorasania, Kharezm (Khwarizm), or Urgentch held the keys of the mightiest

river in Central Asia, and formed in consequence a precious jewel for rivalry among Eastern potentates from an early period of the world's history. Great alterations, geographically and politically, have taken place since those times. The Oxus has changed its outlet, and no longer forms a water-way to the Caspian and thence to Europe. A great European power has arisen which has made gradual but important encroachments in Asia, and between this power on the north and the independent Turcoman tribes on the south the authority of the khan of Khiva has been dwarfed and circumscribed within the narrow limits above indicated.

From the establishment of the Russians on the lower Jaxartes in 1847 dates the decline in power of the khan of Khiva. Prior to that year the khan claimed sovereignty from the Caspian on the west to the confines of Khokand and Bokhara on the east, and from the northern margin of the Ust Urt and the Jaxartes on the north to the mountain range forming the Persian frontier on the south, including Merv. Within these limits his authority was recognized, and although towards the extremities this was merely nominal. Since that year the Russians have annexed the country between the lower Jaxartes and Oxus, established the large trans-Caspian military district on the east shore of the Caspian, and conquered the Akhal Tekke country, thereby hemming in the Khivans on all sides. The Russians have, moreover, by imposing a large indemnity (two millions of roubles) for the campaign of 1873, so crippled the finances of the state that the khan, though nominally independent, is in reality a vassal and in a state of complete subjection to his more powerful neighbours. A Russian military force now watches the khanate from Forts Petro-Alexandrova and Nukus on the right bank of the Oxus, the former fort being within 35 miles of the capital.

History.—It would be impossible to trace here, even in the briefest manner, the changes through which Kharezm has passed, under the successive waves of migration and conquest which have swept across the country in ancient and historic times. The present insignificance and the eventual disappearance of the khanate from the map of Turkestan in the near future being intimately connected with the extension eastward of Russia, it will be more profitable to trace its history after its first connexion with that power.

Russia commenced her relations with Khiva in the 17th century. The warlike Cossacks of the Yaik during their raids across the Caspian learnt of the existence of the rich territory of Khiva, and made an expedition to the chief town, Urgentch, at a time when the khan and his troops were absent. They carried off a large number of women and a rich booty, but were overtaken on their road home by the Khivans and killed to a man. Two subsequent expeditions under Atamans Nezhai and Shemai proved equally disastrous to the Cossacks. These three expeditions were simply the raids of freebooters. In 1717, however, Peter the Great, having heard of the presence of auriferous sand in the bed of the Oxus, and desiring also to "open mercantile relations with India through Turan" and to release from slavery some Russian subjects, sent a properly equipped military force to Khiva. The command of the expedition, which consisted of 3300 men and six guns, with three months' provisions, was entrusted to Prince Bekovitch Toherkaesky. After establishing a fortified base of operations on the east shore of the Caspian, Bekovitch collected his forces at the mouth of the Ural and thence marched across the Ust Urt into Khivan territory. When within 100 miles of the capital he was encountered by the forces of the khan. The battle lasted three days, and ended in victory for the Russian arms. The Khivans, however, induced the victors to break up their force into small detachments in order to facilitate supply,

and then treacherously annihilated them in detail. This disaster did not prevent the Russians from sending embassies from time to time to the khan, but the representations of the envoys did not induce him to desist from enslaving Russian subjects or even to free those already in bondage. The Persian campaign which subsequently followed, the designs in other parts of Central Asia, and the constant embroilment of Russia in European wars caused Khivan affairs to recede temporarily to the background, and it was not until the third decade of the 19th century that the attention of the Muscovite Government was again directed to the khanate. In 1839 a force under General Perovsky, consisting of three and a half battalions, three Cossack regiments, and twenty-two guns, in all 4500 men, with a large train of camels, moved from Orenburg across the Ust Urt to the Khivan frontiers, in order to occupy the khanate, liberate the captives, and open the way for trade. This expedition likewise terminated in disaster. The inaccessibility of Khiva was once more her safeguard. Before the force reached half-way towards its destination it was forced to return, in consequence of the severity of the weather and the loss of life among the men and animals. These expeditions had convinced the Russians that for the effective control of the relations of Khiva a nearer position must be sought. In 1847 they founded the Raim fort at the mouth of the Jaxartes. As this advance deprived the Khivans not only of territory, but of a large number of tax-paying Kirghiz, while the establishment of a fort gave the Russians a base for further operations, a collision became sooner or later inevitable. For the next few years, however, the attention of the Russians was taken up with Khokand, their operations on that side culminating in the capture of Tashkend in 1865. Free in this quarter, they directed their thoughts once more to Khiva. In 1869 Krasnovodsk on the east shore of the Caspian was founded, and in 1871-72 the country leading to Khiva from different parts of Russian Turkestan was thoroughly explored and surveyed. In 1873 an expedition to Khiva was carefully organized on a large scale. The forces placed at the disposal of General v. Kaufmann started from three different bases of operation—Krasnovodsk, Orenburg, and Tashkend. The whole force consisted of more than 10,000 men. Khiva was occupied by the Russians almost without opposition. All the territory (36,700 square miles, and 110,000 souls) on the right bank of the Oxus was annexed to Russia and formed into the Amu Darya sub-district, while a heavy war indemnity was imposed upon the khanate. The difficult position financially in which the khan is thereby placed has more than once impelled him to beg the Russians to take the country under their administration. Russia, however, prefers the present arrangement of maintaining Khiva semi-independent instead of in complete subjection, for, not only does the collection of the indemnity fall upon the Khivan authorities, but the country shields the Russian possessions on the Oxus from the attacks of the Turcomans, which if made must first come in contact with the intervening territory of Khiva.

Topography.—The Khivan oasis is indebted for its fertility to the waters of the Oxus, which by means of irrigating canals and ditches penetrate into what was at one time barren steppes. Where this water reaches the land teams with life; where it ends all is death and a waste. The area of sandy desert reclaimed by the Oxus is estimated by the late Major Wood, Madras Engineers, at 1½ millions of acres. The soil of the khanate is a tenacious clay of a red, and grey colour, more or less impregnated with sand,—the districts brought down by the river. Black earth is seldom seen; but earth strongly impregnated with salts is frequently found. The oasis is generally level, except some unimportant heights and sand-hills.

That part of the Oxus which waters the khanate has at Pitmak a north-west direction, and flows within a single bed. Below Kipehak it bends sharply to the west, and, after describing part of a semicircle to Hodjeli and giving off the Landan, which with the Uboi forms the ancient course of the Oxus, resumes its north-west course to Kungrad. There it takes a north direction, dividing into two branches, the Taldyk and Ulkun, the latter the principal arm, and ultimately disembogues by many channels into the Sea of Aral. The banks of the river are generally low, and in midsummer do not stand more than 6 to 20 feet above the level of the water. The river is in flood three or four times a year, the chief periods being in April and May, when it overflows its banks and does much damage to the canal dams. The average velocity is about 8 miles an hour, but at times of inundation the current becomes much more rapid. The breadth of the river at ordinary times varies from $\frac{1}{2}$ to $\frac{3}{4}$ mile, but increases to 3 or more miles at inundations. There are no obstacles to navigation in the shape of rapids, but the shifting of the sand banks acts as an impediment. The water of the Oxus is wholesome, although of a yellowish-brown colour, which is due to particles in suspension. These particles are gritty, and unlike the mud of the Nile do not fertilize the ground. The deposit from the water when dried is used by the Khivans to form their dams. In consequence of the large body of matter brought down, the irrigating canals require constant clearing. These canals vary from 20 to 160 feet in breadth, and from 10 to 20 feet in depth, and are sometimes as much as 80 miles long. They have a current of about 2 miles an hour, and are mostly navigable by boats. The direction of the canals is west and north-west, from which it may be concluded that the left bank of the river has a natural slope towards the Caspian. By actual measurement it has been found that the fall of the ancient bed is 400 feet from the point near Kipehak where it had its origin to Balkhan Day in the Caspian,—a distance of 800 miles.

From the statement of Abulghazi Khan and other proofs there can be little doubt that two hundred and fifty years ago the Oxus flowed into the Caspian through the Uboi, which was connected with the present channel by at any rate three arms—Dandan, Daryalir, and Landan or Landan. The alteration in the course of the river was probably due to the gradual elevation of the land where the old bed passed, from which naturally resulted a diminution in the velocity of the stream, and at the same time a silting of the channel. From this cause the waters of the Oxus found for themselves another outlet. Whether the Russians will be able to carry out their scheme of forcing the Oxus to resume its old course to the Caspian it would be premature to offer an opinion, but the surveys at present are not favourable. The advantages to Russia would be great, as she would have a continuous waterway from the Volga to Afghanistan.

The khanate has numerous lakes, especially towards the Aral, connected together by affluent canals. They are usually covered with reeds. Lake Ailbugin, once a large inlet of the Aral, is now dry.

The means of communication in the khanate is by road and by water. The roads are usually narrow, but some are as much as 70 feet wide. In spring and autumn, at the time of inundations, they are in bad order. Internal trade is carried on by camels and by oxen.

Government.—The government is an absolute despotism, and, subject to a certain moral control exercised by the proximity of the Russians, is entirely in the hands of the Khan. The chief executive officials are (1) the *kash-beg* or vizier, prime-minister; (2) *mehtar*, chancellor of the exchequer; (3) *inakh*, four in number, local governors; (4)

metch-meirem and *batchman*, controller and collector of customs respectively; (5) *big*, the khan's supporter in battle; (6) *minbashi*, *syabashi*, and *onbashi*, belonging to the military class, now fast disappearing. The *ulema* or priests, of whom the *makib* is the chief, are subdivided as follows:—(1) *kazi kelen* and *kazi*, judicial functionaries; (2) *alem*, chief of the five *mutas*; (3) *reis*, *misfit*, and *ashond*. The acknowledged religion is the Suni form of Mohammedanism. Justice is administered in the mosques and in the private dwellings of the *cadis* and *mutas*, but every Khivan subject has the right to prefer his complaint before the governor or even before the khan.

Revenue.—The khan's revenue is derived from (1) the land-tax, paid in coin by all sedentary Khivan subjects, and in cattle (2½ per cent.) by nomads; (2) a customs due on all incoming and outgoing caravans, and on the sale of cattle—2½ per cent. *ad valorem*; (3) the rent of crown lands. The revenue of certain districts is set aside for the support of the relatives of the reigning khan, and of the rest the greater part is exhausted in paying the large indemnity imposed by the Russians after the campaign of 1873.

Population.—The inhabitants are partly sedentary and partly nomad. They include Uzbeks, Karakalpak, Turcomans, Sarts, Kizilbashes, and Amab—the first three of Mongol origin, the rest of Aryan descent. The Uzbeks come from a Turk stock, and constitute the dominant class. Some few live in towns, but the bulk reside on their farms, where they occupy themselves in agriculture, gardening, silk cultivation, and fishing. Very few engage in trade. They are divided into tribes. The Karakalpak, or "black-hat," are supposed to be a clan of Uzbeks. They inhabit the lower part of the Oxus, and are mostly stock-breeders; they are divided into tribes, and are nearly all nomadic. The Turcomans are of similar origin to the Uzbeks, and are divided into tribes, of which the chief are the Yomud, Karadashi, Goklen, Ersari, Chander, and Imrali. They are all engaged in breeding horses and stock and in agriculture. Some are sedentary, while others migrate to the steppe in summer. The Sarts or Tajiks, who were probably the original inhabitants of the country, live chiefly in the large towns and are engaged in trade or in handicrafts, some in agriculture and silk cultivation. The Kizilbashes are liberated Persian slaves, and are distributed over the khanate, but more particularly inhabit the Tashanz district. Of the Semitic race we find Arabs in small numbers at Shavak. They force the living monuments of the Arab conquest.

Owing to the absence of any census it is impossible to give more than a very rough estimate of the population of the Khivan oasis. Major Wood, a competent observer, estimated it in 1875 at 300,000 souls, of whom two-thirds are Uzbeks and Tajiks. Liberated Persians and other slaves make up 50,000, while the remainder is composed of sedentary Turcomans who occupy cultivated lands or who nomadize about the western borders of the khanate.

There is no marked division of the people into castes or classes. A Khivan may be a merchant, an agriculturist, or craftsman as he pleases; he may possess land or other real property, but for this privilege he must fulfil his obligation to the state, pay taxes, and furnish labourers for digging or repairing canals, upon which the life of the oasis may be said to depend. Only the military class, the priesthood, and the *khodjas* are exempt from the payment of taxes. The *khodjas* consider themselves descendants of the prophet; they pay no taxes and render no military services, nor do they furnish canal labour. They are derived from the same stock as the *khodjas* of Turkestan, and according to tradition came to Khiva six hundred years ago. Agriculture, trade, and handicrafts constitute their chief employment.

Towns.—Khivan towns are nothing more than agglomerations of houses without plan or regularity; the streets are so crooked and narrow that two carts can only pass with difficulty or not at all. The towns are usually surrounded by a defensive wall, in a more or less dilapidated state; sometimes there is also a wet ditch. Outside the walls stretches an extensive suburb. Each town contains usually a bazaar, a caravanserai, and one or more medresses (ecclesiastical colleges) and mosques. The population consists of government officials, shopkeepers, mechanics, and a very few agriculturists. There are no villages as we understand the term,—only farmsteads dotted at intervals along the banks of the canals. The security against Turcoman raids which is given to the townspeople by the wall and ditch is replaced in the case of the farming class by small round guard-houses (*karachi-khane*) constructed along the same canals where the farmsteads are placed.

The chief towns are Khiva (the present capital and residence of the khan), Khazraap, spoken of by the Arab geographers as a strong place in the 10th century, a reputation it still maintains, New Urgentch, the chief trading town; Tashanz, another strong place; Gurien, Hazavat, Illali, Kipchak, Khanka, Hodyali, Kungrad, Pitniak, Kunia Urgentch (once the capital, but destroyed first by Jenghiz Khan, and afterwards by Timur), and Kiat, which up to the 16th century was the capital of Kharezmi, but is now a place of little importance.

Climate.—The climate is quite continental, but is healthy, and the people are long-lived. The prevailing ailments are small-pox, inflammation of the eyes, and ague. Cholera is a rare visitant. Winter begins in November and lasts until February. At this season the thermometer sometimes falls to 20° Fahr., and the Oxus freezes to a depth of 6 to 12 inches. At the end of March the vines, pomegranate, and fig commence to bud, and in the first days of April are covered with green. Wheat harvesting commences early in July, about this time apricots and plums ripen. Leaves begin to grow yellow and fall in the first half of November. The west wind is distinguished by its violence, but it only rages in spring. At this season the north wind also blows strongly. When the wind is in these quarters dew is abundant. Severe storms and earthquakes are of rare occurrence; and, generally speaking, there is little rain, snow, or hail.

Products.—The chief agricultural products are wheat, jugara, rice, sesamum, millet, chigim (a variety of millet), barley, masha (a pulse), linseed, cotton, hemp, lucerne, tobacco, poppy, and madder. The gardens furnish the melon, cucumber, pumpkin, capsicum, garlic, onion, beet, radish, carrot, turnip, potato, and cabbage. Of fruits the mulberry, apple, pear, cherry, plum, date, peach, pomegranate, and grape are in abundance. Of trees we find in small quantities the poplar, black poplar, plane, elm, willow, karaman (a sort of elm), and narvan (a species of oak). *Saksaul* (*Holoxylon ammodendron*) is found in quantities, and furnishes excellent fuel. Shrubs of various kinds are indigenous, and the reed grass, in the absence of meadow-land, affords good fodder for cattle.

Khiva furnishes no metals, but sulphur and salt are present in sufficient quantities to satisfy home demands.

The domestic quadrupeds are camels, horses, asses, horned cattle, sheep, and goats. Of wild animals are found the hog, giraffe, panther, jackal, fox, wolf, and hare. The feathered tribe is represented by the wild goose, swan, crane, pelican, duck, moorhen, bustard, pheasant, quail, snipe, partridge, magpie, crow, sparrow, nightingale (in large numbers), and lark, besides domestic fowls and pigeons. The fish include sturgeon, sterlet, bream, pike, carp, and sandra.

Trade and Industry.—The trade of Khiva, in the Middle

Agree very considerable, has in the present day declined to insignificant proportions. At the epoch when Arab trade flourished, and in the time of Jenghiz Khan, Kharezm possessed important trade routes. Along these routes were dug deep stone-lined wells, and they were moreover dotted at intervals with caravanserais; so that, in the words of a historian of the 14th century, the traveller from Khiva to the Crimea need make no provision for his journey, for all that was needful could be procured from caravanserais on the way. In this latter half of the 19th century the trade is unimportant, and even the ruins of the caravanserais and wells are to be detected with difficulty. The merchants of New Urgentch, it is true, take their wares as far as the great Russian fair of Nijni-Novgorod on the west, to Bokhara on the east, and to Persia on the south, but the caravans are small and money is scarce. The chief articles of trade are horned cattle, camels, horses, sheep, cereals, khalas, silk and cotton cloth, clothing, gunpowder, arms, agricultural implements, two-wheeled carts, saddlery, harness, boats, wood, potash, salt, &c. These wares are sometimes bartered, sometimes sold for money. Dried fish is also an article of export for the Bokhara market. The cotton is of excellent quality, and the silk of Khazarep is renowned in Central Asia.

Of manufactures there are none in the true sense of the word. The Khivans weave in their hand-loom cotton and silk cloth sufficient to satisfy their home necessities. In handicraft they are specially clever as armourers, smiths, and founders. The fuel used is saksaul.

Currency.—The money of the country is the gold till, the silver tanga, and the copper pul. The till is worth 28 to 36 tangas, or from sixteen shillings to a pound, according to the exchange; while the tanga, value about sevenpence, is equivalent to about 55 to 50 puls. Russian, Persian, and Bokharian money are also in circulation.

KHIVA, a fortified city, capital of the Khanate of the same name, situated between two oases, derived from the Oxus, and in the midst of green fields, orchards, and high poplars. It lies in $41^{\circ} 25' 30''$ N. lat. and $60^{\circ} 25'$ E. long., about 400 miles east of Krasnovodsk on the Caspian, 350 miles north of Mashhad in Persia, and 700 miles north-north-west of Kandahar. The city is girt with two mud walls. The inner wall, which surrounds the main town, is built on a low eminence, and forms a tolerably regular parallelogram with four towers at the angles. The wall is about 24 feet high, and has a perimeter of some 2800 yards. Three gates lead into the inner town. The outer wall, 10 feet high, was built in 1843 to enclose a former suburb, and has an irregular perimeter of 7200 yards. Twelve gates pierce this outer wall. In the main or inner town are two palaces of mean appearance, seven mosques, twenty-two educational seminaries, a caravanserai, a covered bazaar of some one hundred and twenty shops, and two hundred and sixty other shops distributed over the place. The principal mosques are those erected in honour of the saints Polvan Ata and Said Bai. (v. c. c.)

KHOL, a town and district in the province of Azerbaijan, Persia, towards the extreme north-west frontier, between Lake Urumiyah and the river Aras. The town lies in $38^{\circ} 37'$ N. lat., $48^{\circ} 18'$ E. long., 77 miles north-west of Tabriz on the great trade route between the Euxine and Persia, and on the Kotura, a tributary of the Aras, crossed here by a seven-arched bridge. The fortifications, which are in a ruinous state, consist of an outer line of bastions, redans, glacis, ditch and covered way, and an inner high wall flanked with towers, the intervening space being occupied with gardens and mud hovels. But the central part forms one of the best laid out towns in Persia, cool streams and lines of willows running along its broad regular streets. Here are a few good buildings, including the

governor's palace, several mosques, a large brick bazaar second only to those of Shiraz, and a fine caravanserai. There is a large transit trade, and considerable local traffic across the Turkish border. Ophthalmia is very prevalent, about 10 per cent. of the inhabitants suffering from inflammation of the eyes. The chief manufactures are copper wares and worsted socks. Here the Turks under Selim I. gained a great victory over the Persians in 1514, but with such heavy losses to themselves that the battle was long after known as the "day of doom." In September 1881 Khol was visited by a series of violent earthquakes, the seismic waves running north-west and south-east in the direction of the main mountain ranges. The population numbers about 30,000, including many Armenians, who occupy a separate quarter. The district consists of an elevated plateau 80 miles by 10 to 15, highly cultivated by a skilful system of drainage and irrigation, producing a series of fertile oases laid out in meadows, gardens, and tillage, and yielding rich crops of wheat and barley, besides apples, pears, cherries, walnuts, chestnuts, and unvarnished mulberries.

KHOJEND, or *HOJAKHT*, chief town of the Khojend and Jizak district in the province of Sir Darya, in Russian Turkestan, is situated on the left bank of the Sir Darya or Jaxartes, 96 miles south-east from Tashkend, and on the direct road from Bokhara to Khokand. The Russian quarter lies between the river and the native town. Near the river is the old citadel, built on the top of an artificial square mound, about 100 feet high, which Mr Schuyler suspected to be a mere hollow wooden framework, only half filled in with earth. The bazaar of Khojend is very large in proportion to the size of the town. There is a wooden bridge over the Jaxartes, whose banks at this point are so high as to make the river useless to the town in the absence of pumping gear; so that when the little stream Khoja Bakargan dries up in summer, there is much suffering from want of water. The great heat intensifies the distress.

There is now no very great trade in Khojend. Formerly the entire commerce between the Khanates of Bokhara and Khokand passed through it, but since the Russian occupation much of that has been diverted. Silk worms are reared, and silk goods are manufactured in the town. A coarse sort of ware is made in imitation of the Chinese porcelain. Lignite is carried to Tashkend from the neighbourhood of Khojend. The surrounding district is tolerably well cultivated; immediately about the town the ground is taken up with cotton plantations and vineyards. The majority of the inhabitants are Tajiks. They are sociable and pleasure-loving, and the whole air of the town is agreeable. The population for 1873 is put down by Mr Schuyler at 30,000.

Khojend has always been a bone of contention between Khokand and Bokhara; and, although belonging from very ancient times to the former, it has often been seized by the latter. When the name of Bokhara assisted Khudayer Khan to regain his throne in 1864, he kept possession of Khojend. In 1865 it was stormed by the Russians; and during the war with Khokand in 1876 it played an important part.

KHOKAND, a city of Turkestan, was, previous to the Russian conquest, the capital of an independent khan, but, owing mainly to the fact that those who reside in it are subject to goitre, it has not been made the administrative centre of the Russian province (FARKHANA, q.v.). The town is situated on the skirts of the Kashgar Deran ridge, which separates Kashgar from Ferghana, and it is traversed by three mountain gullies which send their scanty waters to the Jaxartes. Dating only from the reign of Saur Khan, about the early part of the 18th century, Khokand has within the 10 miles circuit of its mud walls a greater amount of space to spare than is to be found in any other city of Central Asia; some of the market-places are of

great extent, and the bazaar is built on a more handsome scale than that even of Tashkend. The palace erected by the last khan is after the style of the palace at Samarkand, and rivals it in the rich colouring of its enamels and the general effect of its relief. The audience chamber now serves as a Russian church and the women's apartments are occupied by the Russian governor of the fortress. The mosques, according to native exaggeration, number 600, and there are fifteen colleges. The gardens, especially those of the palace, are conspicuous for their rich foliage. Silk weaving and papermaking are the chief industries. Coins bearing the inscription "Khokand the Charming," and known as khokands, have a wide currency. Population about 75,000.

See Schuyler's *Turkistan*, 1878; Khoroshkin's narrative translated in *Recueil d'ouvrages et de voyages dans l'Asie Centrale*, Paris, 1878; Ujfalvy, "L'Asie Centrale," in *Tour du Monde*, 1880.

KHONSAR, a town in the province of Irak-Adjemi, Persia, 92 miles north-west of Isfahan on the Hamadan route, in a gorge of the hills, which here approach so close that all the intervening space is occupied by the houses and their garden plots. The town straggles some 6 miles along the gorge, with a mean breadth of scarcely half a mile. There is good water from the hills, and a great profusion of fruits, the apples yielding a kind of cider, which does not keep. The climate is cool in summer but excessively cold in winter. Population 2600 families, or about 12,500 souls.

KHORAMABAD, a town and fortress of Persia, capital of the province of Luristan, in 33° 32' N. lat., 47° 43' E. long., 138 miles west-north-west of Isfahan, 117 south-east of Kirmanshabad. The fort is perched on an isolated steep rock in the middle of a difficult pass, and is 1000 yards in circuit. The modern town lies at the south-west foot of the fort in a narrow valley watered by the broad but shallow and rapid river Kaegan. A rich plain stretching thence southwards yields abundance of supplies. Population about 8000.

KHORASAN, *s.s.*, "land of the sun," a geographical term originally applied to the eastern quarter of the four, named from the cardinal points into which the ancient monarchy of the Sassanians was divided.¹ After the Arabic conquests the name was retained both as the designation of a definite province and in a looser sense. Under the new Persian empire the expression has gradually become restricted to the north-eastern portion of Persia proper, of which it now forms the largest province. The boundaries of this vast region have scarcely anywhere been accurately determined, and have constantly fluctuated, especially towards the north and east. Speaking generally, however, the province is continuous on the east with Afghanistan and Sistan, north with Astrabad and the recently organized Russian trans-Caspian territory, north-east with the Turkoman country, west with Masandaran and Irak-Adjemi, south with Farsistan and Kirman. It lies mainly within 33° 30'–38° 30' N. lat. and 53°–61° E. long., extending 500 miles north-west and south-east and 300 north and south, with total area of about 160,000 square miles, and a population estimated at from 800,000 to over 1,000,000.

The surface in the north, south-west, and partly in the east is distinctly mountainous to a far greater extent than is commonly supposed. The ranges generally run in two or more parallel ridges, enclosing extensive longitudinal valleys, and running in the normal direction from north-west to south-east. The whole of the north is occupied by an extensive highland system forming a continuation of the Hindu Kush and Paropamisus, and stretching from the

Herat valley between the Iranian plateau and the Turkestan depression north-west to the south-east corner of the Caspian. This system, for which there is no general name, but which is now sometimes spoken of collectively as the Kuren-Dagh or Kopet-Dagh, from its chief sections, forms in the east three ranges, the Hissar-Masjid, Binalud-Kuh, and Jagat, enclosing the Meshhed-Kuchan valley and the Jagat plain. The former is watered by the Kashafrud, or river of Meshhed, flowing east to the Hari-rud, their junction forming the Tajend, which sweeps round the Daman-i-Koh, or northern skirt of the outer range in the direction of the Caspian or Usbei (old bed of the Oxus), but now losing itself in the desert long before reaching them. The Jagat plain is watered by the Kal-Mura river, formed by the junction of the Kara-su and several other head streams, and flowing south-west to the Great Salt Desert. In the west the northern highlands also develop three branches, the Kuren-Dagh stretching through the Great and Little Balkans to the Caspian at Krasnovodsk Bay, the Ala-Dagh forming a continuation of the Binalud-Kuh and the Astrabad mountains merging south-westwards in the Elburz system. The Kuren and Ala Daghs enclose the valley of the Atrak, which flows mainly west to the Caspian at Hasan Kuli bay. The western offshoots of the Ala Daghs and the Astrabad mountains enclose in the same way the valley of the Gurgan, which also flows westwards to the south-east corner of the Caspian. The outer range has probably a mean altitude of 8000 feet, the highest known summits being the Hissar-Masjid (10,500 feet) and the Kara-Dagh (9800); it is crossed by the Maidan-Kuni and Allaho-Akbar (4200 feet) passes leading from Kuchan north to the Dargaz district. The central range seems to be still higher, culminating with the Shah Jahan Kuh (11,000 feet), the Kuh Ala Dagh (12,300), and Kuh Khorkhud (12,500). The southern ridges, although generally much lower, have the highest point of the whole system in the Shah-Kuh (13,000 feet) at the junction of the Astrabad and Elburz ranges.

Another system runs diagonally right across the province from Yazd in the south-west to the Hari-rud valley in the north-east, throwing off the Kuh Shorak, Kuh Shutari (10,000 feet), and Kuh Nostanji (8000 feet) in the Tabas district. Towards Sistan the country is also very mountainous, with several nearly parallel ridges stretching from near Tûn south-east to the Hamun lake or swamp.

Beyond the Atrak and others watering the northern valleys there are scarcely any rivers, and most of these are brackish and intermittent, losing themselves in the Dahti-Kavir or Great Salt Desert, which occupies the central and western parts of the province, and which is separated by the diagonal range from the more sandy and drier desert of Lut in the south. The true character of the kavir, which forms the distinctive feature of east Persia, has scarcely yet been determined, some regarding it as the bed of a dried-up sea, others as developed by the saline streams draining to it from the surrounding highlands. Collecting in the central depressions, which have a mean elevation of scarcely more than 500 feet above the Caspian, the water of these streams is supposed to form a saline efflorescence with a thin whitish crust beneath which the moisture is retained for a considerable time, thus producing those dangerous and almy quagmires which in winter are covered with brine, in summer with a thick incrustation of salt. "The waters of all springs and rivers contain salts in minute quantities, but the rivers of Persia are often so salt as to be undrinkable. The salts brought down by the rivers are deposited in the marsh, which thus gets saltier year by year. It dries up during the fierce summer heats, to become a marsh again when the winter floods occur. This process is repeated for ages, and in the course of time

¹ See Nikolsky's translation of Tabari, p. 155.

the whole soil over which the marsh extends becomes encrusted with salt."¹

The surface of Khorasan thus consists mainly of highlands, saline swampy deserts, and fertile well-watered upland valleys. Of the last, occurring mainly in the north, the chief are the longitudinal valley stretching from near the Herat frontier through Meshhed, Kuchan, and Shirvan to Bunjurd, and the Damages district, which lies on the northern skirt of the outer range projecting into the Akhal Tekke domain, now Russian territory. These fertile tracts produce rice and other cereals, some cotton, tobacco, saffron, and especially melons and other fruits in great profusion, 45 lb of splendid grapes being sold in Damages for ninepence. Other products are manna, gums, and great quantities of saffotida, which is not used by the natives but exported to India. The chief manufactures are the famous Khorasan sabres, firearms, stoneware, armour, fine carpets and rugs, velvets, woollens, cottons, and sheepskin pelisses.

The population is far from homogeneous, consisting of Iranians (Tajiks, Kurds, and Baluchis), Mongols, Tatars, and Arabs, as under:—

Race	District	Population.	Speech.
Tajiks (Persians),.....	Towns and agricultural districts.	400,000	Persian.
Kurds.....	N. frontier.	250,000	Persian mostly.
Baluchis.....	East frontier.	10,000	Baluchis.
Mongols. ^{Tasmuri} ^{Almak} ^{Kasab}	South and E. frontiers.	250,000	Persian.
Tatars... ^{Turkman} ^{Afshar} ^{Kajars, &c.}	North and W. mainly.	100,000	Turks and Persian.
Arabs.....	S.W. mainly.	100,000	Persian. ²
		1,180,000	

The Persians proper have always represented the settled, industrial, and trading elements, and to them the Kurds (removed to the north by Shah Ismail) and the Arabs have become largely assimilated. Even many of the Tatar nomad tribes, collectively called *Iliat*,³ have become *Shahr-nishin*, i.e., "townsfolk," or settled. But all the Baluchis are not only still *Shahr-nishin*, i.e., "country or desert folk," but have lately resumed their old predatory habits, covering incredible distances on their swift camels, and harassing the country as far west as the Yazd district. On the other hand the raids of the Turkoman marauders have almost entirely ceased since the reduction of the Akhal Tekke Turkomans by the Russians in the spring of 1881. In religion great uniformity prevails, all except the Baluchis and Turkomans having conformed to the national Shiah sect.

The administrative divisions of the provinces seem to be Damages, Kuchan, Turbich, Tabbas, Ghayn, Khaf, Meshhed, Nishapur, Shahrud, and Damagan. The chief towns are Meshhed, Kuchan, Mohammadabad, Shirvan, Bostan, Turbich, Tūn, Tabbas, Khaf, and Ghayn. (A. H. K.)

KHOSRU. See PERSIA.

¹ Colonel O. B. Stewart, in *Proc. Roy. Geog. Soc.*, September 1881. This traveller visited the north frontier of Persia in 1880-81, disguised as an Armenian horse-dealer from Calcutta.

² The *Kajars* are the royal tribe to which the present dynasty belongs; hence the reigning shah's title, *Nāṣir-ed-dīn Shāh Kājār*. But *Nāṣir Shāh*, though commonly called a *Kajār*, was an *Afshar*.

³ Some travellers have stated that the Khorasan Arabs still speak Arabic as well as Persian—a mistake due probably to the frequency with which they repeat passages from the Koran. The great bulk of them have long been "Persians" or "Persian-speaking."

⁴ That (plural of *Il*) simply means "tribes," and is applied indifferently to all the nomads of Persia, whatever their affinities may be.

KHOTAN, a city and district of eastern Turkestan, lying between the northern slopes of the Kunlun mountains and the eastern portion of the Gobi (Takla Makan) desert. The district is well watered by a number of rivers, the most important of which, the Karakash and the Khotan Daria, meet to the north of the city. Both soil and climate are excellent, and the vegetation is characterized at once by variety and luxuriance. Indian corn, barley, jowar, buckwheat, rice, alfalfa, pears, peaches, apricots, mulberries, grapes, currants, melons, the chams plant, the cotton plant, are all produced in abundance. Willows, poplars, and tamarisks are the ordinary trees; in some parts they form extensive forests. Of the mineral wealth of the country glowing accounts are given,—gold, copper, iron, antimony, salt, sulphur, coal, jade, and a variety of precious stones being the principal items. Upwards of twenty gold mines are known to exist, and those of Sorghak and Kappa are worked by 4000 and 3000 men respectively. Jade is obtained, more especially in the Karakash district. Among the wild animals are goats, wolves, jackals, foxes, and hares; and the Khotanese keep camels, horses, mules, asses, goats, sheep, geese, ducks, and fowls (the goats and the fowls being particularly numerous). The total number of the inhabitants is variously estimated at from 180,000 to 250,000, and the country is capable of maintaining a much denser population. Females preponderate to as much as 25 per cent. There are six districts, each with a town of its name—Khotan or Ilchi (42,000), Karakash (7000), Yurung Kush (7000), Tschira (28,000), Kiria (28,000), and Naya (3500). The city of Khotan (in Chinese Hu-tan, locally Ilchi) is situated 150 miles south-east of Yarkand and 90 miles due east of Senju, and is only 6 miles distant from the borders of the desert. It has long been celebrated as a great industrial centre, silks, furs, rich carpets (of either silk or wool), paper, and articles in jade being the chief productions; and its traders maintain an active traffic with Tibet.

As early as the 1st century the town contained (according to Chinese authorities) 8800 families. Once, as he calls it, was one of the places visited by Marco Polo. In modern times the first European who reached the city was Mr Johnson in 1895. At that time it was governed by a local Khan, the Chinese having been expelled by their Mohammedan subjects, in 1868, and since then it has been subjugated by Yakub Khan of Kanbar (who perpetrated a terrible massacre at his capture of the place), and again recovered by the Chinese forces.

See Johnson, *J. H. G.* B, 1897, Sir T. D. Forsyth, *Mission to Yarkand*, Calcutta, 1876.

KHOTIN, or KHOTEN (this is the Russian form of the name, which appears in a great variety of disguises—partly dialectal—such as Khotchim, Chotchim, Chocchim, and Chocim), a fortified town of 21,000 inhabitants, in the government of Bessarabia, Russia, situated in 48° 30' N. lat. and 26° 30' E. long., on the right bank of the Dniester, near the Austrian (Galician) frontier, and opposite Podolian Kamenetz. Though it possesses a few manufactures and carries on a considerable trade both legitimate and contraband, Khotin has all through its history been of importance mainly as a military post. In the Middle Ages it was the seat of a Genoese colony; and it has passed through periods of Polish, Turkish, and Austrian possession. The chief facts in its annals as a fortress are the defeat of the Turks in 1621 by Ladislav IV., in 1678 by John Sobieski, and in 1739 by the Russians under Münnich; the defeat of the Russians by the Turks in 1768; the capture by the Russians in 1789; and the occupation by the Russians in 1806. It finally passed to Russia along with Bessarabia in 1812 by the peace of Bucharest.

KHULNA, or KUTNA, a town in Jessor district, Bengal, India, situated at the point where the Bhairav river debouches on the Sundarban delta, in 22° 49' N. lat., 89° 57' E. long., may be described as the capital of the Sundar-

bans, and for the last hundred years at least has been a place of considerable importance. It was the headquarters of the salt department under the East Indian Company. The whole boat traffic from the east and north-east passes here on its way to Calcutta; from Calcutta the principal cargo is Liverpool salt, the trade in which is very considerable. There are numerous sugar refineries.

KHURJA, an important trading town and station on the East Indian Railway in Bhandasahar district, North-Western Provinces, India, 28° 16' N. lat., 77° 54' E. long. The population in 1872 was 28,858—15,843 Hindus and 11,315 Mohammedans. A large business in raw cotton is carried on, of which about 70,000 cwts. are annually exported to Cawnpur, Mirzapur, and Calcutta, eight cotton presses are at work in the town. There is a local trade in cotton, safflower, indigo, sugar, molasses, gram, rice, and *ghat*.

KHUSHAB, or **KOSHAB**, a town in Shahpur district, Punjab, India, situated on the river Jhelum, 32° 18' N. lat., 72° 24' E. long.; population (1868) 8509. A flourishing trade is carried on with Mooltan, Sakkar, Afghanistan, and the Derajat. The exports consist of grain, cotton, wool, *ghat*, and country cloth; and the imports of English piece goods, metal, dried fruits, sugar, and molasses. It is the chief mart for the trade of the Salt Range. Coarse cloth and cotton scarfs are manufactured; there are six hundred weaving establishments.

KHUZISTAN, a province of West Persia, bounded N. and N.E. by Luristan, S.E. by Fars, S. by the Persian Gulf, W. by Turkey, lies mainly within 30°–38° N. lat. and 47°–51° E. long., stretching about 200 miles north and south, with a mean breadth of 80 to 100 miles, and an area of 25,677 square miles. In the south is the rich alluvial lowland tract of Arabistan, "the most extensive and fertile plain in Persia." Elsewhere the surface is very mountainous, being traversed by the lofty Bakhtiari ranges, which form a south-eastern continuation of the Pusht-i-Koh highlands, and which preserve a remarkable parallelism throughout their entire length, while increasing in elevation from 8000 to 16,000 feet as they advance inland to the Kuh-Dinâr. They are broken by several deep and romantic gorges, through which the Karkah, Karûn, Jarahi, and Tab rivers escape to the Euphrates delta or to the coast, watering several fertile upland valleys on their winding course seawards. The climate on the coast is excessively hot, and in some low-lying swampy districts very unhealthy; in the highlands severe winters and hot summers are followed by genial springs and autumns; the prevailing winds are north-west and south-east, the latter bearing much moisture from the Indian Ocean. The lowlands take the name of Arabistan from the Arabs, who form the bulk of their population. Many of the Kâ'b Arabs have been assimilated in speech and religion to the Persians; but most of the great Beni-Lâm nation, comprising in Khuzistan and Baghdad 17 branches, 85 septs, and 30,000 families, are still in the nomad state. The highlands are mainly occupied by the Feilî, Bakhtiari, Kohgeln, Mamasseni, and other Luri tribes of Kurd stock and speech, also nomads and addicted to brigandage. The staples of food are dates and fish in the south, elsewhere the produce of the herds and flocks. The chief products are rice, tobacco, cotton, indigo, silk, maize, barley; the trade is mainly with Baghdad and Bussorah. The manufactures include coarse woollens, cottons, tents, red cloth. Dyeing is extensively carried on in Dîfâlî, which, besides Shaster and Mohammrah, is the only place worthy the name of town.

Khuzistan is the Biblical **CHUS** (q.v.), the classical **Susiana**. The name appears in the great inscription of Darius as **Uvva**, corresponding to the Uti of classical writers. The translation to the modern Khuz, Khuzistan, appears in the name Beth Khuzâyâ, used by Syriac writers of the Sassanian period.

KHYRPOOR. See **KHAIRPUR**.

KIACHTA, or **KIAKHTA**, a mercantile town of Siberia, and one of the chief centres of trade between Russia and China, is situated upon the Kiachta, an affluent of the Selenga, and on an elevated and barren expanse of country surrounded by mountains, in the Russian government of Transbaikal, about 380 miles south-west of the capital Tchita, and close to the Chinese frontier, in 50° 20' N. lat., 106° 40' E. long. Besides the lower town or Kiachta proper, the municipal jurisdiction comprises the fortified upper town of Troitskosavsk, about 2 miles to the north, and the settlement of Ust-Kiachta, 10 miles further distant. The upper town, which is substantially built, contains the public offices, barracks, a stone church, and many large warehouses, &c., and is the headquarters of the commandant of the Transbaikal Cossacks. The lower town, lying directly opposite to the Chinese emporium of Maimachin, consists of several stores and about a hundred houses inhabited mostly by merchants. Prior to 1727 the trade of Kiachta was a Government monopoly, but from that year it was open to private merchants, and continued to improve until 1860, when the right of commercial intercourse was extended along the whole Russian Chinese frontier in conformity with the treaty of Peking. The annual December fairs for which Kiachta was formerly famous, and which were resorted to by merchants from a great distance, and also the regular commercial traffic passing through the town, have considerably fallen off since that date. The Russians exchange here leather, sheep-skins, furs, horns, woollen cloths, coarse linens, and cattle for teas, porcelain, rhubarb, manufactured silks, nankeens, and other Chinese produce. In 1873 the population, including Ust-Kiachta, was 9050.

KIDDERMINSTER, a market-town and municipal and parliamentary borough of Worcestershire, England, is situated in the north-west corner of the county, on the Stour, near its junction with the Severn, on the Staffordshire and Worcestershire canal, and on the West Midland branch of the Great Western Railway, 14 miles north from Worcester and 18 miles south-west from Birmingham. The streets are rather irregular, and the houses for the most part small and mean in appearance, but of late years great improvements have been made by the paving and widening of the streets and the construction of shops and houses of a better class. A new system of drainage has also been completed, and the town is now well supplied with water. Besides the churches, the principal buildings of Kidderminster are the corporation buildings, the infirmary, the town hall in the Renaissance style, erected in 1876, the masonic hall and club, and the buildings of the school of art. The parish church of St Mary, a fine old structure in the Perpendicular style, containing several ancient monuments, was lately extensively repaired. The town is adorned by a statue erected in 1875 to Richard Baxter, who was for some time minister in Kidderminster, and another to Sir Rowland Hill, completed in 1881, and by a beautiful drinking fountain. There is a free grammar school founded in 1637, besides board schools and others connected with some of the churches. A new cemetery for the town was opened in 1878. At an early period Kidderminster had a large manufacture of broad-cloths, but it is now chiefly celebrated for its carpets (see **CARPETS**, vol. v. p. 129), the manufacture of which was introduced about the year 1735. At first Scotch carpets were the only variety made, but in 1745 the manufacture of Wilton and Brussels carpets was commenced, and since that period the carpets manufactured at Kidderminster, on account of the permanency of their colour, due it is supposed to peculiar properties of the water of the Stour, have retained an exceptional reputation. Worst spinning

and dyeing are also carried on extensively, and there are iron foundries, tinplate works, breweries, malchouses, tanneries, flour-mills, and a paper-mill. The population of the municipal borough in 1871 was 19,473, and that of the parliamentary borough 20,814; in 1881 the corresponding numbers were 24,370 and 25,634.

The ancient name of Kidderminster was Chudermister, that is, the minister or church on the brow of the hill. From the time of the Conquest until the time of Henry II. it was a royal manor. Among the private owners who subsequently held possession of it was the poet Waller. Kidderminster returned a member to parliament in the reign of Edward I., but the privilege was subsequently lost. In the 12th year of Charles I. it received a charter of incorporation, and by the Reform Act of 1832 it again obtained the privilege of returning a member to parliament. It is now governed according to the Municipal Act of 1885.

KIDNAPPING is defined by Blackstone as the forcible abduction or stealing away of a man, woman, or child from their own country and sending them into another. The term is, however, more commonly applied to the offence of taking away children from the possession of their parents. By 24 and 25 Vict. c. 100, "whosoever shall unlawfully, by force or fraud, lead or take away or decoy or entice away or detain any child under the age of fourteen years with intent to deprive any parent, guardian, or other person having the lawful care or charge of such child of the possession of such child, or with intent to steal any article upon or about the person of such child, to whomsoever such article may belong, and whosoever shall with any such intent receive or harbour any such child, &c." shall be guilty of felony. The abduction or unlawfully taking away an unmarried girl under the age of sixteen years out of the possession and against the will of her father or mother, or any other person having the lawful care or charge of her, is a misdemeanour under the same Act. The term is used in much the same sense in the laws of the United States. Bishop states the more correct acceptance of the word to be false imprisonment aggravated by the intent to carry the person away to another place, but not necessarily to another country.

KIEFF, KYIEFF, or KIEV, a south-western government of European Russia, continuous with those of Minsk, Poltava, Tchernigoff, Podolia, Kherson, and Volhynia. The area is estimated at 31,664 square miles. In the north we find a low-lying district characterized by marsh and woodland, in the east a series of hills keeps company with the Dnieper; and in the west are several outliers from the Carpathian system. The central region is a kind of steppe. It is only in a very few places that the altitude exceeds 900 feet. Granite with underlying gneiss is the prevailing rock in the west and south-west of the government; in the east there are various Eocene formations. Iron-ore, fire-clay, sandstone, and lignite are among the useful minerals. Towards the southern and the central parts the surface is covered by a deep rich "black earth." Nearly the whole of the government belongs to the basin of the Dnieper, that river forming part of its eastern boundary. In the south-west are a few small tributaries of the Bug. Besides the Dnieper the only navigable stream is its affluent the Pripyat, but two or three of the rest are available for rafts. About a fourth of the surface is occupied by woods, very unequally distributed throughout the territory. Rye is the commonest of the cereals; and next follow oats and wheat. In the growing of beetroots the government is the first in Russia, and its factories for the production of beetroot sugar are the largest in the empire. The whole industrial activity of the district has rapidly developed since about the middle of the century: in 1879 there were 602 establishments, with 35,306 workmen, and a production worth £10,000,000. In the 75 sugar factories large numbers of Tartars from Tamboff and Penza find employment; and next in importance are the flour-mills, leather works, and

tobacco factories. The population of the government has increased from 2,017,262 in 1862 to 2,256,000 in 1875. Little Russians form 80 per cent. of the aggregate; Jews, 13 per cent.; Poles, 4 per cent.; White Russians, 2½ per cent.; and there are a few thousand Great Russians. There are twelve districts.—Radomisl, Kieff, Kaneff, Tcherkassui, Tseligrin, Vasilkoff, Berditcheff, Lipovets, Skvira, Tarashtcha, Uman, Zvenigorodka. Besides the government town the following have upwards of 5000 inhabitants:—Berditcheff, 52,560; Vasilkoff, 16,597; Uman, 15,393; Tcherkassui, 13,914; Tarashtcha, 11,420; Zvenigorodka, 11,375; Skvira, 10,081; Tseligrin, 9677; Kaneff, 7418; Lipovets, 6710; Radomisl, 5906, to which may be added the large Jewish village of Zlatopol, 10,000. The exarchate or diocese of Kieff and Galitch is the oldest in Russia, and comprises 1421 churches, 12 cathedrals, and 30 monasteries.

In 1708 a Kieff government was founded which included the whole eastern Ukraine and an extensive region in Central Russia containing thirty-two towns—Orel, Kursk, &c. The Kieff boat-building, founded in 1782, consisted of parts of the present governments of Kieff, Poltava, and Tchernigoff. In 1796 the present government was practically constituted, though several alligations in regard to the district towns have since taken place.

KIEFF, capital of the above province, the "mother city" and Canterbury of Russia, is situated on the right or western bank of the Dnieper, in 50° 26' N. lat. and 30° 37' E. long., 800 miles from St Petersburg, and 566 miles from Moscow on the highway between Moscow and Odessa. By railway it is connected on the one hand with Kursk and on the other hand with Odessa. The site of the greater part of the town consists of a succession of hills or bluffs separated from each other by ravines and hollows, the elevation of the central portions being from 380 to 385 feet above the ordinary level of the Dnieper. On the opposite side of the river the country spreads out low and level like a sea. Having by this time received all its important tributaries, the Dnieper is a large and navigable stream; but as it approaches the town it breaks up into two currents and forms a low grassy island of considerable extent called Takhonoff. During the spring floods there is a rise of 16 or even 20 feet, and not only the whole island but the country along the left bank and the lower grounds on the right bank are laid under water. The bed of the river is sandy and shifting, and it is only by costly engineering works that the main stream has been kept from returning to the more eastern channel which it formerly occupied. Opposite the southern part of the town, where the currents have again united, the river is crossed by a wrought-iron bar-chain suspension bridge, which at the time of its erection (1851) was the largest enterprise of the kind in Europe. It is about half a mile in length and 52½ feet in breadth, and the four principal spans are each 440 feet. The bridge was designed by Mr Vignole, and the whole of the iron (3500 tons) employed in the construction was prepared in England. The cost was about £400,000.¹

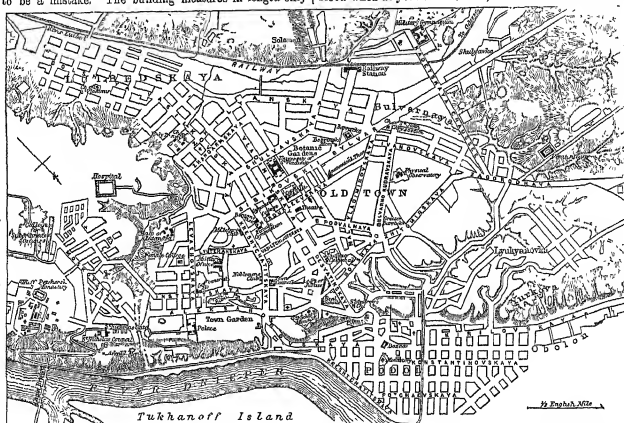
Owing to the natural character of the site, Kieff is broken up into several distinct portions; and from no point is it possible to get a view of the city as a whole. Up to 1837 the town proper consisted of the Old Town, Petcherak, and Podol; but in that year three districts were added, and in 1879 the limits were extended so as to include Kurenneva, Lukyanovka, Shulyavka, and Solomenka, and the whole was divided into eight districts. The administrative area of the town, as thus defined, is about 12,404 acres, or 18 square miles; but these figures give a very exaggerated notion of the place, as there are extensive suburbs and large intervals of unoccupied ground. Wood is still the most

¹ Views of the bridge will be found in *Official Catalogue of the Great Exhibition, 1851*, vol. i. p. 321.

usual building material; no less than 64·68 per cent. of the houses existing in 1874 were of wood alone, and 14·75 per cent. of wood and stone. The number of clay huts is no less than 857 per cent.

The Old Town or Old Kieff quarter (Starokievskaya Tchast) occupies the highest of the range of hills. It is here that the houses are the most closely built, and that stone structures are most abundant. In some of the principal streets—as Vladimir's, Vasilchukoff's—buildings of three to five stories, a comparatively rare thing in Russia, have been erected. In the 11th century the area was enclosed by earthen ramparts, with bastions and gateways, but of these the only remnant is the so-called Golden Gate. In the centre of the Old Town stands the cathedral of St Sophia, the oldest cathedral in the Russian empire. The statement frequently repeated that it was a copy of St Sophia's in Constantinople has been shown by Zakievsky to be a mistake. The building measures in length only

118 feet, while its breadth is 173 feet. But if the plan shows no imitation of the great Byzantine church, the decorations of the interior (pictures, mosaics, &c.) indicate direct Byzantine influences. During the occupation of the church by the Usmans in the 17th century these were covered with a coating of whitewash, and a thorough-going restoration was rendered a matter of necessity; but the chapel of the Three Fontfais has been left untouched to show how carefully the old style has been preserved or copied. Among the mosaics is a colossal representation of the Virgin, 15 feet in height, which, like the so-called "indestructible wall" in which it is inlaid, dates from the time of Yaroslav. It was this prince who founded the church in 1037 in gratitude for his victory over the Petchenegs. His sarcophagus, curiously sculptured with palms, fishes, &c., is still preserved. The church of St Andrew occupies the spot where, according to Russian tradition, the apostle stood when at yet Kieff was not, and declared that the hill



Plan of Kieff.

would become the site of a great city. The present building dates only from 1744-1767. The church of the Tithes, restored in 1842, was originally founded in the close of the 16th century by Vladimir in honour of two martyrs whom he had put to death; and the monastery of St Michael (or of the Golden Heads—so called from the fifteen gilded cupolas of the original church) claims to have been built in 1108 by Svyatopolk II, and restored in 1655 by Bogdan Khmelnitzki.

Up to 1820 the south-eastern district of Petchersk was the industrial and commercial quarter, but it has been greatly altered in carrying out fortifications commenced in that year by Nicholas I. Most of the houses are small and old-fashioned. The monastery—the Kievo-Petcherskaya—is the chief establishment of its kind in Russia; it is visited every year by about 350,000 pilgrims. From the books of the conventual inns it is shown that shelter is given to 150,000 persons per annum; and the numbers for

whom there is no accommodation is often very great,—72,000, for example, were counted lying under the open sky on the night of 15th August 1872. Of the ten or twelve conventual churches the chief is that of the Assumption. There are four distinct quarters in the monastery, each under a superior, subject to the archimandrite: the Laura proper or New Monastery, that of the Infirmary, and those of the Nearer and the Further Caves. These caves or catacombs are the most striking characteristic of the place, the name Petchersk, indeed, is connected with the Russian *pechtchera*, a cave. The first series of these caves, dedicated to St Antony, contains about eighty saints' tombs; the second, dedicated to St Theodosius, about forty-five. The bodies were formally exposed to view; but the pilgrims who now pass through the gloomy galleries, candle in hand, see nothing but the dimples and the inscriptions. Among the more notable names are those of Nestor the chronicler, and Ilia of Murem, the Old

Cossack of the Russian epica. The foundation of the monastery is ascribed to two saints of the 11th century—Anthony of Lymbeth, and Hilarion, metropolitan of Kieff. By the middle of the 12th century it had become wealthy and beautiful, but, completely ruined by Batu in 1240, it remained deserted for more than two centuries. Prince Simeon Obolikhov was the first to start the restoration. A conflagration laid the buildings waste in 1716, and their present aspect is largely due to Peter I. The monastery contains a school of picture-makers of ancient origin, whose productions are widely diffused throughout the empire, and a printing press from which have issued a variety of liturgical and religious works, the oldest known examples bearing the date 1616.

The Podol quarter, as the name indicates, lies on the low ground at the foot of the bluffs. It is the industrial and trading quarter of the town, and the seat of the great fair of the "Contracts," the transference of which from Dnbro in 1797 largely stimulated the commercial prosperity of the city. The present regular arrangement of its streets arose after the great fire of 1811. Lepki district (from the lepki or lime tree, destroyed in 1833) is of recent origin, and is mainly inhabited by the well-to-do classes. It is sometimes called the palace quarter, from the royal palace erected between 1668 and 1670, on the site of the older structure dating from the time of Elisabeth. Gardens and parks abound; the palace garden is exceptionally fine, and in the same neighbourhood are the public gardens with the place of amusement known as the Chateau de Fleurs.

In the New Buildings, or the Luibard quarter, are the university and the botanical gardens. The Ploskaya Tohsat (Flat quarter) or Obolon contains the lunatic asylum; the Lukyanovka Tohsat, the penitentiary and the camp and barracks; and the Bulvannaya Tohsat, the military gymnasium of St Vladimir and the railway station.

Kieff is the seat of the governor-general of the three provinces of Kieff, Podolia, and Volhynia, and as such possesses a large number of administrative institutions. In 1862 it was made the headquarters of a great military district including the same provinces. As a centre of intellectual activity it ranks among the principal cities of Russia. The university of St Vladimir, transferred from Vilna after the Polish insurrection of 1831, possessed 94 professors in 1878, and was attended by 771 students, and the library contained 150,000 volumes. The theological academy and theological seminary are large institutions; and the ordinary educational establishments include three male and four female gymnasiums. A daily paper, founded in 1864, and nine other periodicals are published in the town. Of the learned societies the more important are the medical (1849), the naturalists' (1869), the juridical (1876), the historical of Nestor the chronicler (1872), the horticultural (1876), and the dramatical (1879), the archaeological commission (1848), and the society of church archaeology. There are three considerable theatres.

In 1862 the population of Kieff was returned as 70,841; of this number 8607 were Roman Catholics, 1411 Jews, and 976 Protestants. In 1874 the total was given as 127,951—77.45 per cent. being members of the Greek Church, 10.85 per cent. Jews, 8.18 per cent. Catholics, and 2.45 per cent. Protestants. The clergy—regular and secular—amounted to no less than 8506. Russian and its dialects were spoken by four-fifths of the inhabitants. For 1881 the total population is estimated at 125,000.

The history of Kieff cannot be satisfactorily severed from that of Russia. According to Nestor's well-known legend it was founded in 884 by three brothers Ke, Shchek, and Khoriff. It was in the waters of the Dnieper opposite the town that Vladimir, the first saint of the Russian Church, caused his people to be baptised; and Kieff became the seat of the first Christian church, of the first Christian school, and of the first library in Russia. For three hundred and seventy-six years it was an independent Russian city; for eighty years it was subject to the Tatars; for two hundred and forty-nine years it belonged to the Lithuanian principality, and for ninety-eight years to Poland. It was finally united to the Russian empire in 1569. In 1822 the headquarters of the first army corps, with all the departments of the general staff, were transferred to Kieff from Mogileff. The Magdeburg rights, which the city had previously enjoyed, were abolished in 1836, and the ordinary form of town government introduced; and in 1840 it was made subject to the common civil law of the empire.

A long list of works relating to Kieff will be found in Schemnitz, *Stav. Ross. Imp.* Of more recent publication are the following:—Rambaud's *Revue de l'Europe*, Paris, 1876; Arsenius, *Kieff ou Kieffskiaïa*, St Petersburg, 1876; dealing with the early Kieff heroes, Zakrevski, *Opiyatno Kieff*, 1880; the materials issued by the temporary commission for the investigation of the ancient records of the city; Tarasovskii, *Gorod Kieff*, Kieff, 1881. See also Rambaud in *Revue de l'Europe*, 1876. The standard epological map of the government is Theophilaktov's (see *Ann. Soc. imp. de Nat. de Moscou*, 1875).

KIEFF, the chief town of the province of Schleswig-Holstein in Prussia, is picturesquely situated at the southern end of the Kieler Föhrde, about 66 miles north-east of Hamburg by rail. It consists of a somewhat cramped old town and a better built and more spacious newer part, increased since 1839 by the inclusion of Brunswiek and Düsternbrook. In the old town stands the palace, built in the 13th century, and enlarged by Catherine II. of Russia in the 18th; it contains the university library of 160,000 volumes, and a small collection of casts of antique sculpture and of Thorwaldsen's works. Other interesting buildings are the church of St Nicholas, dating from 1240, with a lofty tower; the old town-house; the prison and court-house; the observatory; the theatre; the Government naval offices; and the Thaulow museum, opened in 1877. The university, founded in 1665 by Christian Albert, duke of Schleswig, and named after him Christiana Albertina, had in 1881 a teaching-staff of 69, with 380 students. The new university buildings were completed in 1876. A naval academy was opened in 1875. Among the public charities there are three hospitals, a blind asylum, an orphanage, an idiot asylum, and a large institution for poor citizens and their widows. Kiel is the most important naval harbour of Germany, and the station of the German Baltic fleet; the port and its approaches are very strongly fortified. The land defences, not yet completed, are to consist of eleven forts, completely encircling the town. The imperial dockyards on the east side of the haven include two large basins (one 235 yards square, the other 271 yards by 285 yards), connected by a canal 70 yards long, four dry docks (each 100 to 120 yards long by 24 or 25 yards wide), and a wet dock. Near them are the yards of a large shipbuilding company. The excellence and safety of Kiel harbour, which only drawback is that it is frozen in winter, have made the town one of the principal ports of the Baltic. It carries on a very active trade with the Danish islands as well as with the Continent. The chief imports are grain, coal, timber, and cattle; the chief exports, timber, coal, fish, and agricultural produce. Iron-founding and the manufacture of machinery, wooden ware, carpets, tobacco, and oil form the leading industries after the shipping trade. In 1879 there entered at Kiel 3074 ships, representing 279,099 tons; 3021 cleared, representing 275,600 tons. Near the town are large steam corn-mills. Kieff possesses a sea-bathing establishment, and is surrounded by fine scenery. The population in 1875, including the garrison, was 37,246.

The name of Kieff appears as early as the 10th century in the form *Kyl*. Kieff is mentioned as a city in the next century; in 1242 it received the *Libeck* rights. In the 14th century it acquired other privileges, and in 1368 entered the Hanseatic league. It suffered much from neighbouring barons; and in the wars in which Schleswig was involved Kieff had its share of siege and capture. In recent times the name of Kieff has been associated with the peace concluded in 1814 between Great Britain and Denmark, and Sweden and Denmark, by which Norway was ceded to Sweden.

KIELOE, the chief town of a government in Russian Poland, is situated about 50 miles north-east of Cracow, in the mountainous district of the Lysa Gora. The copper-mines which were in the 16th century the main support of the place are no longer worked; but it has iron-works and sugar factories of considerable importance. The principal buildings are the cathedral, the bishop's palace, and a nunnery in which is an ancient statue of St Barbara fashioned out of a single piece of galena. In 1873 the population was 7338. Bishop Gadow of Cracow is said to have founded Kielce in 1173.

KIERKEGAARD, SÖREN (1813-1855), the greatest philosophical writer that Scandinavia has produced, was born at Copenhagen, May 5, 1813, and was the seventh child of a respectable Jutland hosiery. He was a very serious and precocious boy, weak in health, morbid in character. Of his mother, singularly enough, he has said no word in his copious autobiographical remains, although he was in his twenty-second year when she died; she had been his father's servant. Kierkegaard became a student at the university of Copenhagen, and took up theology as a profession, but never became a priest. He lived in great retirement, deeply oppressed with melancholy and physical suffering, and was at first very little known to his contemporaries. In 1838 he published his first volume, *Papers of a Still Living Man*, a very poor attempt to characterize Hans Andersen. Two years later he took his degree, with a treatise *On Irony*, which contains the germs of his later speculations. In 1840 he engaged himself to a young lady, and shortly after broke off the engagement, an extraordinary step for which he has given many extraordinary reasons. It was not until 1842 that he began the composition of his greatest work, *Either—Eller* ("Either—Or"), on which his reputation mainly rests; this appeared in 1843, and was immediately followed by a rapid succession of philosophical works, which formed at once an epoch in the history of Danish literature. From 1849 to 1854, however, he was silent as an author. In the last-mentioned year he published a polemical tract against Bishop Martensen, and the short remainder of his life was spent in a feverish agitation against the theology and practice of the state church. But his health, which had always been miserable, was growing worse and worse. In October 1855 he took up his abode in one of the chief hospitals of Copenhagen, where he died, on the 11th of November, at the age of forty-two. His life has been written, with great skill and brilliance, by Dr Georg Brandes (1877). Kierkegaard published about thirty distinct books during his life-time, and left at his death about an equal amount of MS.; a competent analysis of these multifarious labours is given in Brandes's admirable biography.

KILDARE, an inland county of Ireland, in the province of Leinster, is situated between 52° 61' and 53° 28' N. lat. and between 6° 28' and 7° 11' W. long., and is bounded on the W. by Queen's county and King's county, N. by Meath, E. by Dublin and Wicklow, and S. by Carlow. The area is 418,497 acres, or 654 square miles.

Geology.—The greater part of Kildare belongs to the carboniferous plain which occupies the central portion of Ireland. In the east of the county this plain is bounded by elevations belonging to the clay slate formations bordering on the granite mountains of Dublin and Wicklow; in the south it is encroached upon by the granite formations of Carlow; and in the centre it is interrupted by an elevated plateau terminated on the south by the hills of Dunmurry, consisting chiefly of grauwacke and clay slates, and on the north by the Hill of Allen, a conical rock of porphyry and greenstone, which rises abruptly from the Bog of Allen to the height of 300 feet. Marble of very fine quality is obtained in the quarries to the west of the town of Kildare, and copper ore is said to have been found in the hills of Dunmurry.

Rivers.—The principal rivers are the Boyne, which with its tributary the Blackwater rises in the north part of the county, but soon passes into Meath; the Barrow, which forms the boundary of Kildare with Queen's county, and receives the Greese and the Lane shortly after entering Kildare; the Lesser Barrow, which flows southward from the Bog of Allen to near Rathangan; and the Liffey, which enters the county near Ballymore Eustace, and flowing north-west and then north-east quits it at Leixlip, having

received the Morrel between Celbridge and Clane, and the Ryewater at Leixlip. The northern border of the county is traversed by the Royal Canal, which connects Dublin with the Shannon at Clondara. Further south the Grand Canal, which connects Dublin with the Shannon at Shannon Harbour, occupies the valley of the Liffey until at Salinas it enters the Bog of Allen, passing into King's county near the sources of the river Boyne. Several branch canals connected with it afford communication with the southern districts of the county.

Climate and Agriculture.—Owing in a considerable degree to the large extent of bog, the climate of the northern districts is very moist, and fogs are frequent, but the eastern portion is drier, and the climate of the Liffey valley is very mild and salubrious. The soil, whether resting on the limestones or on the clay slate, is principally a rich deep loam inclining occasionally to clay, easily cultivated and very fertile if properly drained, which too often is not the case. About 40,000 acres in the northern part of the county are included in the Bog of Allen, which is, however, intersected in many places by elevated tracts of firm ground. To the south of the town of Kildare is the Curragh, an undulating down of about 8000 acres in extent, and presenting to the eye a beautiful sward of vivid green unbroken by a single tree or shrub. The common is the property of the crown, and is occupied as a sheep walk, while a portion of it forms the principal race-course of Ireland. It is now also the headquarters of a military division. The most fertile and highly cultivated districts of Kildare are the valleys of the Liffey and a tract in the south watered by the Greese. The demesne lands along the valley of the Liffey are finely wooded. More attention is paid to drainage and the use of manures on the larger farms than is done in many other parts of Ireland, but the small farms are mostly cultivated in the usual slovenly manner. The pastures which are not subjected to the plough are generally very rich and fattening.

The following table gives a classification of holdings according to size in 1850 and 1880, as contained in the agricultural returns:—

	1 Acre.	1 and under 5	5 and under 15	15 and under 30	30 and upwards.	Total.
1850	1,990	2,318	2,740	2,480	2,824	10,350
1880	1,414	1,764	1,682	1,106	2,941	8,907

The total area under crop in 1881 was 120,868 acres, or 29 per cent. of the whole acreage of the county. In 1880 239,409 acres, a percentage of 57·2, were under grass, 360 acres lay fallow, 7992 were woods, 37,540 bog and marsh, 288 barren mountain land, and 15,404 water, roads, and fences. The area under crop in 1850 was 147,607 acres, the diminution in 1881 being more than accounted for by a fall of 34,822 in the area under cereals. On the other hand, the area under grass increased between 1850 and 1881 by 47,169 acres. Between 1850 and 1881 the area under wheat, for which the rich deep soil in the valley of the Liffey is well suited, declined from 25,787 to 4130, and that under oats from 45,791 to 28,761, or nearly one-half, while the area under barley was nearly doubled, being 13,888 in 1881. The area under potatoes declined from 12,186 acres in 1850 to 9348 acres in 1881, and, notwithstanding a large increase in pasturage and in the number of cattle, the area under turnips only increased from 9022 to 11,501.

Horses have increased from 13,621 in 1855 to 13,795 in 1881. The number used for agricultural purposes was 8205. Little attention is paid to the breed, and the supply is obtained chiefly outside the limits of the county. Cattle in 1855 numbered 74,480, and in 1881 had increased to 92,252. Milch cows numbered only 12,376, and have diminished since 1855 by 8612. There has been great improvement in the breeds of cattle, crosses with the short-horned or the Durham being now the most common. Sheep numbered 127,614 in 1855, 123,998 in 1880, and 117,790 in 1881. They are grazed chiefly on the Curragh, and are now principally Leinster or crosses with that breed. Pigs have diminished since 1855 from 15,983 to 12,986. Goats in 1881 numbered 8885, and poultry 224,810.

According to the corrected summary of the return of owners of land in Ireland, 1878, the county in 1878 was divided among 1768 owners, possessing altogether 412,490 acres, with a rateable valuation of £294,303. Of the owners 848, or 48 per cent., possessed 1 acre and upwards and the average rateable valuation all over was

16a. 4jd. The duke of Leinster owned 87,227 acres, the marquis of Droghda, 18,800, Sir G. G. Aylmer, 15,395; John La Touche 11,282, and seven other estates exceeded 5000 acres.

Manufactories—Though possessing a good supply of water-power, the county is almost wholly destitute of manufactures, but there are a few small cotton, woollen, and paper mills, as well as breweries and distilleries, and several corn mills. Large quantities of turf are exported to Dublin by the canal.

Railways—The Great Western line crosses the county at its northern boundary near Leary, Maynooth, Kildare, and Rathall, and the Great Southern and Western passes through nearly its whole extent by Naas, Newbridge, Kildare, Monasterevan, and Athy.

Administration—The county comprises fourteen baronies, and contains 107 civil parishes, five parts of parishes, and 1240 townlands. Judicially it is within the home circuit, and is divided into fourteen petty sessions districts and three parts of petty sessions districts. Assizes are held at Naas, and quarter sessions at Athy, Kildare, Maynooth, and Naas. The county contains portions of the six poor-law unions of Athy, Ballynagins, Carlow, Colmbridge, Edenderry, and Naas. The military stations at Newbridge and the Curragh constitute the Curragh military district, and the barracks at Athy and Naas are included in the Dublin military district. There are three townships—Athy, Naas, and Newbridge. The principal other towns are Maynooth (which is the seat of a Roman Catholic college), Celbridge, Kildare, Monasterevan, Killeen, Louisa, Kilsloe, Castlemeath, Ballymore Eustace, and Rathangan. Previous to the Union Kildare returned ten members to parliament, of whom eight represented boroughs, but now it sends only two, who sit as members for the county.

Population—According to the census return of 1659 the population amounted to only 18,825, of whom 796 were English and 18,029 Irish. In 1790 it was estimated at 61,728. According to the parliamentary return of 1821 it was 99,065, and by 1841 it had increased to 116,190, but in 1851 had diminished to 96,495, in 1861 to 90,946, in 1871 to 83,614, and in 1881 to 74,102, of whom 40,869 were males and 33,245 females. In several other counties there is an excess of males over females, but in much larger in Kildare than in any other, which is the more remarkable that between 1851 and 1880 there has been also an excess of male emigrants, the total number of emigrants being 18,561 males and 11,746 females, or 57·6 per cent. of the population. In 1881 there were 37 marriages in 1880 to every 1000 of the population was 8·6, of births 22·0, and of deaths 16·9, the rates for Ireland being 8·8, 24·0, and 19·3. The number of natives of England and Wales residing in the county in 1841 was 408, and in 1871 they had increased to 5370, of natives of Scotland there were 181 in 1841 and 874 in 1871. The number of Roman Catholics in 1881 was 66,184; of Protestants 28,312; of Presbyterians 8816; of Presbyterians, 754; of Methodists, 844. In 1871 there were none who spoke Irish only, but 554 spoke Irish and English. The number who could read and write in 1871 was 48,788; 11,472 could read but could not write, and 26,306 could neither read nor write.

History—The only inhabitants of the county are perhaps to be identified with Ptolemy's Corindri. Afterwards it formed part of the district of Coullan or Gales, which also included portions of Wicklow and Carlow, the principal chieftain being a representative of the family of Ely Caelian or McKelly, who had their residence at the most of Ardaraun near Naas. According to a tale in the Book of Leinster the original name of Kildare was *Druim Craic* (Drumore), which it retained until the time of St. Brigit, after which it was changed to *Chidara*, the church of the oak, from a very old oak under whose shade the saint had constructed her cell. For some centuries it was under the government of the MacDonoughs, kings of Leinster, but along with the remainder of Leinster it was granted by Henry II. to Strongbow. On the division of the palatine of Leinster among the five granddaughters of Strongbow, Kildare fell to Bithla, the fourth daughter, who married William de Ferrers, earl of Derby. Through the marriage of the only daughter of William de Ferrers it passed to William de Vesey. Who was challenged to single combat by John Fitz Thomas, baron of Offaly, for accusing him of treason, fled to France. His lands were thereupon in 1267 bestowed on Fitz Thomas, who in 1316 was created earl of Kildare, and in 1324 was appointed sheriff of Kildare, the office remaining in the family until the extinction of Gerald the ninth earl, in the reign of Henry VIII. Kildare was a liberty of Dublin until 1298, when an act was passed constituting it a separate county.

Antiquities—In the county there are several old gigantic pillar stones, the principal being those at Funchestown, Harristown, Jagginstown, and Mullamatt. Among the more remarkable earthworks are the raths at Mullamatt, Knockosallagh near Killeen, Ardaraun near Naas, and elsewhere, and the numerous sepulchral mounds in the Curragh. Of the round towers the finest is that of Kildare, which is 135 feet high; there are remains of others at Taghadee, Kilsloe, and Castlemeath. At its base and on the sides there were an immense number of religious houses in the county. There are remains of a Franciscan abbey at Castlemeath. At Gracey there are the ruins of an Augustinian monastery and also portions of a building said to have belonged to the Knights

Templars. The town of Kildare has ruins of no less than four monastic buildings, among others the monastery founded by St. Brigit. The site of a monastery at Old Killeen, said to date from the time of St. Patrick, is marked by two stone crosses, one of which is curiously sculptured. The fine abbey of Monasterevan is now the seat of the marquis of Droghda. On the Liffey are the remains of Great Connal Abbey near Celbridge, of St. Wolstan's near Celbridge, and of New Abbey at Moone, where there was at one time a Franciscan monastery, there are the remains of a very old cross with curious sculptures. Among the old castles may be mentioned those of Athy and Castlemeath, built about the time of the Anglo-Norman invasion. Maynooth Castle, built by the Fitzgeralds, Kilsloe, originally built by the seventh earl of Kildare, and restored within the present century, and Timolin, erected in the reign of King John.

KILIA, a seaport town of Roumania, formerly in the province of Moldavia, situated on the northern bank of the northern arm of the lower Danube, 20 miles from its mouth. The inhabitants, between 6000 and 7000 in number, are mainly engaged in the river trade and fisheries. Kilia was occupied by the Russians in 1790, and bombarded by the English and French in 1854. Old Kilia is on the opposite side of the river. A plan of the present town will be found in the maps published by the European Commission of the Danube.

KILIAN, St., the apostle of Franconia, was, according to Hrabanus Maurus, a native of Ireland, whence along with his companions he went to eastern Franconia. After having preached the gospel in Wurzburg, the whole party were put to death by the orders of an unjust judge of the name of Gosbert. Notker Balbulus (c. 912) relates that Kilian's mission emanated from the pope, and that Gosbert was the duke of Franconia, who, after receiving baptism, had been persuaded to put away his wife (Gella) because she was his brother's widow. Gella in revenge caused Kilian and his comrades, Coleman and Totman, to be secretly put to death. Later accounts assign the mission to the time of Canon (688). In the *Martyrologies* Saints Kilian (Kyliana, Chilianus), Coleman, and Totman are commemorated on July 8. Their relics lie in the cathedral (St. Kilianminster) at Wurzburg.

KILIMANJARO, a great snow-topped mountain in eastern Africa, in 3° 5' S. lat. and 37° 22' E. long., has a height of 18,715 feet, and is believed to be the loftiest eminence of the whole continent. It stands completely apart from all the neighbouring heights, but is only "one of many summits that crown the eastern edge of the great plateau of equatorial Africa." At a distance of 100 miles to the north, across the wide expanse of the Kapai and Kilunyu plains, lie the less known mountains Kenia and Lemera; and due west, at a distance of about 30 or 40 miles, rises the noble mass of Mount Meru.

As the natives believe that the summit of Kilimanjaro is composed of silver, it is possible that Aristotle's reference to "the so-called Silver Mountain" from which the Nile flows was based on Indian reports about this mountain; but the real discovery of its existence was made only in 1848 by Mr. Hebmam of the Church Missionary Society (*Obava Missionary Intelligence*, 1849). His account, though ill borne out by Dr. Krapf, was at first received with great incredulity by professional geographers. The matter has been finally set at rest by the visits paid to the mountain by Von der Decken (1861 and 1862) and Mr. Charles New (1867), the latter of whom reached the lower edge of the snow. Kilimanjaro has two principal summits. The eastern, Kibo or Bwana, is a magnificent dome with a smooth and regular outline; the other, Kikavuti, is a dark and rugged peak; and between the two stretches a saddle-like ridge several miles in extent. Treacherous, beset, and obdurate were obtained by Von der Decken from the upper part of the mountain. Mr. New distinguished six clearly marked zones of vegetation. The first was the region of the banana and maize, the surface, when not under cultivation, being clothed with a close turf exceedingly rich in clover; above this lay a belt of jungle; the jungle was succeeded by a forest of gigantic trees with a dense and tangled undergrowth, and an extraordinary profusion of moss both on the ground and on the stems and branches; beyond the trees was a region of hills covered with rich grass and clover; beyond the grass came heath; and this gradually dwindled away into a region of bare wind-swept rocks. Among the fifty species of plants col-

lected on the mountain Dr Hooker found only a few of those European forms which are known to exist in the Cameroons and the Abyssinian mountains.

From the southern slopes of Kilimanjaro descend a great many streams—the Weri-Wari, the Rari, the Gauu, &c.—which, uniting with the Jipe from Lake Jipe, ultimately form the Rufe or Pangani, an important river reaching the Indian Ocean about 6° 30' S. lat. The hilly country round the southern skirts is occupied by the Jaggus or Chaggus, who cultivate maize, millet, and pulao, and keep cattle. Their chief villages are Kilima and Moshe.

See R. Thomson (the geologist of Von der Decken's party) in *Proc. Roy. Soc. Lond.*, 1861-62, *Rept. Prentis in East Africa*, 1860, *Nor. Lipp.*, 1861, *East Africa*, 1878, *Hooker in Journal of Linnean Society*, 1876, and for further literature, Petermann's *Altitudinalen*, 1866, pp. 16-17.

KILKENNY, an inland county of Ireland, in the province of Leinster, is situated between 52° 14' and 53° 52' N. lat., and between 6° 50' and 7° 38' W. long. It is bounded on the N. by Queen's county, E. by Carlow and Wexford, S. by Waterford, and W. by Waterford and Tipperary. Its greatest length from north to south is about 45 miles, and its greatest breadth from east to west about 25 miles. The area is 507,254 acres, or about 793 square miles.

The greater part of Kilkenny is a continuation forming the south-eastern extremity of the Carboniferous Limestone plain of Ireland, but in the south-east this is bounded partly by the Cambro-Silurian rocks which run into the county from Wexford, and partly by a continuation of the granite mountains of Wicklow and Carlow, and it is interrupted in the north by an extensive hilly region forming part of the Castlecomer coal-field, which extends also into Queen's county and Tipperary. The field lies in the form of a broad basin, and rests on flagstone and black shale. The coal is anthracite, and the most productive portions of the bed are in the centre of the basin at Castlecomer. Besides a large number of fossil plants, crustaceans of a rare species and also several peculiar reptilian remains have been found in the measures. The field is believed to contain nearly 80,000,000 tons of workable coal, and at present the annual yield is about 80,000 tons,—the annual yield of Ireland being only about 130,000 tons. On the granite the limestone has the form of a bedded dolomite, and this is also principally the form of the central division to the north-west of Kilkenny. In other places the limestones are bluish or black, the latter being the best quality for burning, and are often associated with shales of a considerable thickness. Cherty beds frequently occur between the limestone and the Coal-measures. Hematite iron of a rich quality is found in the Cambro-Silurian rocks at several places. Tradition has it that silver shields were made about 850 B.C. at Argetros or Silverwood on the Nore, and at Ballygunnion there were very ancient mines associated with the lead. The shelly black marble obtained near the town of Kilkenny has gained wide fame, and is used for tombstones, chimney-pieces, and picture frames. Manganese is obtained in some of the limestone quarries, and also near the Barrow. Mael is abundant in various districts. Pipeclay and potter's clay are found, and also yellow ochre. Copper occurs near Knocktopher.

Rivers.—The principal rivers, the Suir, the Barrow, and the Nore, have all their origin in the Slieve Bloom mountains, and after a widely divergent course southwards discharge their waters into Waterford Harbour. The Suir forms the boundary of the county with Waterford, and is navigable for sloops to Carrick. The Nore, which is navigable to Innishoge, enters the county at its north-western boundary, and flows by Kilkenny to the Barrow, 9 miles above Rose, having received in its course the King's river at Jerpoint and the Argula near Innishoge. The Barrow, which is navigable beyond the limits of Kilkenny into Kildare, forms the eastern boundary of the county from near New Bridge. There are no lakes of any extent, but turloughs are occasionally formed by the bursting up of underground streams.

Climate and Agriculture.—On account of the slope of the country and the nature of the soil, the surface occupied by bog or wet land is very small, and the air is dry and very salubrious. So temperate is it in winter that the myrtle and arbutus grow in the open air. There is less rain than at Dublin, and vegetation is earlier than in the adjacent counties. Along the banks of the Suir, Nore, and Barrow a very rich soil has been formed by alluvial deposits. Above the Coal-measures in the northern part of the county there is a moorish tract devoted chiefly to pasturage. The soil above the limestone is for the most part a deep and rich loam admirably adapted for the growth of wheat. The heath-covered hills afford honey with a flavour of peculiar excellence.

The following table gives a classification of holdings according to size in 1860 and in 1880, as contained in the agricultural returns.—

	1 Acre.	1 and under 5.	5 and under 15.	15 and under 50.	50 and upwards.	Total.
1860	1,092	2,863	4,100	5,809	6,506	16,689
1880	1,784	1,615	2,026	2,052	6,506	14,040

The total area under crops in 1881 was 150,804 acres, a percentage of 31.4 of the whole acreage of the county. In 1880, 298,252 acres, a percentage of 57.8, were under grass, 2196 fallow, 10,799 wood, 10,746 bog, 18,516 mountain, and 31,801 water, roads, and fences. The area under crops in 1860 was 155,928. The area under cereals declined from 112,220 acres in 1850 to 85,282 in 1881, wheat decreasing from 47,846 acres to 11,949, and oats from 62,386 to 85,876, while in other cereals, of which the chief is barley, there has been an increase from 12,641 acres to 17,611. Between 1861 and 1880 the area under grass increased by 40,580 acres. Almost nothing has been done to improve the pasturages of the hilly districts, which are still largely covered with heath. The area under meadow and clover, which includes a large portion of rich soil on the banks of the Nore and Suir, increased from 42,482 acres in 1850 to 62,079 in 1881. Green crops diminished in area from 41,189 acres in 1850 to 31,998 in 1881, potatoes from 34,831 acres to 18,268, and turnips from 11,619 to 9929. Horses since 1850 have increased from 11,161 to 11,608. The number in 1881 used for agricultural purposes was 11,608. Mules since 1850 have increased from 687 to 1054, and asses from 8855 to 5845. Cattle in 1850 numbered 72,998, and in 1881 had increased to 120,564. Cows numbered 37,695, or about a third of the total number of cattle, dairy-farming being largely followed, especially in the hilly districts to the north-west. The most common species of cattle is a cross between the old Irish breed and the longhorn, but Kerry cows are considerably in demand for dairies. For winter-feeding pounded furze tops are frequently used, but in many cases the cattle graze outside in winter. Sheep, the breed of which has been much improved by crossing, increased from 40,460 in 1850 to 86,393 in 1881. Pigs have declined in numbers from 46,763 to 39,777, while goats have increased from 6958 to 6878, and poultry from 197,955 to 410,524.

According to the corrected summary of owners of land, 1878, the land in 1878, exclusive of the county of the city of Kilkenny, was divided among 1150 proprietors, of whom 827 possessed less than 1 acre. The annual rateable valuation is stated in the return of 1878 as £240,695, giving an average value of 13s. 9d. per acre. There were forty-seven owners who possessed upwards of 2000 acres, twelve who possessed upwards of 8000 acres, and six upwards of 10,000 acres, viz., Viscount Clifden, 46,938; Earl of Rosmeath, 28,967; Charles Wandersford, 22,223; Col. W. F. Tighs, 11,970; Marquis of Ormonde, 11,600; and Viscount Mountgarret, 11,912.

Manufactures.—The linen manufacture introduced into the county in the 17th century by the duke of Ormonde to supersede the woollen manufacture gradually became extinct, and the woollen manufacture now carried on is also very small. There are, however, breweries, distilleries, tanneries, and flour-mills, as well as marble polishing works.

Railways.—The county is intersected from north to south by the Maryborough and Waterford line, which is joined near Kilkenny by the South-Eastern Railway from Carlow. The Great Southern and Western Railway skirts the south-western boundary of the county.

Administration.—The county comprises 10 baronies, 124 civil parishes and 16 parts of parishes, and 1601 town-lands. The county of the city contains one parish and four parts of parishes. There are three poor-law unions wholly within the county, viz., Castlecomer, Kilkenny, and Thomastown, and portions of 37, viz., Callan, Carrick-on-Suir, New Ross, Uringford, and Waterford. The county includes the parliamentary borough of Kilkenny, part of that of New Ross, and the township of Callan. There are in the county and city sixteen petty sessions districts. Assizes are held at Kilkenny, and quarter sessions at Kilkenny, Piltown, Uringford, Castlecomer,

Grave's Old Castle, Callan, and Thomastown. The county is within the Cork military district, and there are barracks stations at Kilkenny and Castlemore. Previous to the Union Kilkenny returned sixteen members to Parliament, two representing the county. Since that period two members have been returned for the county, one for the city of Kilkenny, and one for New Ross, which, however, is situated chiefly in Wexford.

Population.—According to the census of 1869, the total population of the county was 18,497, of whom 1449 were English and 16,986 Irish. In 1780 it was estimated at 62,882. In 1821 it had increased to 168,716, and in 1841 to 202,746, but in 1851 it had diminished to 159,514, in 1871 to 109,879, and in 1881 to 99,064, of whom 48,689 were males and 50,825 females. The total number of emigrants from 1st May 1861 to 31st December 1880 was 55,403, or 44 per cent. of this population in 1861. The marriage rate in 1880 to every 1000 of the population was 8.2, the birth-rate 22.1, and the death rate 20.0. In 1881 the Roman Catholics numbered 98,699; Protestant Episcopalians, 4968; Presbyterians, 197; Methodists, 131, and all other denominations, 74. There were resident in 1871 in the county 805 natives of England and 180 of Scotland. In 1871 the number of persons who spoke Irish only was 816, while 8424 could speak Irish and English. 44,779 could read and write, 16,899 could read but could not write, and 36,521 could neither read nor write.

History.—Kilkenny received its name from St Cannocho or Canice, abbot of Aghaboe in Queen's county, who died in 698, and whose see was removed to Kilkenny in the beginning of the 11th century. In the time of Ptolemy the county was inhabited by the Eboriges and the Caoni. Afterwards it formed part of the kingdom of Ussuragh, modernized into Osasry, which was tributary sometimes to Leinster and sometimes to Munster. In 1210 Kilkenny was formed into a county by King John. During the Revolution it was held by the Irish, and it also strongly adhered to the cause of James II. against William III.

Antiquities.—Circular groups of stones of very ancient origin are to be seen on the summits of Slieve Gran and the hill of Cloughmanta. There is a remarkable cromlech at Kilnogue and a large number of cromlechs as well as mounds in various parts of the county. Besides numerous forts and castles there are five round towers, one adjoining the cathedral of Kilkenny, and others at Tulloreh, Kilree, Fernagh, and Aghavillier respectively. The monastic remains in the city of Kilkenny are mentioned under the notice of the town. There are interesting remains of a Cistercian monastery at Jerpoint, said to have been founded by Dunngogh, king of Osasry, and of another belonging to the same order at Graig, founded by King Pemroke in 1212. The Dominicans had an abbey at Bohercon founded in 1267, and another at Thomastown, of which there are still some remains. The Carmelites had a monastery at Knocktopher. There was an Augustinian monastery at Innishoge, and priories at Callan and Kells, of all of which there are still some remains. Of the old castles the most remarkable is Grange or Grandison Castle in Iverk, which is supposed to have been founded by the eighth earl of Ormonde in 1521, and of which three towers and the walls still remain. See Robertson, *Antiquities and Scenery of the County of Kilkenny*, 1851.

KILKENNY, the chief town of the above county, a market-town, county of a city, and parliamentary borough, is finely situated on the Nore, and on the Great Southern and Western Railway, 73 miles south-west of Dublin and 32 north of Waterford. It consists of two distinct portions, Englishtown or Kilkenny proper and Irishtown, separated from each other by a small rivulet, but although Irishtown still retains its name it is now included in the corporation of Kilkenny. The city is irregularly built, but possesses several spacious streets with many good houses, while its beautiful environs and several imposing ancient structures give it an unusually interesting and picturesque appearance. The Nore is crossed by two handsome bridges erected towards the close of last century. The old cathedral of St Canice, from whom the town takes its name, dates from 1062, and with the exception of the cathedral of St Patrick in Dublin is the largest ecclesiastical building in Ireland, having a length from east to west of 226 feet, and a breadth along the transepts from north to south of 123 feet. It occupies a commanding position on an eminence at the western extremity of Irishtown. It is a cruciform structure in the Early English style, with a low massive tower supported on clustered columns of the black marble peculiar to the district. The building was lately restored at a cost of £15,000. It contains a large number of old sepulchral

monuments. On the eastern side of the north transept is the parish church, and a short distance from the south transept are the remains of a round tower, rising to the height of 100 feet. The episcopal palace near the east end of the cathedral was erected in the time of Edward III. and enlarged in 1735. Besides the old cathedral, the principal other churches are the Episcopal church of St Mary, a plain cruciform structure; that of St John, containing a portion of the old abbey of St John; and the Roman Catholic cathedral, erected in 1857 at a cost of £50,000, a cruciform structure in the late First Pointed style, with a massive central tower 186 feet in height. There are important remains of three old monasteries—the preceptory of St John's, founded in 1211; the Dominican abbey, founded in 1225, and now used as a Roman Catholic church; and the Franciscan abbey on the banks of the Nore, founded about 1230. But, among the ancient buildings, that next in importance and interest to the cathedral is the castle, occupying a commanding position on the summit of a precipice above the river Nore. It was originally built by Strongbow, but rebuilt by William le Marechal in 1175, and again restored in the present century, and transformed into the princely residence of the marquis of Ormonde. The grammar school or college, which was originally founded by Pierce, earl of Ormonde, and re-endowed in 1684 by the duke of Ormonde, stands on the banks of the river opposite the castle. In it Swift, Farquhar, Congreve, and Bishop Berkeley received part of their education. Adjoining the city is the Roman Catholic college of St Kyrn, a Gothic building completed about 1840 at a cost of £20,000. The other principal public buildings are the new court-house, the school or city court, the city and county prison, the barracks, and the county infirmary. There is still a small manufacture of coarse woollens and linens. In the neighbourhood there are large collieries, as well as quarries for marble, the manufactures connected with which are an important industry of the town. It also possesses corn-mills, breweries, and a tannery. The population of the county of the city of Kilkenny in 1851 was 18,973, of the town proper 15,808; in 1871 the numbers were 15,748 and 12,710, and in 1881 they were 14,964 and 12,182.

The town of Kilkenny proper owes its origin to an English settlement which took place in the time of Strongbow, and it received a charter from William le Marechal, who married Strongbow's daughter. This charter was confirmed by Edward III., and from Edward IV. Irishtown received the privilege of choosing a portreeve independent of Kilkenny. By Elizabeth the borough, while retaining their distinct rights, were constituted one corporation, which in 1608 was made a free borough by James I., and in the following year a free city. From James II. the citizens received a new charter, constituting the city and liberties a distinct county to be styled the county of the city of Kilkenny, the burgesses of Irishtown containing, however, to elect a portreeve until the passing of the Municipal Reform Act. Frequent parliaments were held at Kilkenny in the 14th century, and so late as the reign of Henry VIII. it was the occasional residence of the lord-lieutenant. In 1642 it was the meeting-place of the assembly of Confederate Catholics. In 1643 Cromwell in the hope, by means of a plot, of obtaining possession of the town, advanced towards it, but before his arrival the plot was discovered. In 1650 it was, however, compelled to surrender after a long and resolute defence. At a very early period Kilkenny and Irishtown returned each two members to parliament, but since the Union one member only has been returned for the city of Kilkenny.

KILLARNEY, a market-town of Ireland, county of Kerry, is situated on a branch line of the Dublin and Cork Railway, 180 miles south-west from Dublin and 47 miles north from Cork. On account of the beautiful scenery in the neighbourhood, the town is much frequented by tourists. Within late years it has been greatly improved in appearance, and the streets are now spacious and well-paved, while many good houses and several imposing public buildings have been erected. The principal buildings are

the court-house, the Roman Catholic cathedral and bishop's palace, designed by Pugin, the episcopal church lately rebuilt, the lunatic asylum, erected at a cost of £30,000, and the railway hotel. Adjoining the town is the fine mansion of the earl of Kenmara. The only manufacture of any importance now carried on at Killarney is that of fancy articles from the wood of the arbutus; but it owed its origin to iron-smelting works, for which abundant fuel was obtained from the neighbouring forests.

The lakes of Killarney, about a mile and a half distant from the town, are situated in a basin between several lofty mountain groups, some rising abruptly from the water's edge, and all clothed with trees and shrubbery almost to their summits. The lower lake, or Lough Leane, which has an area of 5001 acres, is studded with finely wooded islands, on the largest of which, Ross Island, are the ruins of Ross castle, an old fortress of the O'Donoghues; and on another island, the "sweet Innisfallen" of Moore, are the picturesque ruins of an abbey founded by St Finian the leper at the close of the 6th century. Between the lower lake and the middle or Torc lake, which is 680 acres in extent, stands Muckross Abbey, built by the Franciscans about 1440. With the upper lake, which is 430 acres in extent, thickly studded with islands, and closely shut in by mountains, the lower and middle lakes are connected by the Long Range, a winding and finely wooded channel, 2½ miles in length, and commanding magnificent views of the mountains. Midway in its course is a famous echo caused by the Eagle's Nest, a lofty pyramidal rock. The population of the urban sanitary district in 1881 was 6548.

KILLDEER, a common and well-known American Plover, so called in imitation of its whistling cry, the *Charadrius vociferus* of Linnaeus, and the *Agialitis vocifera* of modern ornithologists. About the size of a Snipe, it is mostly sooty-brown above, but showing a bright buff on the tail coverts, and in flight a white bar on the wings; beneath it is pure white except two pectoral bands of deep black. It is one of the finest as well as the largest of the group commonly known as Ringed Plovers or Ring Doters,¹ forming the genus *Agialitis* of Boie. Mostly wintering in the south or only on the sea-shore of the more northern States, in spring it spreads widely over the interior, breeding on the newly-ploughed lands or on open grass-fields. The nest is made in a slight hollow of the ground, and is often surrounded with small pebbles and fragments of shells. Here the hen lays her pear-shaped, stone-coloured eggs, four in number, and always arranged with their pointed ends touching each other, as is indeed the custom of most Limicoline birds. The parents exhibit the greatest anxiety for their offspring on the approach of an intruder: the hen runs off with drooping wings and plaintive cries, while the cock sweeps around, gesticulating with loud and angry vociferations. It is the best-known bird of its family in the United States, throughout which it is found in all suitable districts, but less abundantly in the north-east than further south or west. In Canada it does not range further to the northward than 56° N. lat., and it is not known to occur in Greenland, or hardly in Labrador, though it is a passenger in Newfoundland every spring and autumn.² In winter it finds its way to Bermuda and to some of the Antilles, but it is not recorded from any of the islands to the windward of Porto Rico. However, in the other direction it goes very much further south,

travelling down the Isthmus of Panama and the west coast of South America to Peru. The Killdeer has several other congeners in America, among which may be noticed *A. semipalmata*, so curiously resembling the ordinary Ringed Plover of the Old World, *A. hiaticula*, except that it has its toes connected by a web at the base; and *A. nivescens*, a bird inhabiting the western parts of both the American continents, which in the opinion of some authors is only a local form of the widely-spread *A. alexandrina* or *cantiana*, best known by its English name of Kentish Plover, from its discovery near Sandwich towards the end of the last century, though it is far more abundant in many other parts of the Old World. The common Ringed Plover, *A. hiaticula*, has many of the habits of the Killdeer, but is much less often found away from the sea-shore, though a few colonies may be found in dry warrens in certain parts of England many miles from the coast, and in Lapland at a still greater distance. In such localities it has the curious habit of paving its nest with small stones (whence it is locally known by the name of "Stone-hatch"), a habit almost unaccountable unless regarded as an inherited instinct from shingle-haunting ancestors.

About thirty species all apparently referable with propriety to the genus *Agialitis* have been described, but probably so many do not exist. Some, as the Kentish Plover above named, have a very extended distribution, for that, letting alone its supposed American habitat, certainly occurs in greater or less numbers on the coasts of China, India, and Africa generally. On the other hand there is one, the *A. sancto-helena*, which seems to be restricted to the island whence it takes its scientific name, and where it is called the "Wire-bird" (*Ibis*, 1873, p. 260). Nearly allied to *Agialitis* are two genera peculiar to the New Zealand subregion—*Thinornis*, which does not call for any particular remark, and the extraordinary *Anarhynchus*, which deserves a few words. Of this there is but one species, *A. frontalis*, the Wrybill, so called from its bill being congenitally bent in the middle and diverted to the right side—a formation supposed to give the bird greater facility in seeking its food, chiefly arthropods that lurk under stones, round which it may be seen running from left to right. Mr Buller (*B. New Zealand*, p. 216) connects with this habit the curious fact that the black pectoral band worn by the bird is "narrower and of a less decided colour on the left side of the breast," whence he infers that "the law of natural selection has operated to lessen the colouring on the side of the bird more exposed to Hawks and other enemies while the *Anarhynchus* is hunting for its daily food." Be that as it may, it does not detract from the wonderful nature of this asymmetry of the bill, which is comparable indeed with that found in so large a number of Cetaceans among mammals, but with nothing known among birds, for in the *Crotophaga* (g.n.) the bones of the mandibles are not affected, and in certain Owls (*Nyctala*) the distortion of the ear-bones is not externally visible.

(A. N.)

KILLIZ, or **KILIS**, a town of Syria, in the Turkish vilayet of Aleppo, in 37° 3' N. lat. and 37° 2' E. long, 60 miles north of the city of Aleppo. It is situated in an extremely fertile plain or plateau, completely surrounded with olive groves, the produce of which is reckoned the finest oil of all Syria; and its position on the regular route from Birzjik on the Euphrates to southern Caracania gives it considerable traffic. The bazars are unusually fine, and gunmaking is a common craft in the town. The population, variously estimated at 12,000 and 6000, consists largely of Arabs, the town lying just on the northern rim of the Arab territory.

KILMARNOCK, a market-town, and parliamentary and municipal burgh, in the district of Cunningham,

¹ The word Doter seems properly applicable to a single species only, the *Charadrius morinellus* of Linnaeus, which, from some of its osteological characters, may be fitly regarded as the type of a distinct genus, *Eudromia*. Whether any other species agree with it in the peculiarity alluded to is at present uncertain.

² A single example is said to have been shot near Christchurch, in Hampshire, in April 1867 (*Ibis*, 1867, p. 276).

Ayrshire, Scotland, is situated on both sides of the Kilmarnock water, near its junction with the Irvine, 21 miles south-west of Glasgow by rail. The town is long and narrow, but its principal streets are well-built and spacious. Among the chief buildings are the town-house, the court-house, the corn exchange buildings (including the Albert tower, 110 feet high, and various public offices), the observatory, and the academy, built in 1876 at a cost of £8000 to accommodate six hundred children. Kilmarnock also possesses the endowed Kay schools, an industrial school in the once famous Kilmarnock House, a school of art, an Athenaeum, a public library, an opera-house, and an infirmary. In the Kay park of 40½ acres, purchased from the duke of Portland for £8000 (with a legacy left by a native of the town in 1866), stands the Burns Monument, inaugurated in August 1879. Kilmarnock rose into importance in the 17th century by its production of striped woollen "Kilmarnock cows" and broad blue bonnets. Knitted woollen bonnets are still manufactured to an annual value of about £25,000, but by far the most important textile industry is carpet-weaving. When trade is good, the annual turn out of Brussels and Scotch carpets is valued at about £100,000. There are several spinning mills in connexion with the carpet factories. Tweeds, blankets, shawls, and tartans are produced to a limited but rapidly increasing extent, the manufacture of wine is larger. Calico-printing, once important, has dwindled. The boot and shoe trade is prosperous; and there are very extensive iron and engineering works in the town. Situated in a highly cultivated region, Kilmarnock is famous for its dairy produce; and the largest cheese-show in Scotland is held there annually. The neighbourhood abounds in freestone and coal. The burgh is governed by a provost, six bailies, and eighteen councillors. It unites with Dumbarton, Port-Glasgow, Renfrew, and Rutherglen in returning one member to parliament. The population in 1881 was 23,901.

KILSYTH, a burgh of barony in Stirlingshire, Scotland, is situated about 12 miles north-east of Glasgow. It is ill built and dingy. On August 18, 1646, the Covenanters under Baillie were defeated at Kilsyth by Montrose with great slaughter. Kilsyth is further interesting as the centre of remarkable religious revivals in 1742-43 and 1839. The present village dates from the middle of the 17th century. It became a burgh of barony in 1828 by charter from George IV. The inhabitants are chiefly engaged in the neighbouring coal and iron works; but weaving and paper-making are also carried on. The population in 1881 was 5402.

KILWINNING, a market-town in Cunningham district, Ayrshire, Scotland, is situated on the right bank of the Garnock, 26 miles south-west of Glasgow by rail. The houses are neat, but somewhat straggling. The chief buildings are the parish church (with a handsome detached Gothic tower erected in 1815 in place of an older one, 103 feet high, which fell in 1814), the Free church, and the board school. The greatest interest of the place centres in its ruined abbey, originally one of the richest in Scotland. Founded about 1140 by Hugh de Morville, lord of Cunningham, it was dedicated to St. Winning, who lived on the spot during the 8th century, and has given his name to the town. This beautiful spotman of Early English was destroyed in 1561; and its lands were granted to the earl of Eglinton and others. Kilwinning is the traditional birthplace of Scottish freemasonry; and Kilwinning lodge, said to have been founded by the foreign architects and masons who came to build the abbey, is still looked up to as the mother-lodge in Scotland. The royal company of archers of Kilwinning—dating, it is said, as far back as 1488—used till recently to meet annually to shoot at the papingo, or popinjay, in the manner described

in Scott's *Old Mortality*; and in 1881 an attempt has been made to revive the custom. The former industry in weaving shawls and lighter fabrics has quite died out. The large iron, coal, and fire-clay works in the neighbourhood employ most of the working inhabitants. A woollen-mill, with sixty hands, but capable of employing three hundred, was opened in 1881. The population of the parish in 1881 was 7037; of the town, 3469. About a mile from Kilwinning is Eglinton Castle, the principal seat of the earl of Eglinton, where the famous Eglinton tournament was held in 1833.

KIMBERLEY, formerly called New Rush, one of the mining towns of the diamond district of South Africa, situated in Griqualand West, to the east of the Orange river, 520 miles north-east of Cape Town. Though it dates only from 1872, and has much of the temporary character to be expected from the conditions that gave it existence, it bids fair to be a permanent settlement, having a number of buildings of stone and brick, a market place, banks, churches, &c., and publishing a *Diamond News*. Although in 1874 the population fell almost en masse for the gold-mines of Leydenberg (in Transvaal), the town was estimated in 1881 to have something like 10,000 inhabitants, besides a floating native population about equal in number. See Holub, *Seven Years in South Africa*, 1881.

KIMHI, ReDaK, i.e., Rabbi David Kimhi or Kimchi,¹ was born at Narbonne after 1155, and died probably in the same city about 1235. His father Rabbi Joseph, or his grandfather Rabbi Isaac (Yis'hak) Ibn Kimhi, had immigrated into Provence from Spain, where Arab fanaticism had compelled the Jews to flee from the sword of tyranny. In Provence the family took the Gentile surname of *Petit*.² Rabbi David lost his father (who was himself a grammarian, Bible commentator, and poet of no mean order) very early; but his elder and only brother, Rabbi Mosheh (a fair scholar, but famous chiefly through his younger brother), was his principal oral teacher. The valuable literary treasures of his father, however, falling into his hands, ReDaK grew strong by studying them, and, as we know, eclipsed them completely, although he lacked his father's originality. But, if Rabbi David lacked originality, he had abundance of instinct for finding out the best in the works of his predecessors, and abundance of genius for digesting and assimilating it till it became his own in a peculiar way. Although preceded by Hayyuj, Ibn Janah, and others, and succeeded by Abraham de Balme, Elias Levita, and others, Kimhi has maintained the position of the greatest Jewish grammarian and lexicographer for six hundred and fifty years. And, although much inferior as a Biblical scholar and Talmudist to Rashi, and as a critic and philosopher to Abraham Ibn Ezra, he has outstripped both in the eyes, not only of the Christians, but to some extent even of the Jews, and thus reigned supreme for more than half a millennium, as a commentator on the Bible. The fact is, he united in his own person the child-like simplicity of Rashi and the incisive criticism of Ibn Ezra. Add to this that he was master of the Targums and Aggadot as few before or after him, that he had Hebrew, Arabic, and Greek philosophy at his fingers' ends, and that he was endowed with a truly poetical soul, and the mystery is explained how the merely reproductive scholar could cause original scholars of the highest eminence, but who were one-sided, to be all but forgotten. Not only have his works, in whatever field they are to be found, been printed and reprinted, but the most important of them are translated

¹ Not Kimchi. Compare קימחי in the Talmud Yerushalmi, *Horayoth*, III. 2.

² From these circumstances Kimhi is known as *Hasanpetit* (the Spanish, *petit* the Kimhi, or as *Mosheh Petit*. *Petit* is, to a certain extent, an equivalent of Kimhi (from נדן, grain ground small).

37". A great part of the mountains district is unsuitable for either pasturage or tillage, and is occupied chiefly by deer forests and grouse moor; but the land in the valley of the Dee, in the "How," and along the coast is very productive, and is cultivated according to the most advanced methods. A considerable portion of the "How" is, however, on account of the difficulty of drainage, still occupied by moor and moss. The land in this district is richer and stronger than that in the valley of the Dee, but the most fertile region is that along the sea-coast, the soil consisting more generally of a deep loam resting on clay, although in some places it is poor and thin, or stiff and cold.

According to the agricultural returns for 1881, the total area under crops was 120,651 acres, a percentage of 48.6, that for 1870 being 47.1. The area under corn crops was 44,805; under grain crops, 22,476, under rotation grasses, 46,645; under permanent pasture, 65,652 acres. The area under woods was 27,830 acres, while 12 acres were under nursery grounds, and 28 under market gardens. About two-thirds of the area under corn crops is occupied by oats, which in 1881 covered 31,430 acres, while 12,120 acres were under barley, and 677 acres, chiefly in the neighbourhood of the sea-coast, were under wheat, the area of which has been rapidly declining, 55 under whey, 581 under beans, and 40 under peas. Of green crops

about four-fifths of the area is under turnips and swedes, which in 1881 occupied 15,804 acres, 8058 being occupied by potatoes, 450 by cabbages and smaller crops, 17 by carrots, and 8 by cabbages. Flax occupied 1 acre, and there were 184 acres fallow. Great improvements have lately been effected in regard to farm buildings and drainage.

The total number of horses, many of which are well-bred Clydesdales, in 1881 was 4798. Of these, 3858 are stated to be used solely for agricultural purposes, and 905 to be kept solely for breeding purposes. Cattle in 1881 numbered 26,013, or an average of 21 to every 100 acres under cultivation, the average for Scotland being 23.9. Much attention is paid to the rearing of stock, and cattle feeding is carried on according to the most advanced methods. The most common breed is the short-horn, which are bought in for feeding from Ireland, but a few Canadian cattle have also lately been bought. The more common home-bred stock is a cross between shorthorned and polled; but there are also many valuable herds of the pure polled breed. Sheep in 1881 numbered 24,906, an average of 26.7 to every 100 acres under cultivation, the average for Scotland being 141.8. Blackfaced sheep are of course those chiefly kept on the hill pastures, but on the lowland farms Cheviots or a cross with Leicesters are not uncommon. The number of pigs in 1881 was 1987.

The following table gives a classification of holdings according to size in 1875 and 1880, with the total area under each class of holding:—

	50 Acres and under		From 50 to 100 Acres.		From 100 to 200 Acres.		From 200 to 300 Acres.		From 300 to 1000 Acres.		Above 1000 Acres.		Total	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1875	1,200	14,004	301	23,628	902	107,190	41	15,204	10	6,281	—	—	1,614	130,423
1880	1,081	14,709	298	24,118	870	105,352	39	14,075	8	4,497	—	—	1,506	130,529

It will thus be seen that about three-fifths of the holdings are under 50 acres in extent, but that their number has within recent years been diminishing. According to the *County of Lands and Fisheries Returns*, 1873-74, the land was divided among 1084 proprietors, possessing 244,185 acres, with a gross annual value of £265,388. Of the owners, 1159 possessed less than 1 acre, and the average value per acre was £1. 0s. 6d. Sir Thomas Gladstone owned 45,069 acres. Earl of Kintore, 17,970; James Young, 16,659; Viscountess of Dunfermline, 15,660; Sir J. H. Burnett, 13,029; R. W. Duff, 8723; Mrs Badenoch Nicolson, 8481; W. N. Forbes, 6828. A comprehensive account of the agriculture of Kincardineshire, by James Macdonald, is contained in the *Transactions of the Highland and Agricultural Society for 1881*.

Manufactures.—Wool and manufactures are carried on at Stonehaven, and flax-spinning and weaving at Bervie, Laurencekirk, and a few other places. There are several breweries, tanneries, and distilleries. Fishing gives employment to a number of persons in the sea-coast villages. The rental of the salmon fishings on the coast is £7000, and of those on the rivers £1200 per annum. There is some shipping at Stonehaven.

Railways.—The Caledonian Railway traverses the county from Marykirk to the mouth of the Dee, and a branch line runs along the sea-coast as far north as Bervie.

Administration.—The county comprises eighteen parishes and three parts of parishes: one royal burgh, Bervie, which received its constitution from David II. in return for the hospitality of the inhabitants when he landed there through stress of weather; and one burgh of barony, Stonehaven, which, since 1800, has been the capital of the county, the former capital, Kincardine, in the parish of Forfar, at the time of the time of a royal castle having now declined to the position of a mere hamlet. The county was now joined to the sheriffdom of Aberdeen, weekly courts being held at Stonehaven. One member of parliament is returned for the county, and Bervie is united with the Monroes district of burghs, which returns one member.

Population.—The population between 1801 and 1881 increased from 20,349 to 34,593. In 1871 it was 34,466, and in 1881 it was 34,460, of whom 16,972 were males and 17,488 females. The population of Stonehaven in 1871 was 2895, and in 1881 it was 2915. Laurencekirk in 1881 had a population of 1454, Johnstone 1089, and Bervie 1094.

History and Antiquities.—Apparently Kincardine belonged to the district of Pictavia. Cairns and stone circles are frequent in nearly every part of the shire, and there are numerous traces of Roman camps. According to some the county received the name Maszra from having been granted to Mearna, a Scottish king, brother of the Angus who received the neighbouring county of Forfar. The only old building of special interest is Dunrobert Castle near Stonehaven, the old seat of the Keiths, earls marshall of Scotland. The castle stands on a high projecting rock about 150 feet above the sea, by which it is nearly surrounded, and was formerly an extensive fortress of great strength. In the reign of James II. it was used as a prison for Nonconformists. Among the eminent persons con-

nected with Kincardine may be mentioned John of Fordoun the historian, George Wishart, Robert Barclay the Quaker, Bishop Burnet, Sir John Arbuthnot, Dr James Beattie, Dr Thomas Reid, and Lord Monro.

See the *History and Traditions of the Lands of the Lordships*, 1553; *History and Antiquities of the Marquis*, 1863; and *Memorials of Angus and the Marquis*, 1861,—all by A. Jervise.

KINDERGARTEN. A German word meaning "garden of children," is the name given by Friedrich Froebel (see FROEBEL) to a kind of "play-school" invented by him for furthering the physical, moral, and intellectual growth of children between the ages of three and seven. Froebel's observation of the development of organisms and his fondness for analogies drawn from trees and plants made him attach especial importance to our earliest years, years in which, as he said, lies the tap-root of much of the thought and feeling of after life. Although the analogies of nature had constantly been referred to before Froebel's days ("First the blade, then the ear, then the full corn in ear"), and Bacon, speaking of education, had said that the gardener bestows the greatest care on the young plants, the Renaissance left the imparting theory of education so firmly fixed on the mind of Europe that for two hundred years the developing theory could hardly get a hearing, and little was done to reduce it to practice before the attempt of Pestalozzi. Pestalozzi and other great thinkers (notably Comenius), who attached much importance to the first years of life, looked to the mother as the sole educator. But in the case of the poor the mother might not have time to attend to her children; so towards the end of the last century Pestalozzi planned and Oberlin formed day-asylums for young children, the benefit of which was intended no less for the mother than the child. Schools of this kind took in the Netherlands the name of "play school" and in England, where they have especially thriven, of "infant schools." But Froebel's idea of the "Kindergarten" differed essentially from that of the infant schools. He maintained that there was something to do for young children which even the ideal mother in the ideal family could not do. The child required to be prepared for society by being early associated with its equals; and young children thus brought together might have their employments, especially their chief employment, play, so arranged for them as to draw out their capacities

of feeling and thinking, and even of inventing and creating.

According to the development theory all education must be based on study of the nature to be developed. Froebel's study of the nature of children showed him that their great characteristic was restlessness. This was, first, restlessness of body, delight in mere motion of the limbs; and, secondly, restlessness of mind, a constant curiosity about whatever came within the range of the senses, and especially a desire to examine with the hand every unknown object within reach. Children's fondness for using their hands was specially noted by Froebel, and he found that they delighted, not merely in examining by touch, but also in altering whatever they could alter, and further that they endeavoured to imitate known forms whether by drawing or by modelling in putty or clay. Besides remarking in them these various activities, he saw that children were sociable and needed the sympathy of companions. There was, too, in them a growing moral nature, passions, affections, and conscience, which needed to be controlled, responded to, cultivated. Both the restraints and the opportunities incident to a well-organized community would be beneficial to their moral nature, and prove a cure for selfishness.

Froebel held that the essence of all education was to be found in rightly directed but spontaneous action. So the children must be employed; and at that age their most natural employment is play, especially, as Wordsworth has pointed out, games in which they imitate and "con the parts" they themselves will have to fill in after years. Froebel agreed with Montaigne that the games of children were "their most serious occupations," and with Locke that "all the plays and diversions of children should be directed towards good and useful habits, or else they will introduce ill ones" (*Thoughts concerning Education*, §130). So he invented a course of occupations, most of which are social games. Many of the games are connected with the "gifts," as he called the series of simple playthings provided for the children, the first being the ball, "the type of unity." The "gifts" are chiefly not mere playthings but materials which the children work up in their own way, thus gaining scope for their power of doing and inventing and creating. The artistic faculty was much thought of by Froebel, and, as in the education of the ancients, the sense of rhythm in sound and motion was cultivated by music and poetry introduced in the games. Much care was to be given to the training of the senses, especially those of sight, sound, and touch. Intuition or first-hand experience (*Anschauung*) was to be recognized as the true basis of knowledge, and though stories were to be told, and there was to be much intercourse in the way of social chat, instruction of the imparting and "learning-up" kind was to be excluded. Froebel sought to teach the children not what to think but how to think, in this following in the steps of Pestalozzi, who had done for the child what Bacon nearly two hundred years before had done for the philosopher. Where possible the children were to be much in the open air, and were each to cultivate a little garden.

To judge by all appearances at the present date (1881), the kindergarten will be an important institution in the education of the future. The first kindergarten was opened at Blankenburg, near Rudolstadt, in 1840, but after a steady existence of eight years was closed for want of funds. In 1861 the Prussian Government declared that "schools founded on Froebel's principles or principles like them could not be allowed." But the idea had far too much vitality to be starved or frowned down. Although its progress has not been rapid, it has been constant. As early as 1854 it was introduced into England by the then famous Rogers, and Henry Bernard reported on it that it was "by far the most original, attractive, and philosophical form of infant development the world has yet seen" (*Report to Governor of Connecticut*, 1864). But the

attempt failed, and though there are now a Froebel school, an institution for training young women to conduct kindergartens, and also some good kindergartens, Froebel's idea has hardly yet found a home in Britain. The great propagandist of Froebelianism, the Baroness Marenholtz-Bulow, drew the attention of the French to the kindergarten from the year 1855, and Michelet declared that Froebel had "solved the problem of human education." In the department of the Seine the "Salles d'asile" now consist of a class for children from two to four years old, and a "Froebel class" of children from four to six. In Italy the kindergarten has been introduced by Madame Sella-Schwaile, and is used in the education of the poor. In Austria it is recognized and regulated by the government, though the Volks-kindergarten is not numerous. But by far the greatest developments of the kindergarten system are in the United States and in Belgium. Dr William T. Harris, assisted by Miss Blow, tried the experiment of making the kindergarten a part of the public education in St Louis eight years ago, and there are now no less than 8000 children, all over five years of age, in the St Louis public kindergartens. In Belgium the mistresses of the "Ecoles gardiennes" have for some time been instructed in the "idea of the kindergarten" and "Froebel's method," and in 1880 the minister of public instruction, Van Humbeeck, issued a programme for the "Ecoles Gardiennes Communales," which is both in fact and in profession a kindergarten programme. This programme attributes the improvement in infant schools to "le souffle puissant de Froebel"; and, after explaining that the method to be adopted is based on the laws which govern the development of the child, the minister continues: "In its great principles as well as in its main applications this method is that created by the genius of Froebel." This estimate of Froebel's principles contrasts strangely with the Prussian minister's thirty years earlier.

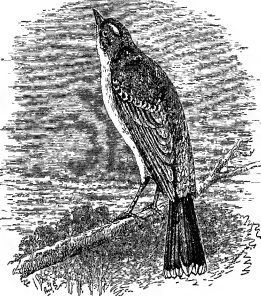
Literature.—Henry Bernard's volume, *Froebel's Kindergarten*, Hartford, U.S.A., 1881, contains a large collection of papers on the subject, original and translated. W. T. Harris's *Report* gives full accounts of the adaptation of the kindergarten to public education at St Louis. Kindergartens in Germany are described in Joseph Payne's *Visit to German Schools*, 1876. Practical guides published in England are J. and B. Rogers's *St ed.*, 1881; E. Wiebes's *Foundations of Children*, and Miss Lynebank's, 1880. Other literature is cited in Steiger's *Opiclopedia of Education*, and in L. Walters's *Die Froebelwerke*, 1881. (R. H. Q.)

KINEMATICS. See MECHANICS.

KING, WILLIAM (1650–1729), a political and religious writer, and successively bishop of Derry and archbishop of Dublin, was born at Antrim in 1650. He was educated at Trinity College, Dublin, and after being presented to the parish of St Werburgh, Dublin, in 1679, was elected dean of St Patrick's, Dublin, in 1688, bishop of Derry in 1691, and archbishop of Dublin in 1702. He died in 1729. King was the author of *The State of the Protestants in Ireland under King James's Government*, 1691, but is best known by his *De Origine Malt*, 1702 (English translation, 1731), an endeavour to reconcile the presence of evil with the existence and goodness of an Omnipotent Being, which was deemed worthy of a reply by Bayle and Leibnitz. He also published a sermon entitled *Divine Predestination and Foreknowledge consistent with the Freedom of Man's Will*, 1709, and various other small treatises.

KING-BIRD, the *Lanius tyrannus* of Linnæus, and the *Tyrannus carolinensis* or *T. pipipi* of most later writers, a common and characteristic inhabitant of North America, ranging as high as 57° N. lat. or further, and westward to the Rocky Mountains, beyond which it goes to Oregon, Washington Territory, and British Columbia, though apparently not occurring in California. In Canada and the northern States of the Union it is a summer visitor, wintering in the south, but also reaching Cuba; and, passing through Central America, it has been found in Bolivia and eastern Peru. Both the scientific and common names of this species are taken from the way in which the cock will at times assume despotic authority over other birds, attacking them furiously as they fly, and forcing them to divert or altogether desist from their course. Yet it is love of his mate or his young that prompts this bellicose behaviour, for it is only in the breeding season that he indulges in it; but then almost every large bird that approaches his nest, from an Eagle downwards, is assailed, and those alone that possess greater command of flight can escape from his repeated charges, which are accompanied

by loud and shrill cries. On these occasions it may be that the King-bird displays the emblem of his dignity, which is commonly concealed, for, being otherwise rather plainly coloured—dark ashy-grey above and white beneath—the erectile feathers of the crown of the head, on being parted, form as it were a deep furrow, and reveal the base, which is of a bright golden-orange in front, deepening into scarlet, and then passing into silvery-white. This species seems to live entirely on insects, which it captures on the wing, and is in bad repute with bee-masters,¹ though, according to Dr. Cuvier, it “destroys a thousand noxious insects for every bee it eats.” It builds, often in an exposed situation, a rather large nest, coarsely constructed outside, but neatly lined with fine roots or grasses, and lays five or six eggs of a pale salmon colour, beautifully marked with blotches and spots of purple, brown, and orange, generally disposed in a zone near the larger end



King-bird

Nearly akin to the King-bird is the Petchary or Chichere, so called from its loud and petulant cry, *T. dominicensis*, or *T. griseus*, one of the most characteristic and conspicuous birds of the West Indies, and the earliest to give notice of the break of day. In habits, except that it eats a good many berries, it is the very counterpart of its congener, and is possibly even more jealous of any intruder. At all events its pugnacity extends to animals from which it could not possibly receive any harm, and is hardly limited to any season of the year.

In several respects both of these birds, with several of their allies, resemble some of the Shrikes, but it must be clearly understood that the likeness is but of analogy, and that there is no near affinity between the two Families *Laniidae* and *Tyrannidae*, which belong to wholly distinct sections of the great Passerine Order, and, while the former is a comparatively homogeneous group, much diversity of form and habits is found among the latter. Similarly many of the smaller *Tyrannidae* bear some analogy to certain *Muscicapidae*, with which they were at one time confounded (see *FRYCHTNER*, vol. ix. p. 351), but the difference between them is deep seated.² Nor is

¹ It is called in some parts the Bee-Martin.

² This is not the place to dwell upon the essential nature of the difference; but two very modes of discriminating them externally may be mentioned. All the *Laniidae* and *Muscicapidae* have but one primary guides in their wings, and their tails are covered with scales

this all, far out of the seventy genera, or thereabouts, into which the *Tyrannidae* have been divided, comprehending perhaps three hundred and fifty species, all of which are peculiar to the New World, a series of forms can be selected which find a kind of parallel to a series of forms to be found in the other group of *Passeres*, and the genus *Tyrannus*, though that from which the Family is named, is by no means a fair representative of it; but it would be hard to say which genus should be so accounted. The birds of the genus *Muscivora* have the habits and almost the appearance of Wheatons, the genus *Alcedo* is called to mind a Water-Wagtail; *Euscarthmus* may suggest a Titmouse, *Elanoides* perhaps a Willow-Wren, but the greatest number of forms have no analogous bird of the Old World with which they can be compared; and, while the combination of delicate beauty and peculiar external form possibly attains its utmost in the long-tailed *Mitralis*, the glory of the Family may be said to culminate in the king of King-birds, *Muscivora rega* (A. N.)

KINGFISHER—*Kingfisher*, Gaim.³, *Rap-pheus* (=pêcheur), Walloon—the *Alcedo* of ornithologists, one of the most beautiful and well-known of European birds, being found, though nowhere very abundantly, in every country of this quarter of the globe, as well as in North Africa and South-Western Asia as far as Sindh. Its blue-green back and rich chestnut breast render it conspicuous as it frequents the streams and ponds whence it procures its food, by plunging almost perpendicularly into the water, and emerging a moment after with the prey—whether a small fish, a crustacean, or an aquatic insect—it has captured. In hard frosts it resorts to the sea-shore, but a severe winter is sure to occasion a great mortality in the species, for many of its individuals seem unable to reach the tidal waters where only in such a season they could obtain sustenance, and to this cause rather than any other (though, on account of its beauty and the utility of its feathers in making artificial flies, it is shot and netted in great numbers) is perhaps to be ascribed its general scarcity. Very early in the year it prepares its nest, which is at the end of a tunnel bored by itself in a bank, and therein the six or eight white, glossy, translucent eggs are laid, sometimes on the bare soil, but often on the fish-bones which, being indigestible, are thrown up in pellets by the birds, and, in any case, before incubation is completed these *rejectiones* accumulate so as to form a pretty cup-shaped structure that increases in bulk after the young are hatched, but, mixed with their fluid excretions and with decaying fishes brought for their support, soon becomes a dripping fetid mass.

The Kingfisher is the subject of a variety of legends and superstitions, both classical and mediæval. Of the latter one of the most curious is that having been originally a plain grey bird it acquired its present bright colours by flying towards the sun on its liberation from Noah's ark, when its upper surface assumed the hue of the sky above it and its lower plumage was scorched by the heat of the setting orb to the tint it now bears.⁴ More than this, the Kingfisher was supposed to possess many virtues. Its dried body would avert thunderbolts, and if kept in a wardrobe would preserve from moths the woollen stuffs

in front only; while in the *Tyrannidae* these are few primaries, and the basal scales extend the whole way round. The more recent distinction in the structure of the thicken seems to have been first detected by Megalithus, who wrote the anatomical descriptions published in 1839 by Audubon (*Orn. Biograph.*, v. pp. 421, 422); but its value was not appreciated till the publication of Johannes Müller's classical treatise on the vocal organs of Passerine Birds (*Abhandl. k. Akad. Wissensch. Berlin*, 1846, pp. 331, 405).

³ But more commonly called *Euscarth*, which finds its counterpart in the Anglo-Saxon *Isen* or *Isem*.

⁴ Rolland, *Racon populaire de la France*, n. p. 74.

therein laid, or hung by a thread to the ceiling of a chamber would point with its bill to the quarter whence the wind blew. All readers of Ovid (*Metam.*, bk. xi.) know how the faithful but unfortunate Ceyx and Alcyon were changed into Kingfishers—birds which bred at the winter solstice, when through the influence of Æolus, the wind-god and father of the fond wife, all gales were hushed and the sea calmed so that their floating nest might ride unharmed over the waves during the seven proverbial "Halcyon Days"; while a variant or further development of the fable assigned to the Halcyon itself the power of quelling storms.¹

The common Kingfisher of Europe is the representative of a well-marked Family of birds, the *Alcedinidae* or *Halcyonidae* of ornithologists, which is considered by some authorities² to be closely related to the *Bucerotidae* (see HORNHILL, vol. xii. p. 169); but the affinity can scarcely be said as yet to be proved; and to the present writer there seems to be at least some ground for believing that a nearer alliance is to be found in the *Galbulidae* (see JACQUARD, vol. xiii. p. 531), *Momotidae* (MORRIS, &c.), *Meropidae*, and perhaps some other Families—though all may possibly be discovered to belong to one and the same larger group. Be that as it may, the present Family forms the subject of a work by Mr. Sharpe,³ which, though still incomplete as regards their anatomy,⁴ is certainly one of the best of its class, and reflects infinite credit on its then youthful author, whose treatment of his subject was most successful. Herein are described one hundred and twenty-five species, nearly all of them being beautifully figured by Mr. Kenlams, and that number may be taken even now as approximately correct; for, while the validity of a few has been denied by some eminent men, nearly as many have since been made known, and it seems likely that two or three more described by older writers may yet be rediscovered. These one hundred and twenty-five species Mr. Sharpe groups in nineteen genera, and divides into two Sub-families, *Alcedininae* and *Daceloninae*,⁵ the one containing five and the other fourteen genera. With existing materials perhaps no better arrangement could have been made, but in the absence of anatomical knowledge it is certainly not to be deemed conclusive, and indeed the method since published by Sundevall (*Testamen*, pp. 96, 98) differs from it not inconsiderably. Here, however, it will be convenient to follow that of Mr. Sharpe. Externally, which is almost all we can at present say, Kingfishers present a great uniformity of structure. One of their most remarkable features is the feebleness of their feet, and the union (syndactylum) of the third and fourth digits for the greater part of their length; while, as if still further to show the comparatively functionless character of those members, in two of the genera, *Alcyon* and *Ceyx*, the second digit is aborted, and the birds have but three toes. In most forms the bill does not differ much from that of the common *Alcedo lapida*, but in *Syns* its edges are serrated, while in *Carcinotus*, *Dacelo*, and *Melidora* the maxilla is prolonged, becoming in the last a very pronounced hook. Generally the wings are short and rounded, and

the tail is in many forms inconspicuous; but in *Tanyptera*, one of the most beautiful groups, the middle pair of feathers is greatly elongated and spatulate, while this genus possesses only ten rectrices, all the rest having twelve. Sundevall relies on a character not noticed by Mr. Sharpe, and makes his principal divisions depend on the size of the scapulars, which in one form a mantle, and in the other are so small as not to cover the back. The *Alcedinidae* are a cosmopolitan Family, but only one genus, *Ceryle*, is found in America, and that extends as well over a great part of the Old World, though not into the Australian Region, which affords by far the greater number both of genera and species, having no fewer than ten of the former and fifty-nine of the latter peculiar to it.⁶

In habits Kingfishers display considerable diversity, though all, it would seem, have it in common to sit at times motionless on the watch for their prey, and on its appearance to dart upon it, seize it as they fly or dive, and return to a perch where it may be conveniently swallowed. But some species, and especially that which is the type of the Family, are not always content to await at rest their victim's showing itself. They will hover like a Hawk over the waters that conceal it, and, in the manner already described, precipitate themselves upon it. This is particularly the way with those that are fishers in fact as well as in name; but no inconsiderable number live almost entirely in forests, feeding on insects, while reptiles furnish the chief sustenance of others. The last is characteristic of at least one Australian form, which manages to thrive in the driest districts of that country, where not a drop of water is to be found for miles, and the air is at times heated to a degree that is insupportable to most animals. The limits of this article forbid an entrance upon details of much interest, but the Belted Kingfisher of North America, *Ceryle alcyon*, is too characteristic a bird of that country to be passed in silence, though its habits greatly resemble those of the European species before described; and the so-called "Laughing Jackass" of New South Wales and South Australia, *Dacelo gigas*—with its kindred forms, *D. leachi*, *D. cervina*, and *D. occidentalis*, from other parts of the country—likewise requires special notice. Attention must also be called to the speculations of Mr. Sharpe (*op. cit.*, pp. xlv. xlvii.) on the genetic affinity of the various forms of *Alcedinidae*, and it is to be regretted that hitherto no light has been shed by palæontologists on this interesting subject, for the only fossil referred to the neighbourhood of the Family is the *Halcyornis tiliapicus* of Professor Owen (*Br. Foss. Mamm. and Birds*, p. 554) from the Eocene of Shappesey—the very specimen said to have been previously placed by König (*Zoon. Foss. ecclis.*, fig. 153) in the genus *Larus*. (A. N.)

KINGLET, a name applied in many books to the bird called by Linnaeus *Motacilla regulus*, and by most modern ornithologists *Regulus cristatus*, the Golden-crested or Golden-crowned Wren of ordinary persons. This species is the type of a small group which has been generally placed among the *Sylviidae* or true Warblers, but by certain systematists it is referred to the Titmouse-Family, *Paridae*. That the Kinglets possess many of the habits and actions of the latter is undeniable, but on the other hand they are not known to differ in any important points of organization or appearance from the former—the chief distinction being that the nostril is covered by a single bristly feather directed forwards. The Golden-crested Wren is the smallest of British birds, its whole length being about 3 inches and a half, and its wing measuring only 2 inches from the carpal joint. Generally of an olive-green colour, the top of its head is bright yellow, deepening into orange, and bounded on either side by a black line, while the wing

¹ In many of the islands of the Pacific Ocean the prevalent Kingfisher is the object of much veneration.

² Cf. RYON, *Centr. Ornithology*, 1850, p. 80; WALLACE, *Ann. Nat. History*, ser. 2, xlviii., pp. 201, 208; and HARTLEY, *Proc. Zool. Society*, 1867, p. 487.

³ A *Monograph of the Alcedinidae or Family of the Kingfishers*, by R. B. Sharpe, 4to, London, 1868-71.

⁴ Some important anatomical points are briefly noticed by Professor Gunnarsson (*Proc. Zool. Soc.*, 1870, p. 280).

⁵ The name of this latter Sub-family as constituted by Mr. Sharpe would seem to be more correctly *Ceyxinae*—the genus *Ceyx*, founded in 1801 by Leach, being the oldest included in it. The word *Dacelo*, invented by Leach in 1818, is simply an anagram of *Alcedo*, and, though of course without any etymological meaning, has been very generally adopted.

⁶ Cf. WALLACE, *Geog. Distr. Animals*, li. n. 315.

coverts are dull black, and some of them tipped with white, forming a somewhat conspicuous bar. The cock has a pleasant but weak song. The nest is a beautiful object, thickly felted of the softest moss, wool, and spiders' webs, lined with feathers, and usually built under and near the end of the branch of a yew, fir, or cedar, supported by the interweaving of two or three laterally diverging and pendent twigs, and sheltered by the rest. The eggs are from six to ten in number, of a dull white sometimes finely freckled with reddish-brown. The species is particularly social, living for the most of the year in family-parties, and often joining bands of any species of Titmouse in a common search for food. Though to be met with in Britain at all seasons, the bird in autumn visits the east coast in enormous flocks, apparently emigrants from Scandinavia, while hundreds perish in crossing the North Sea, where they are well known to the fishermen as "Woodcock's Pilots." A second and more local European species is the Fire-crowned Wren, *R. ignicapillus*, easily recognizable by the black streak on each side of the head, before and behind the eye, as well as by the deeper colour of its crown. A third species, *R. maderensis*, inhabits the Madeiras, to which it is peculiar, and examples from the Himalayas and Japan have been differentiated as *R. himalayensis* and *R. japonicus*. North America has two well-known species, *R. satrapa*, very like the European *R. ignicapillus*, and the Ruby-crowned Wren, *R. calendula*, which is remarkable for a loud song that has been compared to that of a Canary-bird or a Sky-lark, and for having the characteristic nasal feather in a rudimentary or aborted condition. Under the name of *R. modestus*, or "Dalmatian Regulus" of many English authors, two very distinct species are now known to have been confounded, both belonging really to the group of Willow-Wrens, and having nothing to do with *Regulus*. One, which has occurred in Britain, is the *Motacilla superciliosa* of old or *Phylloscopus superciliosus* of modern authors, and is a native of northern Asia, visiting Europe nearly every year, and the other, also of Asiatic origin, is the *Motacilla* or *Phylloscopus proreus*. (A. N.)

KINGS, THE FIRST AND SECOND BOOKS OF, which form the last part of the series of Old Testament histories known as the Earlier Prophets, were originally reckoned as a single book (Josephus, *Orig. ap. Eas.*, *H. E.*, vi. 25; Peshito; Talmud), though modern Hebrew Bibles follow the bipartition which we have derived from the Septuagint. In that version they are called the third and fourth books of kingsdoms (*Βασιλειών*), the first and second being our books of Samuel. The division into two books is not felicitous, and even the old Hebrew separation between Kings and Samuel must not be taken to mean that the history from the birth of Samuel to the exile was treated by two distinct authors in independent volumes. We cannot speak of the author of Kings or Samuel, but only of an editor or successive editors whose main work was to arrange in a continuous form extracts or abstracts from earlier books. The introduction of a chronological scheme and of a series of editorial comments and additions, chiefly designed to enforce the religious meaning of the history, gives a kind of unity to the book of Kings as we now read it; but beneath this we can still distinguish a variety of documents, which, though sometimes mutilated in the process of piecing them together, retain sufficient individuality of style and colour to prove their original independence. Of these documents one of the best defined is the vivid and exact picture of David's court at Jerusalem (2 Sam. ix.-xx.), of which the first two chapters of 1 Kings are manifestly an integral part.¹ As it would be unreasonable to suppose that the editor of the

history of David closed his work abruptly before the death of the king, breaking off in the middle of a valuable memoir which lay before him, this observation leads us to conclude that the books of Samuel and Kings are not independent histories. They have at least one source in common, and a single editorial hand was at work on both. But the division which makes the commencement of Solomon's reign the beginning of a new book is certainly ancient; it must be older than the insertion of the appendix 2 Sam. xxi.-xxiv., which now breaks the continuity of the original history of David's court. From an historical point of view the division is very convenient. The subject of the book of Samuel is the creation of a united Israel by Samuel, Saul, and David. Under Solomon the creative impulse has already died away; the kingship is divorced from the sympathies of the nation; and the way is prepared for the formation of the two kingdoms of Ephraim and Judah, the fortunes of which up to their extinction by the great empires of the East form the main subject of the book of Kings. It is probable, however, that the editor who made the division had another reason for disconnecting Solomon from David and treating his reign as a new departure. The most notable feature in the extant redaction of the book is the strong interest shown in the Deuteronomio "Law of Moses," and especially in the centralization of worship in the temple on Zion as prescribed in Deuteronomy and enforced by Josiah. This interest did not exist in ancient Israel, and is quite foreign to the older memoirs incorporated in the book, amidst the great variety in style and manner which marks the several parts of the history it is always expressed in the same stereotyped phrases and unvarying style; in brief, it belongs to the editorial comments, not to the original sources of the history. To the Deuteronomio editor, then, the foundation of the temple, which is treated as the central event of Solomon's reign, is a religious epoch of prime importance (see especially his remarks in 1 Kings iii. 2 *sq.*), and on this ground alone he would naturally make Solomon's reign commence a new book—the history of Israel under the one true sanctuary.²

When we say in general that the book of Kings was thrown into its present form by a Deuteronomio redactor we do not affirm that he was the first who digested the sources of the history into a continuous work. Indeed the selection of materials, especially in the earlier parts of the narrative, has been thought to point to an opposite conclusion. Nor, on the other hand, must we ascribe absolute finality to his work. He gave the book a definite shape and character, but the recognized methods of Hebrew literature left it open to additions and modifications by later hands. Even the redaction in the spirit of Deuteronomy seems itself to have had more than one stage, as Ewald and other critics recognize. The book was not closed till far on in the exile, after the death of Nebuchadnezzar and Jehoiachin (2 Kings xxv. 27 *sq.*); and the fall of the kingdom of Judah is presupposed in such passages as 2 Kings xvii. 19, 20, xxiii. 28, 27. But these passages are more interjected remarks, which seem to be added to adapt the context to the situation of the Jews in captivity. The main redaction, though subsequent to the reformation of Josiah, which forms the standard with which all previous kings are compared ("the high places were not removed"), does not point to the time of the captivity. Thus, for example, the words "unto this day," 2 Kings viii. 22, xiv. 7, vi. 8, are part of the "epitome" composed by the main redactor (see below), and imply that he wrote before the destruction of the Judæan state.

¹ See this proved in detail, Wellhausen-Block, *loc. cit.*, § 114. The verse 1 Kings ii. 1-12 have no connexion with the rest of the chapter, and are due to a later hand.

² With this it agrees that the later appendix 2 Sam. xxi.-xxiv. does not seem to have passed under the hand of the Deuteronomio redactor. See Wellhausen-Block, § 184.

royal buildings, particularly of the temple, and the account of the dedication of the house (chaps. vi.-ix. 9); and the greater part of the latter account is either due to the redactor or largely rewritten. The whole section is descriptive rather than narrative, and the accurate details might have been got by actual observation of the temple at a date long subsequent to Solomon. In fact, they are not all due to a single hand. Thus we can still reconstruct a shorter text of vi. 17-21, which says only that "the house before the oracle was forty cubits long, and the oracle in the midst of the house within where the ark of Jehovah's covenant was to be placed was twenty cubits in length, breadth, and height; and he overlaid it with gold and made an altar of cedar [the table of shewbread] before the oracle and overlaid it with gold." The original author used the book of Jashar for the account of the dedication, and had access to some exact particulars as to dates, the artist Hiram, &c., which may have been contained in the temple records. The immediate environment of this section, if we set aside the floating elements in chap. ix. already referred to, is occupied with Solomon's dealings with King Hiram, who aided him in his architectural schemes and in the commercial enterprises which procured the funds for such costly works (chap. v. [Heb., v. 15-32] and ch. ix. 10 *sq.*). On each side of this context lies a complex of various narratives and notices illustrating Solomon's wisdom and greatness, but also, in chap. xi., his weakness and the incipient decay of his kingdom. It is evident that the rise of the adversaries who, according to xi. 26, troubled Solomon through all his reign cannot originally have been related as the punishment of the sins of his old age. The pragmatism as usual belongs to the redactor (xi. 4). We have seen that there was once another version of the history of Jeroboam.

In the history of the divided kingdom the redactor, as we have seen, follows a fixed scheme determined by the order of accessions, and gives a short epitome of the chief facts about each king, with an estimate of his religious character, which for the schismatic north is always unfavourable. The epitome, as the religious standpoint shows, belongs to the same hand throughout, *i.e.*, to the Deuteronomistic redactor; but so much of it as relates to Judah is plainly based on good written sources, which from the nature of the particulars referred to may be identified with the book of Royal Chronicles recorded to under each reign, which seems to have been a digest of official notices.

A similar chronicle is named for the kings of Israel, but if it actually lay before the editor he at least did not make such excerpts from it as we find in the Judæan history, for the epitome for Ephraim is very bare of concrete details. Besides the epitome, however, and the short excerpts from the Judæan chronicles which go with it, the history includes a variety of longer narratives, which alike in their subject-matter and their treatment are plainly distinct from the somewhat dry bones of the official records. The northern narratives are all distinguished in a greater or less degree by the prominence assigned to propheta. In the southern kingdom we hear less of the prophets, with the great exception of Isaiah; but the temple occupies a very prominent place.

The history of the man of God from Judah (1 Kings xiii.) is indubitably of Judæan origin. Its attitude to the altar at Bethel—the golden calf does not appear as the ground of offence—is not only diverse from that of Elijah and Elisha, but even from that of Hosea.¹ The other nar-

¹ The expression "dile of Samaria" (ver. 8) reappears only after the deportation of Ephraim (2 Kings xvii. 24, 26), and seems to have come in here from 2 Kings xlii. 19. Even in that passage the last clause of ver. 18, which alone refers to details of the history of 1 Kings xlii., is clearly erroneous; the old prophet did not come from Samaria. Another and later Jewish prophet foretold the fall of the altar of Bethel, *viz.*, Amos of Tekoa.

atives that deal with the history of Ephraim are all by northern authors (see, for example, 1 Kings ix. 3; 2 Kings ix. 6), and have their centre in the events of the Syrian wars and the persons of Elijah and Elisha. But they are not all of one origin, as appears most clearly by comparing the account of the death of Naboth in the history of Elijah, 1 Kings xxi., and the history of Elisha and Jehu, 2 Kings ix. In the latter narrative Naboth's "field" has a little way from Jezreel, in the former it is close to Ahab's palace (*query*, in Samaria?—see ver. 18 and variants of LXX, in ver. 1), and is described as a vineyard. The "burden" quoted by Jehu is not in the words of 1 Kings xxi., and mentions the additional fact that Naboth's sons were killed.² In other words, the history of Jehu presupposes events recorded in the extant accounts of Elijah, but not these accounts themselves. And the narrative in 2 Kings seems to be the more accurate; it contains precise details lacking in the other.

Now it is plain that 1 Kings xxi. belongs to the same history of Elijah with chaps. xvii.-xx. The figure of the prophet is displayed in the same weird grandeur, and his words (omitting the addition already noted in verses 20b *sq.*) have the same original and impressive force. That history, a work of the highest literary art, has come down to us as a fragment. For in 1 Kings xxi. 16 Elijah is commanded to take the desert route to Damascus, *i.e.*, the route east of the Jordan. He could not, therefore, reach Abel Meholah in the Jordan valley, near Bethshean, when he "departed thence" (ver. 19), if "thence" means from Horeb. The journey to Damascus, the anointing of Hazael and Jehu, must once have intervened, but they have been omitted because another account ascribed these acts to Elisha (2 Kings vii. ix.). Now there is no question that we possess an accurate historical account of the anointing of Jehu. Elisha, long in opposition to the reigning dynasty (2 Kings ii.), and always keeping alive the remembrance of the murder of Naboth and his sons (vi. 82), waited his moment to effect a revolution. It is true that the prime impulse in this revolution came from Elijah; but, when the history in 1 Kings represents Elijah as personally commissioned to inaugurate it by anointing Jehu and Hazael as well as Elisha, we see that the author's design is to gather up the whole context between Jehovah and Baal in an ideal picture of Elijah and his work. In doing this he also places Ahab in a different light from that in which he appears in the other extant histories. Had we only his account we might suppose that Ahab had altogether rejected Jehovah and aimed at introducing a new national worship. But, in fact, we learn from the other records that, while like Solomon before him he gave countenance to his wife's religion, Ahab still regarded Jehovah as the God of Israel, consulted His prophets, and gave to his sons names expressive of devotion to the old faith. The ideal delineation of Elijah conveys a vivid picture of his imposing personality and permanent influence; but it records the impression he left behind him rather than the literal details of his life, and is no doubt of younger date than the more photographic picture of the accession of Jehu, though prior to the rise of the new prophesy under Amos and Hosea.³

² The standing phrase common to 1 Kings xxi. 20b *sq.*, 2 Kings ix. 7-10a, belong to the redaction, as is plain in the latter case from ix. 8.

³ Some expressions that point to a later date are certainly added by another hand, *e.g.*, the last part of xvii. 18. In old Israel, up to the time of Hosea, the Baalim (pl.) are the golden calves, which have no place in this context. A late insertion also is the definition of time by the stated oblation in the temple at Jerusalem, xvii. 20, 26. At ver. 86 this is lacking in the LXX; at ver. 28 the longer insertion of the LXX. reveals the motive for the interpolation, *viz.*, to assimilate Elijah's sacrifice to the legal service. The true text says that, when noon was

The episode of Elijah and Ahabah, 2 Kings i., is certainly by a different hand, as is seen even from the new feature of revelation through an angel; and the ascension of Elijah, 2 Kings ii., is related as the introduction to the prophetic work of Elisha.

The narratives about Elisha are not all by one hand, for example, iv. 1-7 is separated from the immediately subsequent history by a sharply marked grammatical peculiarity (the suffix *ו*), moreover, the order is not chronological, for vi. 24 cannot be the sequel to vi. 23; and in general those narratives in which the prophet appears as on friendly terms with the king, and possessed of influence at court (e.g., iv. 13, vi. 9, vi. 21 compared with xiii. 14), plainly belong to the time of Jehu's dynasty, though they are related before the fall of the house of Omri. In this disorder we can distinguish portions of an historical narrative which speaks of Elisha in connexion with events of public interest, without making him the central figure, and a series of anecdotes of properly biographical character. The historical narrative embraced 2 Kings iii., vi. 24-vii. 20, ix. 1-x. 28, in fact, the whole account of the reign of Joram and the revolution under Jehu; and, as 2 Kings iii. has much affinity to the history of Ahab and Jehoshaphat in 1 Kings xxi., we may add the earlier history of the Syrian wars (1 Kings xx., xxii.) to the series. The evidence of style is hardly sufficient to assign all these chapters to a single hand (for example, *וְכָל* is a single chariot in the history of Jehu, but in 1 Kings xx. a collective, the single chariot being *וְכָל־כֵּסֶלֶךְ*); but they are all full of fresh detail and vivid description, and their sympathy with the prophets of the opposition, Micah and Elisha, and with the king of Judah, who takes the prophets' part, does not exclude a genuine interest in Ahab and Joram, who are painted in very human colours, and excite our pity and respect. To the historian these chapters are the most valuable part of the northern history; and the most surprising details have received striking verification from modern research. The stone of Mesha supplies details to 2 Kings iii. 5; the method of obtaining water suggested by Elisha (iii. 16, 17) is that which still gives its name to W. el-Hassâ at the southern end of the Dead Sea (see Wetstein in Delitzsch, *Gen.*, 4th ed., p. 587); and the sudden retreat of the Syrians in 2 Kings x. is very intelligible when we know that they were already at that time pressed by the Assyrians (see on all these points Wellhausen, *op. cit.*).

In the more biographical narratives about Elisha we may distinguish one circle connected with Gilead, Jericho, and the Jordan valley for which Abel-meholah belongs (iv. 1-7, 38-44, ch. v.; vi. 1-7). Here Elisha appears as the head of the prophetic guilds, having his fixed residence at Gilead. Another circle, which presupposes the accession of the house of Jehu, places him at Dothan or Carmel, and represents him as a personage of almost superhuman dignity. Here there is an obvious parallelism with the history of Elijah, especially with his ascension (compare 2 Kings vi. 17 with ii. 12; xiii. 14 with ii. 12); and it is to this group of narratives that the ascension of Elijah forms the introduction.¹

Of the Judean narratives there is none to rival the past and there was no answer to the prophets of Baal, Elijah intervened. Thus we get time for the events which as the text stands could not have all happened the same evening. In 2 Kings iii. 30 for *וַיִּחַר* read *וַיִּחַר*.

The Gilead of Elisha is near the Jordan—comp. vi. 1 with iv. 8, *וַיִּחַר*—and cannot be other than the great sanctuary 2 miles from Jericho, the local holiness of which is still attested in the *Onomasticon*. It is true that in 2 Kings i. 1 Bethel seems to lie between Gilead and Jericho; but ver. 26 shows that Gilead was not originally represented as Elisha's residence in this narrative, which belongs to the Carmel-Dothan series. Hence Robinson's Gilead (Jiljila) seems not to be Gilead.

northern histories in picturesque and popular power. The history of Josiah, 2 Kings xi., xii., of Ahas's innovations, xvi. 10 sq., and of Josiah's reformation, xxii. 3-xxiii. 37, have their common centre in the temple on Zion, and may with great probability be referred to a single source. The details suggest that this source was based on official documents. Besides these we have a full history of Hezekiah and Sennacherib and of Hezekiah's sickness, xvii. 13-xx. 18, repeated in a somewhat varying text in Isa. xxxvi.-xxxix. (compare ISRAEL, vol. xiii. p. 413 sq.). The history of Amariah and Josiah in 2 Kings xiv., with the characteristic parable from vegetable life, may possibly be of northern origin.

When we survey these narratives as a whole we receive an increased impression of the merely mechanical character of the redaction by which they are united. Though editors have added something of their own in almost every chapter, generally from the standpoint of religious pragmatism, there is not the least attempt to work the materials into a history in our sense of the word; and in particular the northern and southern histories are practically independent, being merely pieced together in a sort of mosaic in consonance with the chronological system, which we have seen to be really later than the main redaction. It is very possible that the order of the pieces was considerably readjusted by the author of the chronology; of this indeed the LXX. still shows traces. But with all its imperfections, as judged from a modern standpoint, the redaction has the great merit of preserving the older narratives in their original colour, and bringing us much nearer to the actual life of the old kingdom than any history written throughout from the standpoint of the exile could possibly have done.

Literature.—Since Ewald's *History*, vols. i. and ii., and Kuenen's *Onderzoek*, the most thorough and original investigation of the structure of the book is that in Wellhausen's edition of *Die Geschichte des Volkes Israel* (1878), with which the corresponding section of his *Geschichte* (1878) should be compared. There are modern commentaries by Thomsen (Leipzig, 1849, 2d ed. 1878) and Keil (2d ed. 1878, English translation, 1879); by Balch in Lange's *Bible* (1888, English translation, 1879); by Rawlinson in the *Speaker's Commentary*; and in Reuss's *Bible*. The Assyrian material, which is of the highest value, but requires to be still further sifted, is collected in Schrader's *Kleinere Schriften und altes Testament* (Gießen, 1873), Smith's *Assyrian Epigraphy*, and other works. Translations of the chief inscriptions are given in *Records of the Past*, London, v. y. (W. R. S.).

KING'S COUNTY, an inland county in the province of Leinster, Ireland, is situated between 52° 50' and 53° 25' N. lat., and between 6° 59' and 8° 1' W. long., and is bounded on the N. by Meath and Westmeath, on the W. by Roscommon, Galway, and Tipperary, on the S. by Tipperary and Queen's county, and on the E. by Kildare. It is oblong in shape, but of very irregular outline. Its greatest breadth from north to south is 30 miles, and its greatest length from east to west 45 miles. The area is 493,019 acres, or about 770 square miles.

Geology.—The greater part of the county is occupied by the limestone strata of the central plain. In the south-east the Slieve Bloom mountains, composed of clay-slate surrounded by sandstone, form the boundary between King's county and Queen's county, and run into the former county from south-west to north-east for a distance of about 20 miles, consisting of a mass of lofty and precipitous crags through which there are two narrow passes, the Black Gap and the Gap of Glandine. In the north-east Croghan Hill, a beautiful green eminence consisting of trap conglomerate, rises to the height of over 700 feet. The remainder of the county is flat, but a range of low limestone hills crosses its north-eastern division to the north of the Barrow. In the centre of the county from east to west a large portion is occupied by the Bog of Allen. Along the Slieve Bloom mountains iron is found in small

quantities, and also manganese, ochre, chalk, and potter's clay. Excellent clay-slate flags are quarried. In several places there are bands of foliated limestone, of a greenish hue and granular in texture, which forms a very useful manure.

Rivers.—The county shares in the advantage of the navigation of the Shannon, which skirts its western side and forms its boundary line with Roscommon and Galway. The Brosna, which issues from Loch Ennell in West Meath, enters the county near the town of Clam, and flowing south-westwards across its north west corner, discharges itself into the Shannon after receiving the Clodagh and the Broughill. A small portion of the north-eastern extremity is skirted by the Boyne. The Barrow forms the south-eastern boundary with Queen's county. The Little Brosna, which rises in the Slieve Bloom mountains, forms the boundary of King's county with Tipperary, and falls into the Shannon.

Climate, Soil, and Agriculture.—Notwithstanding the large area occupied by bogs, the climate is generally salubrious, and it is less moist than that of several neighbouring districts. The soil naturally is not of great fertility except in special cases, but is capable of being rendered so by the judicious application of bog and lime manures according to its special defects. It is generally either a deep bog or a shallow gravelly loam. On the former soil corn crops are late in ripening during wet seasons, which on the other hand are specially suitable for the gravelly soils. On the borders of the Slieve Bloom mountains there are some very rich and fertile pastures, and there are also extensive grazing districts on the borders of West Meath, which are chiefly occupied by sheep. Along the banks of the Shannon there are some fine tracts of meadow land. With the exception of the tract occupied by the Bog of Allen, the remainder of the county is nearly all under tillage, the most productive portion being that to the north-west of the Hill of Croghan.

The following table gives a classification of holdings according to size in 1850 and 1880:—

	Under 1 Acre.	1 to 5 Acres.	5 to 15 Acres.	15 to 50 Acres.	50 Acres and upwards.	Total.
1850	1,400	2,748	8,414	9,478	3,078	18,229
1880	1,718	1,030	2,909	2,013	8,333	11,461

The total area under crops in 1881 was 119,751 acres—24.2 per cent of the total acreage of the county. In 1890 238,667 acres (48.4 per cent) were under grass, 424 fallow, 8651 woods, 108,778 (the large percentage of 24.1) bog, 6048 mountain, and 15,827 water, roads, and lanes. The area under crops in 1850 was 188,688 acres, or 24.814 more than in 1880 and 18,787 more than in 1881. The area under cereals declined between 1850 and 1881 from 70,088 to 40,288, that under wheat decreasing from 20,410 to only 1486, that under corn from 87,787 to 28,082, but that under other cereals, of which nearly the whole acreage is under barley, increased from 11,471 to 15,746. Between 1851 and 1880 the area under grass increased by 46,427 acres, a change due in a considerable degree to reclamation. The area under meadow and clover only increased from 40,848 to 44,785 acres. The area under green crops between 1851 and 1881 diminished from 30,551 to 26,178 acres, that under potatoes diminishing from 17,907 to 15,793, while that under turnips increased from 9418 to 9568. Anciently nearly the whole of the county was covered by a vast forest, and, on the borders of Tipperary it is still richly wooded.

Horses, which are a much better breed than the average of Ireland, increased from 19,990 in 1850 to 18,406 in 1881. The number in 1881 used for agricultural purposes was 8889. Mules increased from 817 to 1209, and asses from 4212 to 6931. Cattle in 1850 numbered 47,978, and in 1881 had increased to 68,165. Cows in 1881 numbered 14,749. Dairies are numerous in the northern part of the county on the borders of Meath, but in other districts cattle-feeding is more largely presented than dairy farming. Sheep, which are pastured chiefly on the hilly districts, and have been much improved by crossing, in 1850 numbered 65,559, and in 1880 had increased to 97,870. Goats since 1850 have declined in numbers from 4089 to 8910. Pigs have increased from 15,460 to 20,826, and poultry from 158,164 to 271,878.

According to the corrected summary for 1878 of the landowners

return, the land in 1873 was divided among 1140 owners, of whom 353, or 31 per cent, possessed less than 1 acre. The annual rateable valuation was £248,204, giving an average value per acre of 9s 11d. Forty-six proprietors possessed more than 2000 acres, thirteen had upwards of 5000 acres, and five upwards of 10,000 acres, viz., Lord Digby, 20,722; Earl of Rosse, 22,513; Earl of Charleville, 20,639; Marquis of Downshire, 18,670; and Col. T. Borsard, 18,165.

Railways.—A branch of the Great North-Western Railway traverses the county by Portlanning, Clam, and Banagher, and there is also a branch of the same line from Illesce to Parnstown. The Grand Canal traverses the county from Edenderry in the east to the Shannon in the west.

Administration.—The county comprises twelve baronies, forty-two civil parishes and nine parts of parishes, and 1160 townlands. It contains portions of five poor-law unions, viz., Edenderry, Mountmellick, Parnstown, Rosene, and Tullamore. The county moulds part of the parliamentary borough of Portlanning (the remainder being in Queen's county), and two townships, Parnstown and Tullamore. Assizes are held at Tullamore and quarter-sessions at Parnstown, Philipstown, and Tullamore. King's county is in the Dublin military district, and there are barracks at Parnstown, Banagher, Philipstown, Rosene, Shannon Bridge, and Tullamore. Previous to the Union, King's county returned six members to parliament, two for the county, and two for each of the boroughs of Philipstown and Banagher, but since then only the two county members have been returned.

Population.—The total population of the county in 1850 was 8316, of whom 7035 were Irish and 1325 English. The estimate of De Bargo in 1760 made it 45,613. In 1821 it had increased to 181,088 and in 1841 to 147,551, but in 1851 it had diminished to 112,798, in 1871 to 75,900, and in 1881 to 72,668, of whom 86,942 were males and 86,728 were females. The number of emigrants from 1st May 1851 to 31st December 1880 was 41,748, or 4.6 per cent. of the population in 1851, 21,437 being males and 20,361 females. The marriage rate in 1880 to every 1000 of the estimated population was 8.9, the birth rate 28.5, and the death rate 18.2. In 1881 the Roman Catholics numbered 64,984, the Protestants Episcopalians 1760, the Presbyterians 386, the Methodists 421, and all other denominations 228. The number of natives of England and Wales in the county in 1841 was 298, which had increased in 1871 to 1087; the natives of Scotland in the same years were 109 and 208. The number in 1871 who could speak Irish and English was 245, and in 1881 it was 890. In 1851 there were 18,960 persons who could read and write, 18,157 who could read but could not write, and 28,388 who could neither read nor write.

History.—King's county, with portions of Tipperary, Queen's county, and Kildare, at an early period formed one kingdom under the name of Hy Falgia or Offala, a title which it retained after the landing of the English. Subsequently it was known as Glenamally, Western Glenamally pretty nearly corresponding to the present King's county, and Eastern Glenamally to Queen's county. The principal seats of the district were the O'Connors and the O'Carrolls, whose estates and those of the other leading families were forfeited about the middle of the 16th century. By a statute of 1557 the western district was constituted a shire under the name of King's county in honour of Philip—the principal town formerly the seat of the O'Connors, being called Philipstown, and at the same time the name of the county was changed to Queen's county in honour of Mary. The subjugation of King's county was, however, not completely accomplished till about the beginning of the 17th century, when the O'Connors and their followers were totally routed and dispersed by Sir Oliver Lambert. After the Cromwellian wars a large number of estates were forfeited on account of the insurrectionary actions of Sir John O'Neill.

Antiquities.—Perhaps the oldest antiquarian relic is the large pyramid of white stones in the Slieve Bloom mountains called the Temple of the Sun or the White Obelisk. There are a considerable number of Danish raths, and a chain of mounds commanding the passes of the bogs extended throughout the county. The most important ecclesiastical ruins are those of the seven churches of Clonmacnoise on the Shannon in the north-west of the county, where an abbey was founded by St. Kieran in 548. Afterwards it was formed into a see, which was united with that of Meath in 1668. Within the walls there are several small chapels erected over the graves of ancient chieftains, and also one or two richly ornamented crosses. Adjoining the ecclesiastical ruins are the remains of round towers and of an old castle. Amongst the more famous religious houses in addition to Clonmacnoise were Durrow Abbey, founded by St. Columba in 560; Monasteraden, founded in the 11th century by the monks of Louth; and Selkirk Abbey, founded in the beginning of the 12th century. The principal old castles are Rathmore, probably the most ancient in the county; Banagher, commanding an important pass on the Shannon; Leep O'Kelly in the Slieve Bloom mountains; and Binn or Parnstown, at the west of the east of Rosene, whose fathers erected there the well-known great telescope.

KINGSLEY, CHARLES (1819-1875), an English clergyman, poet, and novelist, was born on the 12th June 1819, at Holne vicarage, Dartmoor, Devon. His early years were spent at his father's living in the Fyn country, and afterwards in North Devon. The scenery of both made a great impression on his mind, and was afterwards described with singular vividness in his writings. He was educated at private schools and at King's College, London, after his father's promotion to the rectory of Chelsea. In 1838 he entered Magdalene College, Cambridge, where he took his degree in 1842, first-class in classics, and senior optime in mathematics. In the same year he was ordained to the curacy of Eversley in Hampshire, to the rectory of which he was not long afterwards promoted, and this was his home for the remaining thirty-three years of his life, although his residence there was much broken by various domestic circumstances as well as, in later years, by promotion to other offices in the church.

In 1844 he married Fanny, daughter of Passoa Grenfell, and in 1848, when aged twenty-nine, he published his first volume, *The Saint's Tragedy*. In 1860 he was appointed to the professorship of modern history in the university of Cambridge, which he resigned in 1869, and was soon after appointed to a canonry at Chester. In 1873 this was exchanged for a canonry at Westminster. He died at Eversley, after a short illness, on the 23d January 1875.

It will be seen that his life had but few incidents. With the exception of occasional changes of residence in England, generally for the sake of his wife's health, one or two short holiday trips abroad, a tour in the West Indies, and another in America to visit his eldest son settled there as an engineer, his life was spent in the peaceful, if active, occupations of a clergyman who did his duty earnestly, and of a vigorous and prolific writer. But in spite of this outward peace he was for many years one of the most prominent men of his time, who both personally and by his works had no little influence on the thought of his generation. Though at no time profoundly learned, he was a man of wide and various information, whose interests and sympathies embraced almost all branches of human knowledge as well as speculations on subjects on which men but slowly learn that speculation avails them nothing. Gifted with great powers of language, both written and in conversation, with a keen wit, and a fund of knowledge far above the average, there were few subjects in which he did not shine, and many in which he excelled. The inherited peculiarities of his opinions and temperament, which made him seemingly though not really inconsistent, excited curiosity, and were in part the reason of his great attractiveness. Sprung on the father's side from an old English race of country squires, and on his mother's side from a good West Indian family who had been slaveholders for generations, he had the keen love of sport and the exceeding sympathy with country folk often fostered by such pursuits, while he had at the same time much of the aristocratic scorn for lower races to be found among those who have been in a dominant position among them.

With the sympathetic organization which made him keenly sensible of the wants of the poor, he threw himself heartily into the movement known as Christian Socialism, of which Mr Maurice was the recognised leader, and for many years he was considered as an extreme radical in a profession which holds as a rule but few such. While in this phase of mind he wrote his novels *Yeast* and *Alton Locke*, in which, though he pointed out unapologetically the folly of extreme, his sympathies were unmistakably shown to be, not only with the poor as in their strife against the rich, but with much that was done and said by

the leaders in the Chartist movement. Yet even then he considered that the true leaders of the people were a poor and a den, and there was no real inconsistency in the fact that at a later period he was among the most strenuous defenders of Governor Eyre in the measures adopted by him to put down the Jamaican disturbances. In politics he might therefore have been described as a Tory aristocrat tempered by sympathy, or as a Radical tempered by hereditary scorn of subject races. The like seeming but not real inconsistencies were to be found in his attitude as a clergyman. He was a man of earnest piety, and lived so near in his own mind to the great realities of the unseen world that he could even afford to speak of serious subjects in a way which in one less reverent than he would have seemed to lack reverence; and, while he held in many respects what would be called a liberal theology, the church, its organization, its creed, its dogma, had ever an increasing hold upon him. Although at one period he certainly shrunk from reciting the Athanasian creed in church, he was towards the close of his life found ready to join an association for the defence of this symbol. With these two influences at work in his mind, it was not unnatural that the more orthodox and conservative should gain the upper hand as time went on, but the careful students of him and his writings will find a deep conservatism underlying all the most radical utterances of his earlier years, while a passionate sympathy for the poor, the afflicted, and the weak held possession of him till the last hour of his life.

Both as a writer and in his personal intercourse with men Kingsley was a thoroughly stimulating teacher. He would not probably have wished to found a school, and most certainly never did so. As with his own teacher Mr Maurice, his influence on other men rather consisted in the fact of his inducing them to think for themselves than that he led them to adopt his own views. Perhaps these were at no time quite definite enough to have been reduced to such system as is demanded for one who would make his disciples think as himself. But his healthy and stimulating influence went far beyond the boundaries of his parish, his canonries, and his wide circle of friends, and was largely attributable to the fact that he gave utterance to the thoughts which were stirring in many minds during the time of his own most vigorous life. His originality, which was great, lay rather in his manner of crystallizing the current thoughts of men, and giving them apt expression, than in any new discoveries in the matters of which he treated. Just because he was completely the product and the mouthpiece of his own time, it may be doubted whether his influence on the future will be very great, and it is possible that men who may read his works by chance some years hence will fail to understand how wide was the influence he exercised.

As a preacher he was vivid, eager, and earnest, equally plain-spoken and uncompromising when preaching to a courtly congregation or to his own village poor. One of the very best of his writings is a sermon called *The Message of the Church to Working Men*; but as a rule his sermons cannot be read with the interest with which they were heard, and none of his later published sermons equal the little volume of *Twenty-five Village Sermons* which he preached in the early years of his Eversley life.

As a novelist his chief power lay in his descriptive faculties. *Yeast* and *Alton Locke* were written out of the heat of strong conviction, and dealt in a brilliant manner with great social questions, but the later novels seem to have been written rather because he wished to say something than because he had something to say, and in spite of new and ever new editions it may be doubted whether the real interest felt in these works is considerable. Few persons

read them twice, although it is fair to say that this may partially arise from the fact that the story is so vividly told that it is not forgotten, and therefore needs no second reading. But the descriptions of South American scenery in *Westward Ho*, of the Egyptian desert in *Hypatia*, of the North Devon scenery in *Two Years Ago*, are among the most brilliant pieces of word-painting in English prose writing, and the American scenery is even more vividly and more truthfully described when he had seen it only by the eye of his imagination than in his work *At Last*, which was written after he had visited the tropics.

As a poet he wrote but little, but that little he wrote with singular facility, and there are passages in the *Saint's Tragedy*, and many isolated lyrics, which ought to take their place in all future standard collections of English literature. *Andromeda* is a very successful attempt at naturalizing the hexameter as a form of English verse, and reproduces with great skill the amorous roll of the Greek original.

In person Charles Kingsley was tall and spare, sinewy rather than powerful, and of a restless excitable temperament. His complexion was swarthy, his hair dark, and his eyes bright and piercing. His temper was hot, kept under rigid control, his disposition tender, gentle, and loving as that of a woman, with flashing scorn and indignation against all that was ignoble and impure, he was a good husband, father, and friend.

Kingsley's life has been written by his widow, in two volumes, entitled *Charles Kingsley, his Letters and Memories of his Life*, and presents a very touching and beautiful picture of her husband, but perhaps hardly does justice to his humour, his wit, his overwinding vitality and boyish fun.

The following is a list of Kingsley's writings:—*Satanstoe Tragedy*, a drama, 1848; *Alton Locke*, a novel, 1849; *Two Years Ago*, a novel, 1851; *The Village Sermons*, 1849; *Phantoms, or Loose Thoughts for Loose Thinkers*, 1852; *Sermons on National Subjects*, 1st series, 1852, *Hypatia*, a novel, 1853; *Glaucon, or the Wonders of the Shore*, 1854; *Sermons on National Subjects*, 2d series, 1854; *Alexandria and her Schools*, 1854; *Washington*, a novel, 1855; *Sermons for the Times*, 1855; *The Heroes*, Greek fairy tales, 1858; *Two Years Ago*, a novel, 1857; *Andromeda and other Poems*, 1858; *The Good News of God*, sermons, 1859; *Miscellaneous*, 1859; *Limits of Exact Science applied to History* (inaugural lectures), 1860; *Town and Country Sermons*, 1861; *Sermons on the Pentateuch*, 1868; *Water-babies*, 1863; *The Roman and the Teuton*, 1864; *David and other Sermons*, 1866; *Hereward the Wake*, a novel, 1869; *The Ancient Regime* (Lectures at the Royal Institution), 1867; *Water of Life and other Sermons*, 1867; *The Hermit*, 1869; *Madam How and Lady Why*, 1869; *At Last*, 1871; *Town Geography*, 1872; *Discipline and other Sermons*, 1872; *From Idylls*, 1878; *Plays and Parables*, 1878; *Health and Education*, 1874; *Westminster Sermons*, 1874; *Lectures delivered in America*, 1875. He was a large contributor to periodical literature; many of his essays are included in *Prose Idylls* and other works in the above list. But no collection has been made of some of his more characteristic writings in the *Christian Socialist and Politics for the People*, many of them signed by the pseudonym he then assumed, "Parson Lot." (O. K. F.)

KINGSTON, the chief city of Upper Canada, New York, United States, is situated on the west bank of the Hudson, about 90 miles north of New York. Its harbour is formed by the navigable portion of Rondout Creek. Among the chief buildings are the city hall, the music-hall, the almshouses, and the county buildings. Kingston is a very busy shipping centre, with 4 miles of wharfrage, and steam and other shipping representing a considerable aggregate tonnage. As the centre of the blue stone region, Kingston ships an immense quantity of that mineral; and, possessing the largest cement factory in the country, its out-turn of that material together with bricks, ice, lime, timber, and other goods swells the amount of its exports to upwards of a quarter of a million tons per annum. The manufactures of the town include salt, tobacco, glass, carriages, beer, boats, and bricks. The population in 1880 was 18,342.

Kingston city was incorporated in 1872. The first settlement on the spot was made about 1665. At Kingston was framed the first

Constitution of New York State, in 1777. In September 1777 the British, under Sir Henry Clinton, scattered the State legislature which had met at Kingston, and in October burned the village.

KINGSTON, the chief city of Frontenac county, Ontario, Canada, is situated at the north-eastern extremity of Lake Ontario, at the point where the St Lawrence issues from it, and at the mouth of the Catarqui Creek, about 160 miles east of Toronto by the Grand Trunk Railway. Of the many fine buildings the chief are the city-hall, the market, the custom-house, the court-house and jail, the post-office, and the university. Among the charities are a hospital, an orphanage, a combined hospital and orphanage, a house of industry, and a house of refuge. The penitentiary and the lunatic asylum are at a little distance from the city. Kingston is the seat of Queen's university and college, and of a medical college affiliated to the university. The Roman Catholic Megopolis college has been closed since 1869. The royal military college of the Dominion is at Kingston. The harbour is deep, spacious, and sheltered, and brisk trade is carried on. As a naval station Kingston occupies an important position. It commands the entrance to the Rideau Canal, and is strongly fortified. Shipbuilding, iron-founding, and the manufacture of locomotives, steam-engines, and machinery, leather, soap and candles, boots and shoes, cotton, and wooden goods are carried on by the inhabitants. Kingston is the seat of an Anglican and of a Roman Catholic bishop. The population in 1881 was 14,093.

Kingston occupies the site of the old French fort Frontenac. It received its present name after it was taken by the British in 1769. For three years (1841-44) it was the capital of Canada.

KINGSTON, the capital of Jamaica. See JAMAICA. KINGSTON-ON-THAMES, a municipal borough and market-town of England, county of Surrey, extends for about a mile and a half along the right bank of the Thames, and is distant from London about 20 miles by the river and 12 miles by rail and road. The ancient wooden bridge over the river, which was in existence as early as 1294, was superseded by a structure of stone in 1837. The town is irregularly built, but its suburbs contain many fine houses and villas embosomed in trees, and of late years it has been rapidly increasing. Public walks and gardens have been constructed along the river. The parish church of All Saints, chiefly Perpendicular in style, contains several brasses of the 15th century; the grammar school, rebuilt in 1878, was originally founded as a chantry by Edward Lovekyn in 1305, and converted into a school by Queen Elizabeth. Near the parish church stood until 1779 the chapel of St Mary, where, it is alleged, the Saxon kings were crowned. The ancient stone said to have been used as a throne at these coronations was removed to the market-place in 1850. A town-hall in the Italian style was erected in 1840, the former building having been a very ancient structure. There are several foundation schools and a large number of charities. The growth of the town has been owing chiefly to the increasing number of London business men who have made it their residence, its proximity to Richmond park and Hampton Court no doubt aiding its popularity. There are large market gardens in the neighbourhood, and the town possesses oil-mills, flour-mills, breweries, and brick and tile works. A little distance up the river are the works of several London water companies. An annual cattle fair is held in November, and county sessions are held at Lent. The population of the municipal borough in 1881 was 19,876.

Kingston doubtless derived its name from the fact that at an early period it was a royal demesne. On digging the foundation for the new bridge a large number of important Roman remains were discovered, and on this account many believe that it was at this spot that Cæsar crossed the Thames when in pursuit of Cassivelaunus. In 938 it was the seat of a witanagmoot convened

by King Egbert. From Edm. in 901 to Ethelred in 978 it was the place where the Anglo-Saxon kings were crowned. Kingston returned members to parliament from the 4th of Edward I. to the 47th of Edward III. It received a charter of incorporation from King John, which was confirmed and extended by several subsequent monarchs. In 1264 the castle of Kingston, no trace of which now remains, was taken by Henry III. In 1648 it was made the rendezvous of forces designed for the release of Charles I. from the Isle of Wight, but in the skirmish near the town the Royalists were defeated, and Lord Francis Villiers was killed.

See Rents, *Charters of the Town of Kingston, 1797*, and the histories of the town by Andouin, 1818, and Hildon, 1812.

KINGSTON-UPON-HULL. See HULL, vol. xii p 340¹

KINGSTON, WILLIAM HENRY GILES (1814-1880), boys' novelist, was born in London, February 28, 1814. Much of his youth was spent at Oporto, where his father was a merchant, but when he joined his father in business, and afterwards when he carried on business for himself, he lived chiefly in London. In 1844 his first book, *The Cirrasiian Chief*, appeared, and its success led to the publication in 1845 of *The Prime Minister, a Story of the Days of the Great Marquis of Pombal. The Lusitanian Sketches* that appeared soon after describe Kingston's travels in Portugal. In 1851 *Peter the Whaler*, his first book for boys, came out. That and its immediate successors were received with such unequivocal popularity that Kingston retired from business, and devoted himself to the production of tales of adventure for boys. Within thirty years he wrote upwards of one hundred and thirty such books. He travelled at various times in many of the countries of Europe, and lived for a while in Portugal during the civil war there. His *Western Wanderings*, published in 1856, describes a tour in Canada. In all philanthropic schemes Kingston took deep interest; he was the promoter of the mission to seamen; and he acted as secretary of a society for promoting an improved system of emigration. He was a supporter of the volunteer movement in England from the first. For his services in bringing about a commercial treaty between Portugal and Britain he was knighted by the queen of Portugal; and his literary merits were recognized at home by a grant from his own sovereign. He died at Willesden, August 5, 1880.

Kingston's boyish ambition had been to enter the navy, and he always kept his affection for the sea. As he advanced in life he had opportunities of cruising in men-of-war, besides sailing in merchantmen and his own yacht; and it was thus that he gained the knowledge of practical seamanship that he used so graphically in his books. Most of his stories are stories of the sea; and he generally laid his plots in the old romantic days before England's wooden walls had given place to iron-clads. He was a master of the simple romance in which boys delight, and knew well how to draw the peculiar compound of valour and magnanimity that forms the hero to healthy boyhood. He had great assimilative power in using the accounts of travellers in countries where he had never been; and his imagination supplied him abundantly with gallant adventures, thrilling dangers, and hairbreadth escapes. His books are useful in insinuating knowledge whilst they are giving pleasure, and they are valuable inasmuch as their whole tone is pure, wholesome, and manly. Characteristic specimens of his works are *The Three Midshipmen*; *The Three Lieutenants*; *The Three Commanders*; and *The Three Admirals*. Occasionally his books were not in the form of a story; and some of them are designed for adult readers.

KINGSTOWN, a seaport town of Ireland, in the county of Dublin, is situated at the south-eastern extremity of Dublin Bay, 6 miles south-east from Dublin by railway.

¹ The population of the municipal borough amounted in 1881 to 164,260, and that of the parliamentary borough of Hull to 161,519.

It is a large seaport and favourite watering-place, and possesses several fine streets and terraces commanding picturesque sea views. The original name of Kingstown was Dunleary, which was exchanged for the present designation after the embarkation of George IV. at the port on his return from Ireland in 1821, an event which is also commemorated by a granite obelisk erected near the harbour. The town was a mere fishing village until the construction of an extensive harbour, begun in 1817 from designs by Rennie, and finally completed in 1859, at a cost of £225,000. The eastern pier has a length of 3600 feet, and the western of 4950 feet, the total area enclosed being about 280 acres, with a varying depth of from 16 to 27 fathoms. Kingstown is the station of the mail packets to Holyhead in connexion with the London and North-Western Railway. It has a large export and import trade both with Great Britain and foreign countries, but as its shipping returns are now included in those of the port of Dublin, it is impossible to give accurate details. The principal exports are cattle, and the principal imports corn and provisions. The harbour revenue exceeds £2000 annually. By the Towns' Improvement Act of 1854, Kingstown, with several surrounding districts, was formed into a township, having an area of 1450 acres. The population in 1861 was 14,257, which in 1871 had increased to 16,378, and in 1881 to 18,280.

KING-TIH CHIN, a town near Foo-ling Heen in the province of Keang-se, China, and the principal seat of the porcelain manufacture in that empire. Being situated on the south bank of the river Chang, it was in ancient times known as *Chang-nan Chin*, or "town on the south of the river Chang." It is unwallled, and stretches along the bank of the river in a somewhat straggling way. The streets are narrow, and crowded with a population which is reckoned at a million, the vast majority of whom find employment at the porcelain factories. Since the Ch'in dynasty (567-589) this has been the great trade of the place, which was then called by its earlier name. In the reign of King-tih of the Sung dynasty (1004-1007) a manufactory was founded there for making vases and objects of art for the use of the emperor. Hence its adoption of its present title. Since the time of the Ming dynasty a magistrate has been especially appointed to superintend the factories and to despatch at regulated intervals the imperial porcelain to Peking. The town is situated on a vast plain surrounded by mountains, and boasts of three thousand porcelain furnaces. These constantly burning fires are the causes of frequent conflagrations, and at night give the city the appearance of a place on fire. The people are as a rule orderly, though they have on several occasions shown a hostile bearing towards foreign visitors. This is probably to be accounted for by a desire to keep their art as far as possible a mystery, and is after all only an extreme interpretation of the law which forbids strangers to lodge in the town. This feeling appears less unreasonable when it is remembered that the two kinds of earth of which the porcelain is made are not found at King-tih Chin, but are brought from K'i-mun in the neighbouring province of Gau-hwy, and that there is therefore no reason why the trade should be necessarily maintained at that place. The two kinds of earth are known at pih-tun-tze, which is a fine fusible quartz powder, and kaou-lin, which is not fusible, and which it is said gives strength to the ware (see KAOLIN). Both materials are prepared in the shape of bricks at K'i-mun, and are brought down the Chang to the east of the manufactory.

KINO, an astringent drug introduced into European medicine in 1757 by Fothergill, an eminent physician and patron of economic botany. When described by him it was believed to have been brought from the river Gambia

in West Africa. According to Moore (1733), a factor to the Royal African Company, the tree yielding the drug is known in the Mandingo language as "kino." When first imported, however, it was sold in England as *Gummi rubrum astringens Gambiense*. It was introduced into the Edinburgh pharmacopoeia in 1776 under the above name, and into the London pharmacopoeia in 1787 under the name of *Resina kino*. Specimens of the plant sent home by Mango Park in 1805 were recognized as identical with *Pterocarpus erinaceus*, Poiret. In 1811 the African drug was no longer to be met with in English commerce, its place being supplied by several other kinds.

The drug which is at present recognized as the legitimate kind is East Indian, Malabar, or Amboyus kino, and is obtained from *Pterocarpus Marsupium*, Roxb. (*Leguminosae*). It is collected in the Government forests of the Malabar coast, the collectors being required to pay a small fee for the privilege, and to perform the tapping carefully and without injuring the timber. The mode of obtaining the kino is by making a perpendicular incision, with lateral ones leading into it, in the trunk, a vessel being placed at the foot of the incision to receive the juice. When exuding it resembles red currant jelly,¹ but hardens in a few hours after exposure to the air and sun. When sufficiently dried it is packed into wooden boxes for exportation. When these are opened it breaks up into angular brittle fragments of a blackish-red colour and shining surface. In cold water: it is only partially dissolved, leaving a pale flocculent residue, which is soluble in boiling water, but deposited again on cooling. In spirit of wine, sp gr. '838, it is entirely soluble, affording a solution having an acid reaction, but the liquid by long keeping assumes a gelatinous condition. It is also soluble in caustic alkalis and to a large extent in a saturated solution of sugar, but is wholly insoluble in ether. In chemical composition kino appears to be nearly allied to Pengu catechu, but differs from it in not yielding catechin when exhausted by ether, but only a minute quantity of soapy prismatic crystals of a substance which is soluble in cold water, and thus more nearly resembles pyrocatechin. Pyrocatechin is, however, not present in the fresh bark or wood of the tree. Ettli (1878) states that he has obtained kinoin, $C_{12}H_{12}O_6$ from Malabar kino, while Hanbury and Flückiger failed to obtain it from that drug, but found it in Australian kino. According to Bentley, kino-tannic acid, catechin (or probably pyrocatechin), and kino red are the essential constituents of Malabar kino. The first of these is precipitated from an aqueous solution of the drug by dilute mineral acids, and the last by boiling an aqueous solution of kino-tannic acid for some time, when it separates as a red precipitate. The chemical constitution of Malabar kino is therefore only imperfectly known. The quantity of kino collected in Madras is comparatively small, and is supposed not to exceed a ton or two annually, but it is often shipped from Cochin.

Bengal, Butea, or Palas kino—obtained from *Butea frondosa*, Roxb (*Leguminosae*), a native of India and Burmah, well known under the name of the Palas or Dhak tree, and remarkable for its large orange papilionaceous flowers—also finds its way occasionally into British commerce. A portion is also obtained from *Butea superba*, Roxb, and *Butea parviflora*, Roxb. Butea kino does not stick to the teeth when chewed like ordinary kino, although like the latter it gives a red tinge to the saliva. It is usually more or less mixed with small fragments of bark. It is almost completely soluble in water, and to the extent of 46 per cent. in boiling alcohol, but different specimens vary in solubility. It is believed to contain about half its weight

of kino-tannic acid, the remainder consisting of a soluble mucilaginous substance, and a minute quantity of pyrocatechin, which can be extracted by ether. In India Butea kino is used instead of the Malabar kino, and is called by the Hindus kumli or kuneu.

Botany Bay, Australian, or Eucalyptus kino is a more or less resinous astringent exudation obtained from several species of *Eucalyptus*. It is found in flattened cavities in the trunks, and is mostly collected by sawyers and wood-splitters. It frequently comes into the London market, and the best variety, probably the product of *E. corymbosa*, Sm., is used under the name of "red gum" in the preparation of astringent lozenges for sore throat. According to Wiemer of Vienna, Australian kino contains a little catechin (a statement doubted by Flückiger) and pyrocatechin, no pectinous matter, but a gum nearly allied to that of acacia. Flückiger also obtained from it kinoin, $C_{12}H_{12}O_6$, which he regards as the methylated gallic ether of pyrocatechuic acid, viz. $C_6H_4(OCH_3)_2C_6H_3O_5$.

Between 1808 and 1820 a substance was met with in French commerce under the name of Jamaica kino, which is said to have been prepared by inspissating the juice of the seaside grape, *Coccoloba uvifera*, L. (*Polygonaceae*). When powdered it has a somewhat bituminous odour and an astringent slightly bitter taste. It is but little soluble in cold water or alcohol, but dissolves almost entirely in boiling water, and to the extent of about 75 per cent. in hot alcohol. In thin laminae it is only semi-transparent, the fragments usually met with in commerce being quite opaque. In 1835 an article appeared in French commerce under the name of "kino de la Colombie" which is stated in *Histoire des Drogues* to be in all probability an extract of the bark of *Rhiphophora Angale*, L. A liquid kino is obtained from *Pterocarpus indicus*, which does not harden like that obtained from *P. Marsupium*. Although used in India it is not imported into Europe. Other varieties of kino are mentioned in the same work, but they must be regarded rather in the light of curiosities than as articles of commerce.

Kino is used in medicine as an astringent, chiefly in the form of tincture; but, owing to its tendency to gelatinize, that preparation is much less used than formerly.

See D. Fothergill, *Med. Obs.*, 1757, p. 358; T. Moore, *Travels into the Inland Parts of Africa*, 1787, p. 180, 208, 287; *Histoire des Drogues*, 7th ed., tom. ii. p. 428-439; Lewis, *Matéria Medica*, 1784, p. 866; Daniell, *Pharmaceutical Journal*, (1) xiv. p. 65; *Pharmacographia*, 2d ed., p. 186; Pereira, *Mat. Med.*, 4th ed., vol. ii., pt. ii., p. 325; Bentley and Trauen, *Medicinal Plants*, Nos. 79-81.

KINROSS, a small inland county of Scotland, is situated between 56° 8' and 56° 18' N. lat., and 3° 14' and 3° 35' W. long. It is of an irregular circular form, and in outline somewhat resembles a toothed wheel, lying between Perthshire on the north-west and Fife on the south-east. Its breadth from west to east is about 12 miles, and its length from north to south about 10 miles; the area is 49,812 acres, or about 78 square miles. Next to Clackmannan it is the smallest county in Scotland.

The surface consists principally of an oval and level plain, which is bounded on the N.W. by the Ochils, on the E. by Bishop Hill and the Lomonds, on the S. by Benarty Hill, and on the S.W. by the Cleish Hills. This plain opens out on the west along the Devon valley towards Stirling, on the north-east towards the valley of the Eden, and more narrowly on the south between the Cleish Hills and Banarty. Kinross is touched by the river Devon at the Crook of Devon, not far from the Rumbling Bridge; and the river Leven, which has its source in the loch of that name, flows for about half a mile in Kinross before entering Fife. Of the streams which flow into Lochleven the principal are the Gainry, the South Queish, and the North

¹ African kino is very liquid and of an extremely pale red colour when it first flows out, but soon coagulates and becomes of a deep, blood-red hue.

Quich. Lochleven, the area of which has been lessened by extensive reclamation works undertaken in 1826, has still a surface of 3406 acres, and its trout fishing is the best of any loch in Scotland. The loch contains several islands, the principal being Queen Mary's Island, 8 acres in extent, Reed Flowers, 1 acre, and the island of St Serf, 80 acres.

Geology and Agriculture.—The greater part of the county belongs to the upper strata of the Old Red Sandstone, but a portion in the north-west to the porphyry formation of the Ochilts, while on the east there is a narrow boundary of the Coal-measure slightly interrupted by trap. Coal is wrought in the southern part of the county, but only to a

small extent; limestone is very abundant, and sandstone is obtained for building purposes.

The lower part of the county is generally well sheltered, and suitable for all kinds of crops. In this region the soil is generally of a mossy character, but when well drained and cultivated is very fertile. The eminences are devoted chiefly to the pasturage of sheep and the rearing of cattle. Much land has been reclaimed within recent years, and the methods of farming are now quite equal to those of the most advanced districts of Scotland.

A great proportion of the land is held in fee by small proprietors who farm their own properties. The following table gives a classification of holdings according to size in 1880 and 1876.

	50 Acres and under.		From 50 to 100 Acres.		From 100 to 200 Acres.		From 200 to 500 Acres.		From 500 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1876	138	1,080	32	7,721	102	35,690	21	2,261	2	1,415	208	81,377		
1880	125	9,613	39	2,074	118	21,564	21	9,307	2	520	216	46,010		

According to the agricultural returns for 1881, the total area under crops was 31,460 acres, of which 7298 acres were under corn crops, 3078 under green crops, 11,548 under rotation grasses, 6100 permanent pasture, and 17 fallow. 2576 acres were under woods. The percentage of cultivated area in 1870 was 67, and in 1880 it was 69.0. The area under permanent pasture has increased very much of late years, while there is an unusually large percentage under rotation grasses. 6501 acres, or more than two-thirds of the area under corn crops, is occupied by barley and bere, while oats had 1850 and wheat only 112 acres. Nearly the whole area under green crops was occupied either by turnips and swedes or potatoes, turnips and swedes having 2663 and potatoes 567 acres.

The total number of horses in 1881 was 1099, of these 699 were used solely for agricultural purposes, and 849, a very large proportion, were unbroken horses or mares kept solely for breeding. Cattle in 1881 numbered 5655. Much cows numbered 984, less than one-fifth of the whole. A considerable number of cattle are pastured on the lowland farms. They are chiefly a native breed, which has been improved by crossing. Sheep in 1881 numbered 28,830. They are chiefly pastured on the hills, but a considerable number are also wintered on the lowland farms. Pigs in 1881 numbered 504.

In 1878-79 the land was divided between 728 proprietors, and its gross annual value was 254,771, 14s. Of the owners, 458 or 64.3 per cent. possessed less than 100 acres, and the average value per acre was £1, 8s. 10d. There were nine proprietors who held more than 1000 acres, the largest estates being those of the Right Hon. W. P. Acland, 2369 acres, and Sir Graham Montgomery, 2386.

Manufactures and Trade.—Tartan planks, shawls, and other woollen goods are manufactured at Kinross, which also possesses corn-mills and a brewery. There is a large linen factory at Milnathort, as well as manufactures for woollen goods.

Administration.—The county sheriff courts are held weekly or fortnightly. Kinross is well joined with Clackmannan and Linlithgow in one sheriffdom, and quarter sessions are held on the first Tuesday of March, July, August, and October. The county unites with Clackmannan in returning a member to parliament.

Population.—Kinross has the smallest population of any county in Scotland. From 6726 in 1801 it rose to a maximum of 9073 in 1831, from which it fell in 1841 to 8798, and although it rose to 8924, it gradually diminished till in 1871 it was 7198, while in 1881 it was 6696, of whom 3112 were males and 3587 females. The principal villages are Kinross (population in 1881, 1960), the capital of the county and a market-town; Milnathort (1200), with linen and woollen manufactures; Kinneswood (250); and a portion of Killy, the remainder being in Fife.

History and Antiquities.—The early history of Kinross-shire is given in the article Fife. There are traces of an ancient fort or camp on the top of the hill of Dunagie in the parish of Cleish, and a remarkable cairn called Cairn-a-voun on a hill on the northern boundary of the parish of Orwell, in the centre of which a rude stone cut was discovered with an urn full of bones and charcoal. In 1857 a hoard of seven hundred Roman coins was dug up in the vicinity of the county town. The priory of Fortmeak, properly situated on the island of St Serf in Lochleven, although the priory and canons often resided at Kinneswood, was originally the oldest Cistercian establishment in Scotland,—being a gift of the Pictish kings after their conversion. Some time before 961 it was made over to the bishop of St Andrews, and shortly after 1144 a body of canons regular was established in it in connexion with the priory of canons regular established in that year at St Andrews. The estate of Lochleven was a royal residence as far back as 1287. In it Archibald,

lord, earl of Douglas, was imprisoned in 1429, and Queen Mary from June 16th 1567 to May 2d 1568, at a short distance north-east of Kinross stands the ruined castle of Burielgill.

KINSALE, a parliamentary borough and seaport town of Ireland, in the county of Cork, is situated on the estuary of the Bandon, 24 miles south from Cork by rail. The town occupies chiefly the acclivity of Compass Hill, and, while possessing a striking and picturesque appearance, is built in a very irregular manner, the streets being narrow and so precipitous that in many instances conveyances have to take a very circuitous course. The principal buildings are the castle fort, completed by the duke of Ormonde at a cost of £70,000, and captured by the earl of Marlborough in 1690; the parish church, an ancient but insignificant structure erected as a conventual church about the 14th century; the assembly-rooms, the barracks, the Carmelite friary, and the convent of the sisters of mercy. Kinross is much frequented by summer visitors, and is also an important fishery station, the number of boats employed in the division of which it is the principal port being about 350, employing over 1700 men and boys. It possesses also a commodious harbour, but the trade has become almost extinct owing to the proximity of Cork. The population in 1881 was 4976.

Kinsale is said to derive its name from *cam tala*, the headland in the sea. At an early period the town belonged to the De Courcys, a representative of whom was created baron of Kinsale in 1181. It received a charter of incorporation from Edward III., having previously been a borough by prescription, and its privileges were confirmed and extended by various subsequent sovereigns. For several centuries previous to the Union it returned two members to parliament, but since then it has returned only one. It was the scene of an engagement between the French and English fleets in 1680, was forcibly entered by the English in 1488, was partly consumed by fire in 1694, was captured by the Spaniards and retaken by the English in 1601, was entered by the English in 1641, who expelled the Irish inhabitants, was the scene of the landing of James II. and of the French army sent to his assistance in 1689, and was taken by the English in the following year.

KIOTO, KYOTO, MIYAKO, or SAIKYO, the ancient sacred capital of Japan, is situated on the main island of the Japanese archipelago. It occupies the level bottom of a valley between the ridges Huijo-san and Higashiyama on the east, and of Tenno-san on the west, and is so girt by the streams Kamogawa and Katsuragawa as to have an almost insular position. With Tokio, to the north-east, it is connected by two highways, the Tokaido, 307 miles long, and the Nakasendo, 393 miles long. To Osaka on the coast a railway line was opened in 1877. Kioto is regularly and compactly built on the rectangular system, the immense number of Shinto and Buddhist shrines and temples being almost entirely beyond the city proper. The large suburb beyond the Kamogawa, which is crossed by many bridges, is the finest in respect of inns and temples. The houses,

chiefly of wood, are small, and are further dwarfed by the great width of the streets. Tea-houses and pleasure-gardens abound, and the whole air of the city is pleasant. "With its schools, hospitals, lunatic asylum, prisons, dispensaries, almshouses, fountains, public-parks, and gardens, exquisitely beautiful cemeteries, and streets of almost painful cleanliness, Kyōto is the best-arranged and best-managed city in Japan."¹ The chief building is, of course, the imperial palace surrounded by beautiful gardens. Formerly forbidden to even most natives, it is now occupied as a museum of Japanese arts and manufactures. Among the other buildings are the former residences of the taikun and of the mikado's nobility, the various normal training and other schools for both sexes and all ages, the hospital, &c. Under the city government of Kyōto there was founded in 1870 an industrial department to foster the industries of the place. There are divisions for the encouragement of gardening, shoe-making, silk and other weaving, paper-making, leather-making, the manufacture of mineral waters, and many other branches of industry. Kyōto supports also a pauper colony. The silk-factories, though on a small scale, are numerous. Crapes, bronze goods, and porcelain (largely for the English market) are also produced in the city. The population in 1870 was estimated at 370,000.

Kyōto is much the oldest of the three great cities of Japan, but both Tōkyō and Ōsaka have far outstripped it in importance. In the reign of the emperor Kuwammu, towards the end of the 8th century, Nara was superseded as the capital by Kadamō, afterwards called Kyōto, and sometimes Miako; and this last town became identified with the mikado, as Yedo was with the shōgun. It was the scene of the first contests of the Taira and Minamoto clans. In the 16th century Xavier preached in its streets; and in the 17th Kämpfer twice visited it. In 1864 a fierce contest, followed by a conflagration, resulted from an attack upon it by the Obshū clan and Kikettai. After the revolution in 1869 the mikado and his court migrated to Yedo, thenceforth called Tōkyō or eastern capital. Kyōto also received an alternative name—Saiyō, or western capital; but it is never used. Kyōto is not a treaty port; and foreigners are not allowed to reside in it unless they are in Japanese employ.

KIPPIS, ANDREW (1725–1796), a learned and laborious compiler, was born at Nottingham, March 28, 1725. From school at Sleaford in Lincolnshire he passed at the age of sixteen to spend a five years' course in the Dissenting academy at Northampton, of which Dr Doddridge was then president. In 1746 Kippis became minister of a church at Boston; in 1760 he removed to Dorking in Surrey; and in 1763 he became pastor of a dissenting congregation at Westminster, where he remained till his death on 8th October 1796. Kippis took a prominent part in the affairs of the body with which he was connected. From 1763 till 1784 he was classical and philological tutor in Coward's training college; and when another institution of the same kind was opened at Hackney he was prevailed upon, somewhat against his will, to serve as tutor there for a few years. In 1767 he received the degree of D.D. from Edinburgh university; in 1778 he was elected a fellow of the Antiquarian Society, and a fellow of the Royal Society in 1779. He left a reputation for piety, learning, and active virtue.

Kippis was a very voluminous writer. He contributed largely to *The Gentleman's Magazine*, *The Monthly Review*, and *The Library*; and he had a good deal to do with the establishment and conduct of *The New Annual Register*. He published also a number of sermons and occasional pamphlets; and he prefixed a life of the author to a collected edition of Dr Nathaniel Lardner's *Works* (11 vols. 8vo, 1788). He wrote a life of Dr Doddridge, also, which is prefixed to Doddridge's *Exposition of the New Testament* (6 vols. 8vo, 1792). His chief work is his edition of the *Biographia Britannica*, of which, however, he only lived to publish 6 vols. (folio, 1778–1793). Many new lives were inserted, written for the most part by the editor himself; and extensive additions and corrections were made. These last were given in the form of footnotes to

the original text,—a plan which often gives the work the air of a long controversy, and swelled it beyond reasonable bounds. As a monument of the painstaking exertion of the editor the work is interesting; and as a mere storehouse of facts it possesses a genuine value. Kippis's *Life and Voyages of Captain James Cook* was reprinted from this book, 4to, 1788. See notice by A. Rees, D.D., in *The New Annual Register* for 1796.

KIRBY, WILLIAM (1769–1860), entomologist, was born at Witleham in Suffolk, September 19, 1769. From the village school of Witleham he passed to Ipswich grammar school, and thence to Caius College, Cambridge, where he graduated B.A. in 1781, not becoming M.A. till 1815. Taking orders in 1782, he spent his entire life in the peaceful seclusion of an English country parsonage, till 1796 as curate, afterwards as rector, of Barham in Suffolk. Although Kirby was once and again induced to use his pen against the spirit of free thinking then reacting from France upon England, he had little taste for controversy. His favourite study was natural history; and eventually entomology engrossed all his leisure. His first work of importance was his *Monographia Apum Angliæ* (3 vols. 8vo, 1802), which as the first scientific treatise on its subject brought him into notice with the leading entomologists of his own and foreign countries. Latreille, Fabricius, Illiger, and Walkenaeer were among his correspondents; and his opinion and advice were sought by many less illustrious. The practical result of a friendship formed in 1805 with Mr Spence, a scientific gentleman of Hull, was the jointly written *Introduction to Entomology* (4 vols. 8vo, 1815–26, 7th ed. 1856), one of the most popular books of science that have ever appeared, and still highly valuable. In 1830 Kirby was chosen to write one of the *Bridgewater Treatises*, his subject being *The History, Habits, and Instincts of Animals*. This, published in 2 vols. in 1835, undeniably fell short of his earlier works in point of scientific value. On July 4, 1860, William Kirby died, after a long life of piety, benevolence, and diligence. He was an original member of the Linnean Society; and his name was on the rolls of all the chief scientific associations in England and abroad.

Beside the books already mentioned, Kirby was the author of many papers in *The Transactions of the Linnean Society*, *The Zoological Journal*, and other periodicals; of *Sketches on Sir James Smith's Hypothesis respecting the Origin of our Species*; and of the *Anathus of Virgil*, 1819, of *Seven Sermons on our Lord's Temptations*, &c., 1823; and of the sections on insects in the *Account of the Animals seen by the late Northern Expedition while within the Arctic Circle*, 1821, and in *Flavus Borealis-Americana*, 1837. *The Life of the Rev. William Kirby, M.A.*, by Rev. John Freeman, was published in 1862. It contains a list of Kirby's works.

KIRCHER, ATHANASIUS (1602–1680), a learned scholar and accomplished mathematician, was born May 2, 1602, at Geisa near Fulda, was educated at the Jesuit college of Fulda, and entered upon his novitiate at that order at Mainz in 1618. After continuing his studies at Paderborn, Münster, Cologne, Coblenz, and Mainz, he became professor of philosophy, mathematics, and Oriental languages at Würzburg, whence he was driven (1631) by the troubles of the Thirty Years' War to Avignon. Through the influence of Cardinal Barberin he next (1636) settled in Rome, where for eight years he taught mathematics in the Collegio Romano, but ultimately resigned this appointment in order that he might devote the closing years of his life entirely to the study of hieroglyphics and other archaeological subjects. He died November 28, 1680.

Kircher was a man of wide and varied learning, but singularly devoid of judgment and critical discernment. His voluminous writings in philology, natural history, physics, and mathematics often, accordingly, have a good deal of the historical interest which attaches to pioneering work, however imperfectly performed; otherwise they now take rank as curiosities of literature merely. They include *Ars Magna*, 1661; *Magus, sive de arte magnetica opus imperitum*, 1664; and *Magnetica natura regnum*, 1667; *Pyrotechnia Optima*, 1668; *Longina Alcyonacea resuscitata*, 1668; *Obeliscus*

¹ Miss Bird, *Unbeaten Tracks in Japan*, vol. II. p. 252.

Pamphilus, 1650; and *Edipus Aegyptiacus*, hoc est *universalis doctrina hieroglyphica interpretata*, 1688.—works which may claim the merit of having first called the attention of the learned to the Egyptian hieroglyphs, *Arx magna leon et umbra in munito*, 1616-40; *Alsius quæ universales, sive arx magna consona et dissona*, 1650; *Polygraphum, seu arithmetica linguarum quo cum omnibus mundi populis potest quæ responderi*, 1688; *Mundus subterranus, quo subterranea mundi opificum, universæ denique nature divites, obliuiscens effectum casum demonstrantur*, 1665-78; *Natura illustrata*, 1667; *Arx magna scientiæ*, 1690; and *Lutetius*, 1699, a work which may still be consulted with advantage. The *Specimen Mithæusæ linguæ* (1688) gives an account of what may be described as a kind of calculating machine of his invention. The valuable collection of antiquities which he bequeathed to the Collegio Romano has been described by Bonamici (*Museum Kircherianum*, 1709; republished by Battani in 1773).

KIRCHHEIM-UNTER-TECK, chief town of a district in the Danube circle of Wurtemberg, is prettily situated on the Lanter, not far from the Teck, and about 16 miles south-east of Stuttgart. Its castle was built in 1538. The manufactures include cotton goods, damask, pianofortes, machinery, lanterns, chemicals, cement, &c. The town also has wool-spinning establishments and breweries, and a corn exchange. It is the most important wool market in South Germany, the annual turn-over averaging about 1,650,000 lb. The population in 1875 was 6197.

KIRGHIZ, a large and wide-spread division of the Mongolo-Tatar family, of which there are two main branches, the Kara-Kirghiz of the uplands and the Kirghiz-Kazaks of the steppes. To the same group belong the Kipchaks, forming a connecting link between the nomad and settled Turki peoples of Ferghana and Bokhara, and the Kara-Kalpaks on the south-east side of the Aral Sea, who are intermediate between the Kazaks and Uzbecks. The Kirghiz jointly number about 3,000,000, and occupy an area of perhaps the same number of square miles, stretching from Kulja westwards to the lower Volga, and from the head streams of the Ob southwards to the Pamir and the Turkoman country. In the Mongolo-Tatar family their position is peculiar, they being closely allied ethnically to the Mongolians and in speech to the Tatars. To understand this phenomenon, it should be remembered that both Mongols and Tatars belonged themselves originally to one racial stock, of which the former still remain the typical representatives, but from which the latter have mostly departed and become largely assimilated to the regular "Caucasian" type. But the Kirghiz have either remained nearly altogether unmixed, as in the uplands, or else have intermingled in the steppes mainly with the Volga Calmucks in the west, and with the Zungarian nomads in the east, all alike of Mongol stock. Hence they have everywhere to a large extent preserved the common Mongolian features, while retaining their primitive Tatar speech. Physically they are a middle-sized, square-built race, inclined to stoutness, especially in the steppes, mostly with long black hair, scant beard or none, small, black, and oblique eyes, though blue or grey also occur in the south, broad Mongoloid features, high cheek bones, broad, flat nose, small mouth, brachycephalous head, very small hands and feet, dirty brown or swarthy complexion, often yellowish, but also occasionally fair. These characteristics, while affixing them directly to the Mongol stock, also betray an admixture of foreign elements, probably due to Finnish or Chudic influences in the north, and Tajik or Iranian blood in the south. Their speech also, while purely Turki in structure, possesses, not only many Mongolian and a few Persian and even Arabic words, but also some terms unknown to the other branches of the Mongolo-Tatar linguistic family, and which should perhaps be traced to the Kiang-Kuan, Wu-ann, T'ing-ling, and other extinct Chudic peoples of South Siberia partly absorbed by them. These relations to the surrounding Asiatic races

will be made clearer in the subjoined detailed account of the Kara-Kirghiz and Kirghiz-Kazaks.

The Kara-Kirghiz.—The Kara or "Black" Kirghiz, so called from the colour of their tents, are known to the Russians either as Chernyle ("Black") or Dikokammenyie ("Wild Stone" or "Rocky") Kirghiz, and are the Black Kirghiz of some English writers. They are on the whole the purest and best representatives of the race, and so true is this that, properly speaking, to them alone belongs the distinctive national name Kirghiz or Krgyz. This term is commonly traced to a legendary chief, Kirghiz, sprung of Oguz-Khan, ninth in descent from Japhet. It occurs in its present form for the first time in the account of the embassy sent in 569 by Justin II. to the Uighur Khan, Dugla-Ditubulu, where it is stated that this prince presented a slave of the "Kergbiz" tribe to Zemark, head of the mission. In the Chinese chronicles the word assumes the form Ki-li-ki-tz', and the writers of the Yuan dynasty (1280-1367) place the territory of these people 10,000 li north-west of Peking, about the head streams of the Yenisei. In the records of the Tang dynasty (618-907) they are spoken of under the name of Kha-ki-tz' (pronounced Khaka, and sometimes transliterated Haka), and it is mentioned that these Khakas were of the same speech as the Khoel-khu. From this it follows that they were of Mongolo-Tatar stock, and are wrongly identified by some ethnologists with the Kiang-Kuan, Wu-ann, or T'ing-ling, all of whom are described as tall, with red hair, "green" or grey eyes, and fair complexion, and must therefore have been of Finnish stock, akin to the present Soyotes of the upper Yenisei.

The Kara-Kirghiz are by the Chinese and Mongolians called *Burut*, where *ut* is the Mongolian plural ending, as in Tangut, Yakut, modified to *yut* in Buryat, the collective name of the Siberian Mongolians of the Baikal district. Thus the term *Bur* is the common Mongolian designation both of the Baikal Mongols and of the Kara-Kirghiz, who occupied this very region and the upper Yenisei valley generally till comparatively recent times. For the original home of their ancestors, the Khakas, lay in the south of the present governments of Yeniseisk and Tomsk, stretching thence southwards beyond the Sayan range to the Tannu-ula hills in Chinese territory. Here the Russians first met them in the 17th century, and by the aid of the Kazaks exterminated all those east of the Irtysh, driving the rest further west and south-westwards. Most of them took refuge with their kinsmen, the Kara-Kirghiz nomad highlanders, whose homes, at least since the 13th century, have been the Ala-tau range, the Issik-kul basin, the Tokes, Chu, and Talass river valleys, the Tian-shan range, the uplands draining both to the Tarim and to the Jaxartes and Oxus, including Khokand, Karategin, and Shighan southwards to the Pamir table-land, visited by them in summer. They thus occupy most of the uplands along the Russo-Chinese frontier, between 35° and 50° N. lat. and between 70° and 85° E. long., where they have been recently joined by some Chilikis, Kipchaks, Naimans, and Kitars from Andjian and the Kasak steppes.

The Kara-Kirghiz are all grouped in two main sections—the On or "Right" in the east, with seven branches (Bogu, Sary-Baghabah, Bon-Baghabah, Salin or Solye, Chonik, Kayak, Basingan), and the Sol or "Left" in the west, with four branches (Kokobe or Kady, Boru, Mundusa, Kitai or Kintai). The Sol section occupies the region between the Talass and Oxus head streams in Ferghana (Khokand) and Bokhara, where they come in contact with the Gekides or Highland Tajiks. The On section lies on both sides of the Tian-shan, about Lake Issik-kul, and in the Chu, Tokes, and Naryn (upper Jaxartes) valleys.

Each of the On tribes comprises a number of stocks or septa, which are further divided into clans or families, of which, however, the lists are complete for the Bogu and Sary-Baghabah alone. Of the Bogu there are six stocks, with 11,000 tents, and numbering 55,000 to 60,000 souls. Of the Sary-Baghabah there are four stocks,

with 16,800 tents, or 80,000 to 90,000 souls. The Sakaj nomads 10,000 tents, or about 50,000 souls, making a total of 200,000 in Russian territory. The Sol section, with the independent On tribes, are roughly estimated at about 200,000, making 400,000 Kara-Kirghiz altogether.

All are essentially nomads, occupied mainly with stock breeding, chiefly horses of a small but hardy breed, sheep of the fat-tailed species, oxen used both for riding and as pack animals, some goats, and camels of both species. Agriculture is limited chiefly to the cultivation of wheat, barley, and millet, from the last of which a coarse vodka or brandy is distilled. Trade is carried on chiefly by barter, outfit being taken by the dealers from China, Turkestan, and Russia in exchange for manufactured goods.

The Kara-Kirghiz are governed by the "manaps," or tribal rulers, who enjoy almost unlimited authority, and may even sell or kill their subjects. In religious matters they differ little from the Kazaks, whose practices are described below. Although generally recognizing Russian sovereignty since 1864, they pay no taxes, and merely furnish certain raw products to the Russian troops on their passage through the country.

The *Kazaks*—Though not unknown to them, the term Kirghiz is never used by the steppe nomads, who always call themselves simply Kazaks, that is, "riders," as the word is commonly interpreted. The first authentic reference to this name is by Pirdoua (1920), who speaks of the Kazak tribes as much dreaded steppe marauders, all mounted and armed with lances. From this circumstance the term Kazak came to be gradually applied to all freebooters similarly equipped, and it thus spread from the Amlo-Caspian basin to South Russia, where it still survives under the form of "Kossak." Hence though Kazak and Cossack are originally the same word, the former now designates a Mongolo-Tatar nomad race, the latter various members of the Great and Little Russian Slav family. No satisfactory explanation of its origin has been given. Since the 18th century the Russians have used the compound expression Kirghiz-Kazak, chiefly in order to distinguish them from their own Cossacks, at that time overrunning Siberia. Herbertstein (1820) is the first European who mentions them by name, and it is noteworthy that he speaks of them as "Tatars," that is, a people rather of Turki than Mongolian stock. In their present homes, the so-called "Kirghiz steppes," they are far more numerous and wide-spread than their Kara-Kirghiz kinsmen, stretching almost uninterruptedly from Lake Balkash round the Aral and Caspian Seas westwards to the lower Volga, and from the river Irtysh southwards to the lower Oxus and Ust-Urt plateau. Their domain, which is nearly 2,000,000 square miles in extent, thus lies mainly between 45° and 55° N lat. and from 45° to 80° E long. Here they came under the sway of Jenghiz Khan, after whose death they fell to the share of his son Joohi, head of the Golden Horde, but continued to retain their own khans. When the Ubeigs acquired the ascendancy, many of the former subjects of the Joohi and Jagatai hordes fell off and joined the Kazaks. Thus were formed about 1500 two powerful estates in the Kipchak and Chetah steppes, the Moghul-Ulugh and the Kazak, the latter of whom, under their khan Arslan, are said by Sultan Baber to have had as many as 400,000 fighting men. Their numbers continued to be swollen by voluntary or enforced accessions from the fragments of the Golden Horde, such as the Kipchaks, Naumans, Konrats, Jalairs, Kankis, whose names are still preserved in the tribal divisions of the Kazaks. And as some of these peoples were undoubtedly of true Mongolian stock, their names have given a colour to the statement that all the Kazaks were rather of Mongol than of Turki origin. But the universal prevalence of a nearly pure variety of the Turki speech throughout the Kazak steppes is almost alone sufficient to show that the Tatar element must at all times have been in the ascendant.

The Kirghiz-Kazaks have long been grouped in three large "hordes" or encampments, further subdivided into a number of so-called "races," which are again grouped in

tribes, and these in sections, branches, and auls, or communities of from five to fifteen tents. The division into hordes has been traditionally referred to a powerful khan, who divided his states amongst his three sons, the eldest of whom became the founder of the Ulu-Yuz, or Great Horde, the second of the Uru-Yuz, or Middle Horde, and the third of the Kudu-Yuz, or Little Horde. The last two under their common khan Abulkhair voluntarily submitted in 1750 to the czarina Anne. Most of the Great Horde were subdued by Yumna, khan of Ferghana, in 1798, and all the still independent tribes finally accepted Russian sovereignty in 1819. The races, range, and numerical strength of these hordes are shown in the following table:—

Races	Range	Tents	Souls
GRAND HORDE (Usta, Zila- tai, Sargan, Kovrat.)	Chiefly south of Lake Balkash and near the Tan-Shan; between Semipalatinsk and Semirechensk.	85,000	450,000
MIDDLE HORDE (Arykai, Nauman, Kip- chak, Ural- Ghirci.)	Chiefly on the low hilly watershed between the Ob and Amlo-Caspian basins, from Aral Sea to Lake Balkash, governments of Semipalatinsk and Akmo-linsk, West Siberia.	175,000	1,100,000
LITTLE HORDE. (Alinsai, Zaulai, Jeli- urug.)	From Kara-Kum Co-sert to lower Volga, north of Aral Sea, and in governments of Orenburg, Uralak, Turguni, and Astan- khan	170,000	1,000,000

Since 1801 a fourth division, known as the Inner or Bukayevskaya Horde, from the name of their first khan, Bukel, has been settled in the Orenburg steppe. It is estimated at 40,000 tents or 200,000 souls, giving for all the Kazaks 470,000 tents and 3,750,000 souls.

But these divisions affect the common people alone, all the higher orders and ruling families being broadly classed as White and Black Koz or Bones. The White Bones comprise only the khans and their descendants, besides the issues of the khojas or Moslem "saints." The Black Bones include all the rest, except the *Telengut* or servants of the khans, and the *Kul* or slaves.

The Kazaks are an honest and trustworthy people, but heavy, sluggish, and unfriendly. Even the hospitality enjoined by the Koran is displayed only towards the "faithful," that is, exclusively to the members of the orthodox Sunni sect. So essentially nomadic are all the tribes that they cannot adopt a settled life without losing the very sentiment of their nationality, and becoming rapidly absorbed in the Slav population. They dwell exclusively in the khittas or yurts, a semi-circular tent consisting of a light wooden framework, and red cloth or felt covering, with an opening above for light and ventilation. It is usually furnished with a large family clothes chest, felt carpet, wooden bedstead, leather bottles for kumis (fermented mare's milk), a tea service, and a few domestic utensils. Yet it may easily be pitched or struck in half an hour, and is rapidly transported on camels across the steppe. The camp life of the Kazaks seems almost unendurable to Europeans in winter, when they are confined altogether to the tent, and exposed to endless discomforts. In summer the day is spent mostly in sleep or drinking kumis, followed at night by feasting and the recital of tales, varied with songs accompanied by the music of the flute and balalaika. But horsemanship is the great amusement of all true Kazaks, who may almost be said to be born in the saddle. Hence, though excellent riders, they are bad walkers, and, though hardy and long-lived, unusually feeble and often decimated by small-pox and Siberian plague. They have no fixed meals, and live mainly on mutton and goat and horse flesh, and instead of bread use the so-called *balamyk*, a mass of flour fried in dripping and diluted in water. The universal drink is kumis, which is wholesome, nourishing, and a specific against all chest diseases.

The dress consists of the chapan, a flowing robe of which one or

two are worn in summer and several in winter, fastened with a silk or leather girdle, in which are stuck a knife, tobacco pouch, seal, and a few other trinkets. Broad silk or cloth mantles are often worn over the chaps, which is of velvet, silk, cotton, or felt, according to the rank of the wearer. Large black or red leather boots, with round white felt pointed caps, complete the costume, which is much the same for both sexes.

Like the Karg-Kinghs, the Kazaks are nominally Sunnites, but Shamanists at heart, worshipping, besides the Kulak or good divinity, the Shaitan or bad spirit. Their faith is strong in the *talismans* or soothsayer and other charlatans, who know everything, can do everything, and heal all disorders at pleasure. But they are not fanatics, though holding the abstract doctrine that the "Kafir" may be lawfully opposed, including in this category, not only Buddhists and Christians, but even Mohammedans of the Shah sect. There are no fasts or abstinences, mosques or mollahs, or regular prayers. Although Mohammedans since the beginning of the 18th century, they have scarcely yet found their way to Mecca, their pilgrims visiting instead the more convenient shrines of the "saints" scattered over eastern Turkistan. Unlike the Mongolians, the Kazaks treat their dead with great respect, and the low steppe hills are often entirely covered with monuments raised above their graves.

Letters are neglected to such an extent that whoever can merely write is regarded as a savant, while he becomes a prodigy of learning if able to read the Koran in the original. Yet the Kazaks are naturally both musical and poetical, and possess a considerable number of national songs, which are usually repeated with variations from month to month.

The Kazaks still choose their own khans, who, though confirmed by the Russian Government, possess little authority beyond their respective tribes. The real rulers are the elders or umpires and sultans, all appointed by public election. Brigandage and the *berakats* or raids among out of tribal feuds, which were formerly recognized institutions, are now severely punished, sometimes even with death. Capital punishment, usually by hanging or strangling, is inflicted for murder and adultery, while three, nine, or twenty-seven times the value of the stolen property is exacted for theft.

The domestic animals, dairy pursuits, and industries of the Kazaks differ but slightly from those of the Karg-Kinghs. Some of the wealthy steppe owners own as many as 20,000 of the large fat-tailed sheep. Goats are kept chiefly as guides for these flocks, and the horses, though small, are hardy, swift, light-footed, and capable of covering from 50 to 60 miles at a stretch. The total live-stock was thus estimated in 1878 by Tills:—cattle, 120,000; horses, 1,750,000; oxen, 600,000; sheep, 2,000,000; goats, 150,000. Amongst the Kazaks there are a few workers in silver, copper, and iron, the chief arts besides being skin dressing, wool spinning and dyeing, carpet and felt weaving. Trade is confined mainly to an exchange of live stock for woven and other goods from Russia, China, and Turkistan.

Since their subjection to Russia, the Kazaks have become less lawless, but scarcely less nomadic. A change of habit in this respect is opposed alike to their tastes and to the climatic and other outward conditions. Hence the progress of culture can here lead only to the depopulation of the steppes wherever incapable of being irrigated, and to the gradual extinction or absorption of the Kirghiz-Kazaks by their Slav rulers.

Literature.—Alexis Larnhin, *Description des Turkes et des Steppes des Kirghiz*. Kazaks, translated from the Russian by Ferry de Olney, 1840; Radloff, *Proben der Volksliteratur der Russischen Sibiriens* (1861); *Le Kirghiz*, *Le Kirghiz*, *et Kirghiz*, also *Des de la Soc. de Geo.*, 1878-79; *Semennoff*, paper in *Vegetation Mittheilungen*, 1860, No. 9; *Vukharskoye* *Soyezni* in 1868-69; *Maklure de Olney*, paper in *Par de l'Asie*, 1871, *Vendredi*, *Journal*, *Chine des Turco-Tatarischen* *Turks*. (A. H. K.)

KIRIN, GIRIN, or in Chinese CHWEN-CHANG, the chief town of the province of Central Manchuria or Kirin, is situated at the foot of the Lan-Ye-Ling mountains, at the edge of a wide and well-wooded plain, and on the left bank of the Girin-Lo or Sungari, there 300 yards in breadth. The situation is one of exceptional beauty; but the streets are narrow and irregular. Tobacco is the principal article of trade, the kind grown in the province being greatly prized throughout the Chinese empire under the name of "Manchu leaf." Formerly ginseng was also an important staple, but the supply from this quarter of the country has been exhausted. Outside of the town lies a plain "thickly covered with open fields containing the dead bodies of Chinese emigrants exposed for identification and removal by their friends; if no claim is made during ten years the remains are buried on the spot." Kirin was chosen by the emperor Kanghai as a military post during the wars with the Eleuts; and it owes its Chinese name of Chwen-chang, i.e., Naval Yard, to his building there the

vessels for the transport of his troops. The population was estimated at 300,000 in 1812, at present it is about 190,000.

See Palladius, "Expedition through Manchuria," in *Journal Roy Geog Soc.*, 1872; Williamson, *Journeys in North China*.

KIRKCALDY, a royal and parliamentary burgh and seaport on the south-east coast of Fife-shire, Scotland, 12 miles north from Edinburgh. The chief topographical feature of the town is its length, which is nearly 4 miles within the municipal boundary, as extended by Act of Parliament in 1876. Formerly there was little besides one main street with lanes and shorter streets branching from it, but during the last five-and-twenty years a large number of new streets and villas have been built along the high ground to the north. The parish, however, is a very small one, the landward part (now Abbotshall) having been disjoined in 1650. In population and most other statistical respects Kirkcaldy is the principal town in the county, and the tenth in Scotland, ranking next after Perth and Kilmarnock. The valuation of the burgh in 1881, including railways, was £87,092, and the census of the same year showed a population of 23,692. Besides some importations of flax, timber, whiting, &c., the chief regular trade of the port is that carried on by means of coasting vessels with Leith, Glasgow, and London. The annual harbour revenue is about £2000, and that of the custom-house £52,000.

The linen manufacture, begun in the early part of the 18th century, has long been the staple industry, the town being one of the chief centres of the trade in Scotland. The spinning of flax by machinery was introduced into the district in 1793, and in 1807 steam was added as a motive power. At present there are six mills with 18,880 spindles, employing when in full operation about 1450 persons. There is also an extensive net factory. Twelve power-loom factories, with an aggregate of 2100 looms, broad and narrow, employ fully that number of operatives. In these, as in the spinning mills, a large proportion of the workers, about 80 per cent., are females. Hand-loom weaving has almost entirely disappeared. The principal fabrics manufactured are sheetings, ticks, hollandes, tow-lings, diapers, dowlas, &c.; and one or two firms are now making cotton goods to some extent. There are three bleachfields, with 180 workpeople. Next in importance to the various branches of the linen manufacture are the floor-cloth works. First introduced by the late Mr Michael Nairn, the production of floor-cloth at Kirkcaldy has for some years been the largest in the world. There are six factories employing about 930 workpeople. The hosiery manufacture has also been successfully established. In 1877 the Messrs Nairn built the first factory in Scotland for this branch of industry, and its success has resulted in the formation of other two companies. The three firms employ an aggregate of nearly 450 hands. A large amount of machinery, including steam-engines, boilers, sugar-mills, rice-mills, and the like, is also manufactured in Kirkcaldy. There are eight works in operation, several of them extensive, and about 800 men and lads are employed. Among miscellaneous works may be noted two potteries (one of them including a tile-work with 400 operatives), malting barns, flour-mills, several dye-works, a brewery, and a large printing and lithographic business.

The educational, ecclesiastical, and literary institutions of Kirkcaldy are numerous. There are seven public schools, with 3490 children on the roll, and nearly as many private and ladies' schools, with about 350 in attendance. In addition there are three schools belonging to Philip's trust, at which 500 children receive gratuitous education and clothing; the revenue of the trust for the purposes of these three schools was £2115 in 1880. There are

twenty-six churches,—the finest architecturally being St Brycedale Free church. The town has two public libraries, one of them with nearly 10,000 volumes, and there are three weekly newspapers.

For much of its recent prosperity Kirkcaldy is indebted to the water scheme, for which an Act was obtained in 1887, and an Amendment Act in 1870. The sum authorized to be expended by these bills was £53,000, but an Extension Act was passed in 1881 giving power to raise £40,000 additional when required. An extensive system of drainage is also in process. A sheriff substitute has recently been appointed for the Kirkcaldy district.

Kirkcaldy, with Dysart, Kinghorn, and Burntisland, returns one member to parliament.

An *Excursion de Kirkcaldy* is mentioned in the list printed by Sibbald of the churches in the county of Fife in the year 1178. In 1240 it was bestowed by David, bishop of St Andrews, on the abbey of Dunfermline. The name of Kirkcaldy also occurs in the map of the civil divisions of Scotland in the 18th century prefixed to Professor Conno's *Scotland in the Middle Ages*. In 1834 the town, with its harbour, was given by David II. to the abbey of Dunfermline, and in 1480 it was "disposed" by Richard, abbot of Dunfermline, to the battles and council of Kirkcaldy.

The commerce of the place has suffered many fluctuations. In 1678, as we learn from the *Register of the Privy Council*, the district of Kirkcaldy had the largest manufacture of salt in Scotland, and about 1680 it was assessed as the sixth town in the kingdom. About 1644 there were one hundred ships belonging to the port, in 1700 only three, in 1792 the number had risen to twenty-nine, and in 1843 to ninety-one. Since then, chiefly owing to the abandonment of the whale-fishing, and the unsuccessfulness of the harbour to admit large vessels, the trade of the port has considerably declined. The number of vessels belonging to it may be stated at twenty-seven. A considerable extension of the present harbour is among the possibilities of the future.

Adam Smith, whose great work *The Wealth of Nations* formed an era in the history of political economy, James Oswald of Dunfermline, a schoolfellow of Adam Smith, and a statesman of much promise; George Gillespie, a leading member of the Westminster Assembly; and Balcanquhall, a lord of session in the time of Queen Mary, were natives of Kirkcaldy. A fine vessel of the name of *Adam Smith*, built at the town, was born about a mile from the burgh boundary. (F. H.)

KIRKCOUBRIGHT, a maritime county of Scotland, known as the "Stewartry of Kirkcubright," and also as East Galloway, is situated between 54° 43' and 55° 19' N. lat., and between 8° 33' and 4° 34' W. long., and is bounded on the N and N.W. by Ayr, E. and N.E. by Dumfries, S. by the Solway Firth and the Irish Sea, and W. by Wigtonshire and Wigton Bay. Its extreme length from north-west to south-east is about 45 miles, and its breadth varies from 21 to 31 miles. The total area comprises 810,343 acres, or about 954 square miles.

The larger half of the county in the north-west direction consists of a rugged and mountainous table-land, with lofty summits of every variety of aspect, intersected often by deep glens. The scenery of this region is for the most part wild and bleak, its solitary desolation being heightened by the presence of many small lochs and tarns, but almost totally unrelieved by a single tree or shrub, although the peat deposits give evidence that the district was at one time covered by an extensive forest. The most elevated regions are generally covered with heath, but at the northern boundary there is a range of grassy hills. Many of the mountains have an elevation of over 2000 feet, the highest summits being Mearrock (2762 feet) in the parish of Minnigaff, and Ouerine (2668), Carlin's Cairn (2650), and Carnmore in Carsphairn (2619)—all in the parish of Carsphairn. The south-eastern half of the county is for the most part level but undulating, its uniformity being broken by frequent rocky knolls or small rounded hills, and in the south-eastern corner rising into several elevated summits, the highest of which is Criffel, 1867 feet. The greater part of this district is finely wooded, and abounds in picturesque scenery, especially towards the sea-coast and in the neighbourhood of the rivers and numerous lochs.

The southern coast is usually bold and rocky, and is much indented by the estuaries of various rivers, which form a number of natural harbours. Owing to the shallowness of the sea-bed, large stretches of sand are exposed in the Solway Firth at ebb-tide, and the rapid flow of the tide has often occasioned loss of life to the unwary.

Geology.—Geologically Kirkcubright forms part of the Silurian belt of the south of Scotland, but this formation is interrupted in the county by several upheavals of granite, one in the north-west south of Loch Doon, another near the centre immediately west of Loch Ken, and a third round Criffel on the shores of the Solway Firth. The lofty table-land is supposed to have been at one time the seat of an immense ice-bed (see paper by W. Jolly, in *Trans. Edin. Geol. Soc.*, 1868), whose action has doubtless in part created the isolated round-backed ridges of granite in the valley of the Urr, the finest example in Scotland of the *Roche moutonnée*, which constitutes a peculiar feature in alpine scenery (A. Somerville in *Trans. Edin. Geol. Soc.*, 1879). A more striking result of the glacial action was the dispersion of Kirkcubrightshire granite to Cumberland, to North Wales, and even so far south as the neighbourhood of Wolverhampton (D. Mackintosh in *Quart. Journ. Geol. Soc.*, 1879). The Silurian strata are for the most part of a slaty character, but in some places are composed of a species of red sandstone. Especially in the neighbourhood of the granite the strata are very much contorted, and give evidence of having at one time been subjected to the action of immense heat. The granite is principally of a pale grey resembling that of Aberdeen, but a red variety also occurs. The principal quarries are at Dalbeattie and Creetown. Strata of lead are believed to stretch between Minnigaff and the Leadhills in Dumfriesshire, but the metal is very little worked. Iron ore exists in different parts of the county, but from the absence of coal is almost wholly unutilized. Copper and barytes are also found, especially in the parish of Urr. Marl is obtained in large quantities from a number of the lochs.

Rivers.—The Nith, which rises in Ayrshire and flows through Dumfriesshire, forms for about 12 miles the boundary between Dumfries and Kirkcubright, an equal distance of boundary to the north-west being formed by its tributary the Cluden water. The Urr, which rises in Loch Urr on the borders of Dumfriesshire, flows south-eastward by Dalbeattie to the Solway Firth, where it forms a small bay. The Ken rises in Dumfriesshire, and after being joined from the west by the Dengh water flows south-east into Loch Ken, the stream that issues from the loch taking the name of the Dea, and after a beautiful course south-westward falling into the Solway Firth. The Fleet, which rises in Loch Fleet, after a course of about 7 miles, falls into Wigton Bay, where it forms an estuary. The Cree, which has its origin in two streams in Ayrshire, and forms the boundary of Kirkcubright with Ayrshire, and afterwards with Wigtonshire, flows south-east by Minnigaff and Newton Stewart, and falls into Wigton Bay at Creetown.

Agriculture.—A considerable proportion of the land in the higher regions of Kirkcubright is unsuitable for tillage, and yields a very small return as pasturage. In many cases also the soil is very stony. In the lower regions it is generally dry but rocky. Much has been done of late years to increase the value of the land by draining the swamps, by the removal of stones, and by deepening the soil and enriching it with manures. Generally the climate and soil are not adapted for the rearing of grain, but are specially suited for grass and green crops.

According to the agricultural returns for 1881 the area under crops was 179,227 acres, or 29 per cent. of the whole area. The area under corn crops was 82,849 acres; under green crops, 18,091; under rotation grasses, 71,061; under permanent pasture, 57,471 acres. The area under woods was 19,741 acres. The system of cropping is generally as follows:—first year, in breaking up from

pasture, barley or more generally oats; second year, green crop; thirdly, wheat, oats, &c., fourth year, hay or pasture, which is generally continued for three additional years. It is now becoming a very common practice to sow in grass after turnips without taking a corn crop, the soil being also frequently allowed the advantage of the manure of the sheep which have eaten the turnips on the ground. Of corn nearly the whole area is under oats, which in 1881 occupied 31,031 acres, while only 923 were under barley and bere, and 140 under wheat. Of green crops the area under turnips and arvicola in 1881 was 11,690 acres, under potatoes 2847, mangolds 91, carrots 33, cabbage, kohlrabi, and rape 402, and velvet 100.

The total number of horses in 1881 was 6395. Of these 3780 are stated to be used solely for agricultural purposes, and 1606 to be unbroken horses and mares kept solely for breeding. The breeding of Clydesdale horses has of late years been increasing. Cattle in 1881 numbered 40,737. The Ayrshire breed of cattle was introduced into Galloway about the beginning of the century, and has risen rapidly in favour, being now the principal stock in West Galloway. Polled or Galloway cattle is a common breed in East

Galloway, especially on inferior farms, and is still preferred for dairy purposes on many low country farms. The number of cows in 1881 was 12,071, of other cattle above two years of age 14,002, and of cattle under two years of age 14,684. The number of cattle to every 100 acres under cultivation was 22.8, the average for Scotland being 23. Within recent years the increase in the number of cows has been very great, cheese-making, in which much progress has been made, now occupying the chief attention of the farmer. Cattle feeding is also largely practised, and for this purpose large quantities of lean cattle are imported from Ireland. Sheep in 1881 numbered 362,289, an average of 302.1 to every 100 acres under cultivation, the average for Scotland being 141.9. Blackfaced sheep are the most common on the high grounds, and even on the lower parts the Cheviot breed is decreasing owing to the low price of wool. In some districts crosses of a Leicester tup with a blackfaced or Cheviot ewe are common. Pigs, which are kept principally on dairy farms, are generally fed on whey and Indian corn. In 1881 they numbered 5607.

The following table gives a classification of holdings according to area in 1875 and 1880.—

	60 Acres and under.		From 60 to 100 Acres		From 100 to 200 Acres		From 200 to 400 Acres.		From 400 to 1000 Acres.		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1875	761	11,377	265	39,794	418	76,218	119	48,408	28	19,468	1	5,614	1,605	180,085
1880	770	11,496	254	39,481	451	85,031	120	48,009	26	16,564	1	2,022	1,605	177,102

In 1872-73 the land was divided among 2380 proprietors, and amounted to 571,950 acres, with a gross annual value of £260,060. Of the owners 1908, or 79 per cent., possessed less than 1 acre, and the average value was 12s. 8d. per acre. There were three proprietors who possessed upwards of 40,000 acres, viz. the earl of Galloway, 55,981, H. G. Murray Stewart, 45,387; and William Forbes, 40,446. Other eight possessed upwards of 10,000 acres.

Manufactures.—The principal trades are Kirkcudbright, Greetown, and Gatahouse. Linen, woolen, and cotton goods are manufactured in the towns and villages, and there are also breweries, distilleries, tanneries, and paper-mills. Shipbuilding is carried on to a small extent at Kirkcudbright. Lead is obtained at Woodhead and Milmull; and there are extensive granite works at Dalbeattie and Greetown; and at Dalbeattie there are brick and tile works. Deep-sea fishing is prosecuted in the Solway, and salmon fisheries at the mouths of the rivers.

Railways.—A line from Dumfries to Castle Douglas is continued by Gatahouse and Greetown to Newton Stewart, and a branch line runs south from Castle Douglas to Kirkcudbright.

Administration.—The county includes twenty-eight parishes. Quarter sessions are held on the first Tuesday of March, May, and August, and the last Tuesday of October, and justice of peace small debt courts are held at Kirkcudbright, New Galloway, Castle Douglas, Maxwelltown, Gatahouse of Fleet, and Creebriar. The county forms a portion of the sheriffdom of Dumfries and Galloway. A sheriff court is held twice a week. A sheriff circuit small debt court is held at Castle Douglas, Maxwelltown, New Galloway, and Greetown, and a small debt court for the whole shire at Kirkcudbright. The county returns one member to parliament, and the burgh of Kirkcudbright unites with Annan, Dumfries, and Lochmaben in returning another. New Galloway unites with Wigton, Stranraer, and Whithorn in returning a third, while Maxwelltown, a portion of which is in the county, forms part of the burgh of Dumfries.

Population.—From 29,311 in 1801 the population gradually increased till it reached 48,861 in 1861. Since then it decreased to 42,495 and in 1871 to 41,869, but in 1881 it was 43,136, of whom 10,798 were males and 22,338 females. None of the towns exceed 3000 in population. Kirkcudbright, a royal and parliamentary burgh, has a population of 3571. New Galloway, Maxwelltown, Castle Douglas, Dalbeattie, and Gatahouse are police burghs. The principal villages are Creebriar, Greetown, Gatahouse, Dalry, Haugh of Urr, Kirkpatrick-Durham, and New Abbey.

History and Antiquities.—Anciently Kirkcudbrightshire formed part of the kingdom of Strathclyde, being occupied partly by the Norwegians, who held the whole of Galloway westward from the Dee, and partly by the Selgives, whose territory stretched eastward from the foot of the Galloway, one of the towns of the Selgives, Car-banrigum, in all probability occupied the site of the stronghold called the Moat of Urr. In 79 A.D. Agricola landed on the shores of the Solway Firth and overran Strathclyde, but the district was not completely subjugated by the Romans till the building of the wall of Severus in 208. Many traces of Roman camps are still to be seen, and a very perfect one exists at Fulcrum in the parish of Anwoth. Some suppose that the important indications of human occupation in the ovens on the coast were due to the fact that some of the inhabitants betook themselves to these during the Roman occupation (see "Account of the Exploration of the Borroose Cave" in *Proc. Soc. Antiq. Scot.*, 1874-1876, 1877). The Pictish tribe which,

according to Bede, inhabited Galloway in 608, is supposed by Skene to have been the original *Novantes*,—a tribe, he thinks, of Gaelic or Gaelic Fichta who retained their independence because of the isolated position of the country. In the 7th century the district was invaded by the Angles, but their rule over it ceased about the end of the 8th century. In 740 Alpin, king of the Scots of Dalriada, was slain in battle, probably near the site of the present town of Kirkcudbright. The name Galloway, by which the country occupied by Kirkcudbright and Wigtonshire is now known, is first to have been applied to it while it formed part of the Anglian kingdom of Northumbria, the word *Gallowaith* being formed from *Galdwydd* the Welsh equivalent of Galloway, the word meaning the Geals under the dominion of foreigners. Of the ancient inhabitants of Galloway there are in Kirkcudbrightshire a large number of relics. In several of the lochs crannogs or lake dwellings as well as castles and a variety of implements and other remains have been found. Druidical circles are very common, and among the numerous crannogs may be mentioned that of Drumaluanne on the moor of Barclay in Minnigaff parish, which is 891 feet in circumference. Of the Pictish kilns there are several specimens in the parishes of Minnigaff and in other places. The most notable old forts are a very ancient one on a sea-cliff near Borgue, an old Pictish tower at Battrin in the same parish, a circular fort with trifled walls at Castle Gower, parish of Buntilla, and others on the hill of Halbarra, Crossinchall, the hill of Dungulla, Kelton, and on Ben-ary hill. An old wall known as the Devil's dyke, supposed to have been built previous to the Roman invasion, passed through Galloway from Lochryra into Dumfriesshire. In the 9th century the district was invaded by the Danes, and so much harassed that many of the inhabitants emigrated to Wales. In the following century Galloway along with Strathclyde was subdued by Edmund and brought under the rule of Malcolm I. of Scotland. Some time in the 11th century it was subdued by the Danes and the Norwegians, but in the beginning of the 12th century they were overpowered by a Celtic chief Fergus, who founded a line of lords of Galloway, some of whom asserted their independence of the Scotch crown. The line became extinct in the male branch in 1284, after which Galloway was for some time under the rule of Edward I. of England. The lordship in the female line became divided between two families, one of whose representatives, John Balliol, laid claim to the crown of Scotland, but in 1308 the district was freed of the English and brought under allegiance to Robert Bruce, after which the lordship of Galloway was conferred upon Edward Bruce. In the 14th century Galloway again assumed the pretensions of the Balliols to the throne of Scotland, but the district was finally completely subjugated in 1388 by Sir William Douglas, whose descendant Archibald recovered from the crown in 1871-72 the lordship of Galloway. After the forfeiture of the estates of the Balliols, Kirkcudbright was placed under the immediate rule of the crown, and was governed by the royal steward, whence it has still the name of the "stewartry," but it appears that the stewardship was afterwards transferred to the Douglasses, and was not restored to the crown until the forfeiture of their estates in 1465.

The principal old castles are Threave Castle on the Dee, the seat of the Douglasses, for the reduction of which during the reign of 1465 it is said that the famous cannon Mons Meg was manufactured; Cardross Castle, on the west side of the Fleet; and the castle of Kirkcudbright, which belonged to the lords of Galloway, and was frequently the residence of royalty.

The principal monastic buildings were the Cistercian abbey of Dundrum, founded in 1142; Tongland Abbey, founded by the Premonstratensians under the auspices of Fergus in the reign of David I., the priory of St Mary's Isle, founded also by Fergus, and subsequently united as a dependent cell to the abbey of Holyrood; the New Abbey founded for Cistercian monks in 1275, the priory of Lundin, founded by Uchire, lord of Galloway, for Benedictine nuns; a convent for Franciscan or Greyfriars, founded at Kirkcubright in the reign of Alexander II.; and a nunnery in the parish of Kirkcubright.

See Symson, *A Large Description of Galloway*, 1684, new ed. 1893; Murray, *Literary History of Galloway*, 1828, and the *Historical of Galloway* by Mackenzie, 1841, and Mackenzie, 1870-72.

KIRKÍ, or **KIRKE**, a town and military cantonment in Poona district, Bombay, India, 18° 35' N. lat., 73° 54' E. long. The town, with its adjoining suburbs and the military cantonments, contains a total population of upwards of 31,000 inhabitants.

KIRKINTILLOOH, a burgh of barony and market-town of Dumbartonshire, Scotland, about 7 miles north of Glasgow. The town is rather irregularly built. The cruciform parish church dates from 1644. The Broomhill house for incurables is situated near the town. Traces of the wall of Antonine are to be discerned behind the church. The inhabitants are chiefly employed in the chemical and iron-works on the banks of the Forth and Clyde Canal, and in coal-mining, which is being rapidly developed in the district. Weaving to a small extent is also carried on. Kirkintilloch became a burgh of barony by grant of William the Lion. Since 1871 it has been under the General Police Act of 1862. The population in 1881 was 10,582.

KIRK-KILISSIA, or **KIRK-KILISSEH**, a town in the vilayet of Adrianople, Turkey, is situated on a feeder of the Erkeke, which is an affluent of the Maritza, about 36 miles east of Adrianople. It has its chief importance from its position at the southern outlet of the Fakhi defile over the Strandja mountains, through which passes the shortest road from Shumla to Constantinople. It contains six mosques, several Greek churches, and a large bazaar. A special kind of confection is made at Kirk-Kilissia; and a considerable quantity of butter and cheese is sent thence to Constantinople. The population is estimated at about 16,000.

KIRKWALL, a royal and parliamentary burgh of Scotland, and the chief town of the Orkney Islands, is situated near the centre of the island group, at the south-east corner of a well-sheltered bay on the east side of the island of Pomona, 240 miles north of Edinburgh by steamer, 68 north of Wick, and 54 north of Thurso. It consists principally of an irregular street about a mile in length running along the margin of the bay, and so narrow that carts and similar vehicles in many places cannot pass each other. The houses are generally substantially built, with the gables facing the street nearly as frequently as the fronts. In courts leading from the main street there are many ancient buildings, formerly occupied during winter by the leading families of the islands. The more modern portion of the town is built with great regularity, and in the suburbs there are several good villas surrounded by gardens. The most prominent feature of the town is the cathedral, dedicated to St Magnus, the patron saint of Orkney, a stately cruciform structure with a length of 236 feet from east to west and a breadth of 66 feet. It was founded by Earl Ronald in 1187, and the older portion, embracing the greater part of the present building, is in the Norman style of architecture. The choir was lengthened by Bishop Stewart in 1511, and the western extremity of the nave was completed by Bishop Reid, who succeeded to the bishopric in 1640. The building has undergone extensive repairs during the present century. The choir is used as the parish church. The bells were presented by

Bishop Maxwell, the predecessor of Bishop Reid, but the larger or tenor bell was recast in 1862. The cathedral contains a number of old monuments. Adjoining it are the ruins of the bishop's palace, where King Haaco died in 1263, and also the earl's palace, which after the forfeiture of the earl of Orkney was given to the bishops for their residence. There is a grammar school, which was endowed by Bishop Reid, and also several charitable institutions. The town has no manufactures of importance, and its prosperity depends chiefly on its being the capital and principal port of the islands. It is often touched by ships passing to Norway and the Baltic. The harbour is amply sufficient for the shipping of the port, and a fine iron pier was erected in 1867. There is regular steam communication with Lerwick, and with Lath by Aberdeen and Wick. Kirkwall (a name derived from *kirk*, church, and *edgr* or *vaag*, bay), was a place of some size when the islands were in the possession of the Norsemen, and by James III. it was created a royal burgh. It unites with the other burghs in the Wick district in returning a member to parliament. The population of the parliamentary burgh in 1881 was 3938.

KIRMAN, the ancient Karmāna, a province of south Persia, bounded on the E. by Sistān and Baluchistan, on the W. by Farsistan, N. by Khōrāsān, on the S. by Lāristān, Makrān, and the Strait of Ormuz. It is of very irregular shape, expanding in the north towards Khōrāsān, and gradually contracting in the south to the narrow coast district of Mogistān; the extreme length between Sistān and Fars east and west is 400 miles; the greatest breadth from south of Yeod to the coast at Bandar-Abbās is 300 miles; and the total area is estimated at 56,000 to 60,000 square miles. It is generally described as consisting of two parts, an uninhabitable desert region in the north, and a habitable mountainous region in the south. But the recent explorations of Khanikoff, Goldsmid, Lovett, St John, and others require this view to be considerably modified. There are mountains and desert tracts in all parts, while much of what appears on the maps as forming the western portion of the great Kirmān desert consists of the fertile upland plateau of the Kūh-Bandā, stretching along the eastern base of the lofty range which runs from Yeod south-east to Khabīs. West of and parallel to this range are two others, one culminating north of Bam in the Kūh-Hazār, 14,650 feet, the other continued at about the same elevation under the name of the Jamāl Bāris south-eastwards to the Kohistan highlands on the Makrān frontier. These chains traverse the fertile Nurmanashahr district, dividing it into several longitudinal valleys of considerable length, but not averaging more than 12 miles in width. Snow lies on their slopes to a great depth for the better part of the year, feeding the springs and "karez" or underground irrigation rills, by means of which large tracts in this almost rainless region in summer are kept under cultivation. Still further west the Kūh-Dinār range is continued from Fārsistan also in a south-easterly direction to the valley of the Mināh, which is the only river worthy of the name in the whole province.

Between the south-western highlands and the Jamāl Bāris there is much arid and unproductive land. But the true desert of Kirmān lies mainly in the north and north-east, where it merges northwards in the desert of Lūt,¹ which stretches far into Khōrāsān. These southern deserts differ from the Great Kavir, or Salt Desert of North Khōrāsān, mainly in three respects:—they are far less saline, are more sandy and drier, and present in some places tracts of from 80 to 100 miles almost absolutely destitute of vegetation. Yet they are crossed by a well-known track

¹ The term *lut* means simply *add, waterless*, and has nothing to do with the *Lot* of Holy Writ, as some have supposed.

running from Kirman north-eastwards to Herat, which is traversed by couriers at great risk in about eighteen days. It appears from recent observation that these sandy wastes are continually encroaching on the fertile districts, and this is the case even in Nurmanshahr, which is being invaded by the sands of the desolate plains stretching thence westwards to Bam. There are also some "kafsh" or salt swamps, answering to the kavir of Khôrâsân, but occurring only in isolated depressions, and nowhere of any great extent. The desert of Kirman lies about 500 or 600 feet above the sea, apparently on nearly the same level as the desert of Lut, from which it cannot be geographically separated.

The climate, which varies much with the relief of the land, has the reputation of being the most unhealthy in Persia, the fever-stricken districts of the Caspian alone excepted. The cool air from the snowy ranges is usually attended by chills and agues, so that the people on the whole prefer the sultry heat of the plains. Still some of the sheltered upland valleys in Nurmanshahr and elsewhere enjoy a genial climate like that of Shirâz.

The chief products are cotton, wheat, barley, gums, dates of almost unrivalled flavour from Mogetan, and wool both of sheep and goats (*kork*) noted for its extreme softness. This wool is used in the manufacture of the Kirman shawls, which yield in delicacy of texture only to those of Kashmîr, while often surpassing them in design, colour, and finish. A shawl of the finer quality, 3 yards long, is sold on the spot for from £20 to £24. Spinning and dyeing are also practiced, so that the province completes the manufacture of its own raw material. Its carpets and felts are also unexceeded for richness of texture and durability. Besides these woven goods it exports mainly cotton, grain, and dates, receiving in return from India chintzes, muslins, indigo, tea, gold-cloth, china, glass, sugar; from Turkestan madder, rhubarb, drugs, gums, furs, silks, Bokhara furs, steel, copper, tea. Bandar-Abbas is the natural outlet; but, since shipping has shown a preference for Bushehr further north, the trade of Kirman has greatly fallen off.

The inhabitants, numbering altogether about 500,000, consist of Tajiks in the towns and agricultural districts, some Türk, Rind, and Baluchi nomads in the east and south-east, and numerous Kûrd tribes, here called Leks. Shiel gives a list (incomplete) of twenty-one of these Lek tribes, dwelling partly in houses partly in tents, and numbering altogether about 200,000 souls.

The chief towns are Kirman (the capital), Regan, Kruk, Kâm, Bam, Khâbs, Khârd, and Bandar-Abbas.

KIRMANSHAHÂN, or **KERMANSHAH** (Arabic, *Kermânshâh*), a town and district of west Persia, lying between Ardâlan and Lûristân north and south. The town is the chief place in what is known as Persian Kûrdistân, an expression, however, which has no administrative significance. It lies in 34° 18' N. lat. and 46° 37' E. long., on a rising ground connected with the Zagros hills, which stretch south-eastwards to the Bakhtiari range. Here it occupies an important strategical position near the right bank of the river Kernah, 260 miles south-west of Tehrân, 262 north-west of Isfahân, 220 north-east of Baghdad, and 280 south of Tebriz. Although surrounded by fortifications with five gates and 8 miles in circuit, it is now practically an open town, for the walls are in ruins and the moat choked with rubbish. During Muhammad Ali Mirza's administration it was a very flourishing place, with a population of 35,000 and a large local and transit trade between Baghdad and Tehrân. Since then it has suffered more than most towns in Persia from misgovernment, under which its few buildings have gone to decay, its bazars have become empty, and its trade reduced to a local traffic in the excel-

lent fruits produced in the surrounding gardens and orchards. The rich and beautiful carpets and rugs for which it was formerly noted are no longer to be had, and the population has fallen to about 12,000, exclusive of a garrison of 5000 usually maintained at this important frontier station.

Kirmanshâhân is governed by a royal prince, with jurisdiction over the district, which occupies an extensive tract between Mount Elwend and the Turkish border. Here the plains are well watered and very fertile, while the hills are covered with rich pastures which support large flocks of sheep and goats, besides horses of a good breed crossed with Arab blood. About 70,000 sheep are yearly taken to Tehrân by the Kûrd shepherds, who form the vast majority of the inhabitants of the district, residing some in houses some in tents, and numbering altogether about 180,000.

KIRRIEMUIR, a burgh of barony and market-town of Forfarshire, Scotland, is beautifully situated on an eminence, above the glen through which the Gairie flows. It lies about 6 miles north-west of Forfar, and about 62 miles north of Edinburgh. The town, consisting of several narrow diverging streets, is tolerably well built. Its educational advantages are good; by the Henry bequest a number of boys are maintained at the public school; and by the Webster bequest a school has been endowed and erected. The special industry of the town is linen-weaving, for which large power-loom factories have recently been built. The population in 1881 was 6588.

KIRSANOFF, a town of Russia, in the government of Tamboff, 61 miles east of the government town, near the junction of the Pursavka with the Vorona, with a station on the railway between Saratoff and Kozloff. The population, which increased from 5699 in 1862 to 7200 in 1872, is mainly engaged in agriculture and trade, the only manufactures of importance being those of wax and tallow. There is a nursery with nearly one hundred nuns in the town. Kirsanoff owes its origin to the opening of iron-works in 1733. It became a district town in 1779.

KISFALUDY, **KÁROLY** or **CHARLES** (1788-1830), one of the most genial, prolific, and gifted poets of Hungary, and especially celebrated as the regenerator of the national drama, was born on the 6th of February 1788, at Tét, in the county of Gyor. His birth cost his mother her life, which unfortunate circumstance preyed upon the father's mind and caused him to view the child with feelings akin to aversion. The austerity of his father and the loss of his mother were, however, in a great measure made amends for by Károly by the love of his elder sister Tétéz, who tended him during his early years with maternal care, and remained devoted to him through his whole life. In 1799 he was sent to the gymnasium at Gyor (Raab), where he made only moderate progress in his studies, whilst the impetuosity of his disposition often involved him in trouble. Placed as a cadet in Duke Esterházy's regiment in 1804, he saw a good deal of service, rising to the rank of captain. In 1811 he quitted the army with the intention of marrying. Offended at this step, his father withdrew from him all support, and his affianced bride rejected him upon finding him at variance with his father. His sister, then the wife of Captain Gábor Parkas, offered him an asylum in her home, where he remained during the winter of 1811-12; but, unwilling to eat the bread of dependence, Károly removed to Pest and afterwards to Vienna, where he tried to live by his skill in painting. He at this time began assiduously to study the works of Shakespeare, Schiller, and Lessing, became a frequent visitor at the Vienna theatre, and made the acquaintance of its official poet Theodor Körner, whose drama *Zrinyi* was written at Kisfaludy's suggestion. Rendered impatient by ill success, he soon left Vienna, and

for over four years wandered, mostly on foot, through Germany, Switzerland, France, and Italy as far as Rome, obtaining as before a precarious livelihood as an artist. At length subdued by misfortune, and longing for his home and a more honourable career, he in 1817 sought by the aid of his sister reconciliation with his father, who, though still hard to be entreated, allowed him a slight pecuniary assistance. Although not without friends at Pest, where he now took up his abode, he continued to support himself by his brush until the spring of 1819. It was on the 3d of May in this year that the successful performance at Pest of his national drama, in five acts, *The Tatars in Hungary*, placed the name of Károly Kisfaludy on the roll of literary fame. It was rapidly followed by other dramas, all of which met with popular favour. Not only was he now admired by his own countrymen, but by means of the German translations of Gsál in the *Theater der Magyaren* (Brinn, 1820) he soon became known abroad. Freed from pecuniary embarrassment, Károly Kisfaludy was now able to devote his best energies to literature, poetry, and the drama. In 1822 he started an annual under the name of *Aurora*, which he continued to edit until the year of his death. Although its success was great and his popularity continued to increase, he became ever more and more critical with regard to his own productions; and, if his earlier pieces must be regarded rather as the outcome of natural talent than as the result of matured consideration, his later productions bear evidence to the high culture of his mental powers. In recognition of his exceptional literary merit, he was in 1826 rewarded with the prize of the Marczibányi foundation; about this time also he came into possession of the estate at Tót through the death of his father. Towards the close of 1829 his health began to fail, and, though he rallied for a time, consumption, accelerated by the news of his sister's death, brought his career to a close on the 21st November 1830, at the early age of forty-two, while his friends were rejoicing at the tidings of his election as a member of the Hungarian academy of sciences. The first edition of his collected works was published by Toldy in 10 vols. (Buda, 1831). To the *Kisfaludy Károly élete*, prefixed to the Pest edition of 1873, we are indebted for many of the foregoing particulars.

KISFALUDY, SÁNDOR or ALEXANDER (1773-1844), elder brother of Károly Kisfaludy, whom he excels as a lyric poet though not as a dramatist, was born on the 27th of September 1773 at Sümeg in the county of Zala, Hungary. Choosing the career of a soldier, he entered the army in 1793, and was soon appointed to a lieutenancy in the Hungarian life guards at Vienna. There he employed his spare time in literary pursuits, and especially in the study of Italian poets. Upon the death of his patron Prince Anton Esterházy, Kisfaludy was sent back to Hungary. Soon after this, at a vintage festival in Badacsony, he made the acquaintance of Rozsalia Szegedy, whom, notwithstanding a subsequent long estrangement, he eventually married, and who under the name of Liza is the subject of his *Himny*. During the Italian campaign of 1796 Kisfaludy was stationed at Milan, and upon the surrender of that city he was sent as a prisoner of war to Yanclose, where he began to write the series of love sonnets for which he afterwards became so famous, and which were suggested to his mind by the songs of Petrarch. After his release at the peace of Campo Formio (17th October 1797), Kisfaludy was posted as captain in a regiment quartered at Wurtemberg, and in 1799 he took part in the battles of Stokach, Winterthur, and Zürich. In 1800 he left the army, and stayed for five years at Kám in the county of Vas, subsequently removing to his native place Sümeg, where he devoted himself to agricultural and literary

pursuits. By this time Kisfaludy had gained the highest reputation as a lyric poet by his *Loves of Himfy*, the first part of which, published anonymously at Buda in 1801, was received with such applause as had never before been accorded to any Magyar work. The second part appeared under his own name in 1807. On the "insurrection," or general rising of the Hungarian nobles against Napoleon, in 1809, Kisfaludy accepted the post of major of cavalry, and was also nominated by the palatine one of his adjutants. After his return to private life Kisfaludy wrote several dramatic pieces, and from 1820 contributed largely to his brother's annual *Aurora*. In 1818 he gained the Marczibányi prize for his *Ballads* (2d edition, Buda, 1818), which work was translated into German by Gsál (Vienna, 1820); and in 1831 he was elected member of the Hungarian academy of sciences, in the formation of which he had taken an active part. He died on the 28th of October 1844, at the age of seventy-two. His collective works, in 6 vols., were published at Pest in 1847 by Toldy. Exquisite metrical English renderings of several verses from the *Himfy* will be found in Sir John Bowring's *Poetry of the Magyars* (London, 1830).

See J. Foresey, *Magyar Irók. Élet- és Gyűjtemény*, Pest, 1866.

KISH, or KARS (the first form is Persian and the second Arabic), an island in the Persian Gulf, which rose to importance in the 12th and 13th centuries, and flourished on the fall of Siráf as a chief station of the Indian trade with the West. Edrâs in the 12th century describes it as the capital of a pirate chief who had acquired great wealth and power, and ravaged the coasts far and wide. He also drew a tribute from the pearl fisheries of the gulf. In the following century Yâkût describes it from personal observation as a beautiful and flourishing island, the seat of the lord of 'Omân, sovereign of those seas, and the station for ships trading between India and Fârsistân. The lord of Kish was respected even in India for his wealth and maritime power. According to Ibn el Atîr he was at constant war with the sovereign of Hormuz, and the rise of the latter port seems to have been fatal to the importance of Kish (Ibn Batûta, i. 244, and note in Paris edition; Kazwîni, ed. Wusteni, i. 161). The island is generally identified with the modern Kenn and the Katsis of Arrian. See Vincent, *Voyage de Nérarque*; Ouseley's *Travels*, i. 169 sq.

KISHANGARH, or KRISHNAGAR, a native state in Râjpûtânâ, India, lying between 26° 17' and 26° 59' N. lat., 74° 43' and 75° 13' E. long., with an area of about 724 square miles, and an estimated population of 105,000. It was founded in the reign of the emperor Akbar, by a younger son of the râjâ of Jodhpur. In 1818 Kishangarh first came into direct relations with the British Government, by entering into a treaty together with the other Râjpût states, having for its object the suppression of the Pindârî marauders by whom the country was at that time overrun. The estimated revenue in 1875 was £30,000.

KISHINEFF, the Kishlanow of the Moldavians, a town of Russia, capital of the province of Bessarabia, on the right bank of the Byk, a tributary of the Dniester, situated on the railway between Odessa and Jassy in Roumania, 118 miles north-west from the former. At the beginning of this century it was but a poor village, and in 1812, when it was acquired by Russia from Moldavia, it had but 7000 inhabitants; twenty years later its population numbered 35,000, while in 1862 it had, with suburbs, 92,000 inhabitants, and now its population is more than 110,000, composed of the most varied nationalities—Moldavians, Wallachs, Russians, Jews, Bulgarians, Tartars, Germans, and Tsigans. The town consists of two parts—the old or lower town, on the banks of the Byk, and the new or high town, situated on high crags, 450 to 500 feet above the level of

the river. The wide suburbs are remarkable for their gardens, which occupy about 12,000 acres, and produce great quantities of fruits (especially plums, which are dried and exported), tobacco, and wine. The buildings of the town are, however, very plain, and the streets remain mostly unpaved. Kishineff is the seat of the archbishop of Bessarabia, and has an ecclesiastical seminary with 800 students, a college, and several secondary and primary schools. There are several tallow-melting houses, steam flour-mills, candle and soap works, distilleries, and tobacco factories. The trade is very active and yearly becomes more important, Kishineff being now a centre for the whole Bessarabian trade in grain, wine, tobacco, tallow, wool, and skins, exported to Austria and to Odessa. The fairs, which are held twice a week, are very animated, and their yearly return is estimated at £300,000. The town played an important part in the late war between Russia and Turkey, as the chief centre of the Russian invasion.

KISHM, or TAWLAN (i.e., Long Island), an island at the mouth of the Persian Gulf, separated from the coast of the Persian province of Kirmān by Clarence Strait, which at its narrowest point has a breadth of less than 2 miles. The island has a length of about 56 miles, its main axis running north-east and south-west; and the area is estimated at 640 square miles. A range of hills from 300 to 600 feet in height, and with strongly marked escarpments, runs nearly parallel to the southern coast; they are largely composed, like those of Hormuz and the neighbouring mainland, of rock salt, which is regularly excavated in one or two places, and forms one of the chief products of the island, finding its way first to Muscat and thence to India and Africa. The rest of the island consists of sandstones and marls. In its general aspect it is parched and barren-looking, like the south of Persia, but it contains fertile portions which produce grain, dates, grapes, melons, &c. Naphtha springs exist near the village of Salak on the south coast. Kishm, the largest of the towns, lies at the eastern extremity of the island; Bassidore, the next in importance, at the western extremity; and Lâft (Lut, Leit) about midway along the northern coast. The town of Leit was reduced by a British fleet in 1809. Politically the island belongs to Persia, but the shah has long farmed it to the sultan of Muscat. The inhabitants are reckoned at 6000 or 8000.

Kishm is the ancient Oracta, or Urochthra, a name said to survive in a village called Brakt. The old Arabic word is Barkātān or Bary-Kānān. Mas'ūdī (ch. x), who mentions its capture by 'Amrūn of Asy, says that it also bore the name of Lâft. See Waldstein's *Travels to the City of the Caliphs*, 1840, vol. i. p. 65 sq.; *Poly. in Journ. Roy. Geog. Soc.*, 1864; Springer, *Atlas Geog. Arabiensis*, p. 119 sq.; and Ouseley's *Travels*, i. 162.

KISSINGEN, the chief town of a department in the government district of Lower Franconia and Aschaffenburg, Bavaria, is situated on the Franconian Saale, 656 feet above sea level, and about 62 miles east of Frankfurt-on-the-Main. Its streets are regular, and its houses attractive. A stone bridge spans the Saale at the town. It has a local court, a commercial school, a theatre, and various benevolent institutions, besides all the usual buildings for the lodging, cure, and amusement of the 10,000 annual visitors who are attracted to this, the most popular watering-place in Bavaria. In the Kurgarten, a tree-shaded expanse between the Kurhaus and the handsome colonnaded Conversations-Saal, are the three principal springs, Rakonci, Pandur, and Maxbrunnen, of which the first two, strongly impregnated with iron and salt, have a temperature of 51°-56 Fahr.; and the last (50°-72°), is like Selters or Solzer water. At short distances from the town are the intermittent artesian spring Soelenbrunndel, the Schönbrunndel, and the Theresienquelle; and in the same valley as Kissingen are the minor spas of Booklet and Brückensau.

The waters of Kissingen are prescribed for both internal and external use in a great variety of diseases, such as chronic catarrh, rheumatism, scrofula, affections of the bowels, of the lungs, and also of the eyes and ears. They are all highly charged with salt, and productive Government salt-works were at one time stationed near Kissingen. The manufactures of the town, chiefly carriages and furniture, are unimportant. The population in 1875 was 3471.

The salt springs were known in the 8th century, and their medicinal properties were recognized in the 16th, but it was only within the first half of the 19th century that Kissingen became a popular resort. On July 10, 1866, the Prussians defeated the Bavarians with great slaughter near Kissingen. The town was the scene of the attempted assassination of Prince Bismarck by Kallmuss, July 13, 1874.

KISTNA, or KUNISTNA, a district in the Madras Presidency, India, lying between 15° 35' and 17° 10' N. lat., and between 79° 14' and 81° 34' E. long., and bounded on the N. by Godāvri, on the E. by the Bay of Bengal, on the S. by Nellore, and on the W. by the Nizām's Dominions and Karul. Kistna is, speaking generally, a flat country, but the interior is broken by a few low hills, the highest being 1857 feet above sea-level. The principal rivers are the Kistna, which cuts the district into two portions known as the Maelupatam and Gantrur divisions, and the Manyer, Palern, and Naguluri (tributaries of the Gundlakamma and the Kistna); the last only is navigable. The Kolar Lake, which covers an area of 21 by 14 miles, and the Romparu swamp are natural receptacles for the drainage on the north and south sides of the Kistna respectively. Iron and copper exist, and at one time the mines were worked; but the smelting of copper is now a thing of the past, and that of iron is also dying out. Diamond mines are still worked, to a very slight extent, in five villages belonging to the nizām; and at other places there are traces of mines which were abandoned long ago. Garnets and small rubies are also found. There are no forests in the district. Every variety of the game birds of India, except the pheasant, woodcock, and hill partridge, abounds. The most deadly of poisonous snakes, the Russell viper, is common about Masulipatam. The cobra, carpet snake, and one kind of *bangarus* (*Atractus*) are also met with.

The census of 1871 returned the population of Kistna district at 1,452,874 (1,378,089 Hindus, 73,987 Mohammedans, 90 Europeans, 218 Eurasians, and 86 "others"). As a whole the people are poor, except in the fertile Godāvri delta. The cultivated area, exclusive of zamindari estates, in 1875-76, was returned at 1,907,215 acres, cultivable but not under tillage 931,377 acres, and waste 1,215,853 acres. The principal agricultural products are rice, maize, ragi, pulses, hemp, flax, cotton, tobacco, gungey, oil-seeds, oilives, wheat, gurli, indigo. The delta is irrigated by the Kistna river, which in 1876 watered 518,029 acres. A considerable trade is carried on in dressed hides at Beavara. The inland villages carry on weaving from native hand-made cotton or silk thread. The chief exports are cotton and indigo. The total revenue in 1870-71 amounted to £548,469, of which £259,172 was derived from the land. The number of cultivators' holdings in 1871 was 127,689, owned by 159,086 proprietors or co-proprietors.

The early history of Kistna is inseparable from that of the northern Ghazis and Godāvri district. Dharandikōta and the adjacent town of Amaravati were the seats of early Hindu and Buddhist Governments; and the more modern Rājamahendri (Rajamahendri) owed its importance to later dynasties. The Chalukyas here gave place to the Ganapatya, who in turn were ousted by the Reddi chiefs, who flourished during the 14th century, and built the forts of Bellamkōndā, Kondavir, and Kondapalli. On the death of one of these, at the commencement of the 16th century, Deva Rājāla, of the Vijayanagar dynasty, seized the country and held it until Mohammed II. (1469-86), a Muslim king of the Bahman line, wrested this portion of his kingdom from him. The power of the Bahmanī dynasty failed towards the end of the 16th century. Kuli Kutab Shah became king of Golconda about 1612 A.D., and his kingdom included the whole of what is now the Masulipatam portion of Kistna district. On the other side of the Kistna, Narasimha Deva Rājāla ruled at this time. His territory, which included Gantrur, was annexed to Golconda by Kutab Shah's great-grandson, about 1600. This line of kings ended with Tanha,

who was dethroned by Aurangzeb in 1687. Meantime the English had, in 1622, established a small factory at Masulipatam, where they traded with varying fortune till 1760, when the French took possession of it. From 1769, when it was recaptured by Colonel Forde, with a force sent by Lord Clive from Calcutta, the power of the English in the greater part of the district was complete. In 1786 the entire administration was assumed by the Company; but the absolute right of sovereignty was not obtained until 1823.

KISTNA, or KRISHNA, a large river of southern India, stretching almost across the entire peninsula from west to east. It rises near the Bombay sanatorium of Mahābaleshwar in the Western Ghats, only about 40 miles from the Arabian Sea. Its source is held sacred, and is frequented by pilgrims in large numbers. From Mahābaleshwar the Kistna runs southwards in a rapid course into the Nizam's Dominions, then turns to the east, and ultimately falls into the sea by two principal mouths. Along this part of the coast runs an extensive strip of land, which has been entirely formed by the detritus washed down by the Kistna and Godāvāri. The river channel is throughout too rocky and the stream too rapid to allow even of small native craft. In utility for irrigation the Kistna is also inferior to its two sister streams, the Godāvāri and Kāvēri (Cauvery). By far the greatest of its irrigation works is the Bezārva enicut, commenced in 1852. Bezārva is a small town at the entrance of the gorge by which the Kistna bursts through the Eastern Ghāts, and immediately spreads over the alluvial plain. The channel there is 1300 yards wide. During the dry season the depth of water is barely 6 feet, but sometimes it rises to as much as 36 feet, the maximum flood discharge being calculated at 1,188,000 cubic feet per second. Of the two main canals connected with the dam, that on the left bank breaks into two branches, the one running 39 miles to Ellore, the other 49 miles to Masulipatam. The canal on the right bank proceeds nearly parallel to the river, and also sends off two principal branches, to Nizāmpatam and Comamur. The total length of the main channel is 254 miles, and the total irrigated area 226,000 acres, yielding a revenue of £89,000.

KIT-CAT-CLUB, a convivial association of Whig wits, painters, politicians, and men of letters, founded in the reign of James II. The name, according to Defoe, was derived from the keeper of the house in which the club met, Christopher Cat, a pastry cook in Shire Lane, which now no longer exists, but formerly ran parallel with Chancery Lane near Temple Bar. The pies of Christopher were the principal dish of the club, and the *Spectator* (No. 9) derives the name, not from the maker of the pies, but from the pies themselves, which were of a species generally known as "kit-cats." According to another authority, the meeting place of the club was at the sign of the Cat and Fiddle in Gray's Inn Lane, kept by a person of the name of Christopher. The locale of the club was afterwards changed to the Fountain tavern in the Strand, and latterly to a room specially built for the purpose at Barn Elms, the residence of the secretary, Jacob Tonson. In summer the club met at the Upper Flask, Hampstead Heath. The club consisted of thirty-nine noblemen and gentlemen, and included among other distinguished men the duke of Marlborough, Lords Halifax and Somers, Sir Robert Walpole, Vanbrugh, Congreve, Steele, and Addison. The portraits of many of the members were painted by Sir Godfrey Kneller, himself also a member, of a uniform size, less than half length, which is known as the kit-cat size. The club was dissolved about 1720.

KITE,¹ Anglo-Saxon *Cyga*, the *Falco milvus* of Linnaeus and *Milvus ichnus* of modern ornithologists, once perhaps the most familiar: bird-of-prey in Great Britain, and now one of the rarest. Three or four hundred years ago

foreigners were struck with its abundance in the streets of London, and the evidence of two of them, one being the eminent naturalist Belon, has been already given (*BIRDS*, vol. iii. p. 798, note). It was doubtless the scavenger in ordinary of that and other large towns (as a kindred species now is in Eastern lands), except where its place was taken by the Raven; for Sir Thomas Brown (*circa* 1663) wrote of the latter at Norwich—"in good places about the city which makes so few Kites to be seen hereabout." Wolley has well remarked of the modern Londoners that few "who see the paper toys hovering over the parks in fine days of summer, have any idea that the bird from which they derive their name used to flout all day in hot weather high over the heads of their ancestors." Even at the beginning of the present century the

"Kites that swim sublime
In still repeated circles, screaming loud,"

formed a feature of many a rural landscape in England, as they had done in the days of Cowper. But an evil time soon came upon the species. It must have been always hated by the henwife, but the resources of civilization in the shape of the gun and the gin were denied to her. They were, however, employed with fatal zeal by the gamekeeper; for the Kite, which had long afforded the supremest sport to the falconer, was now left friendless,² and in a very few years it seems to have been exterminated throughout the greater part of England, certain woods in Huntingdonshire and Lincolnshire and in the Western Midlands, as well as Wales, excepted. In those latter a small remnant still exists; but the well-wishers of this beautiful species are naturally chary of giving information that might lead to its further persecution. In Scotland there is no reason to suppose that its numbers suffered much diminution until about 1835 or even later, when the systematic destruction of "vermin" on so many moors was begun. In that kingdom, however, it is now as much restricted to certain districts as in England or Wales, and those districts it would be most inexpedient to indicate.

The Kite is, according to its sex, from 25 to 27 inches in length, about one half of which is made up by its deeply forked tail, capable of great expansion, and therefore a powerful rudder, enabling the bird while soaring on its wide wings, more than 5 feet in extent, to direct its circling course with scarcely a movement that is apparent to the spectator below. Its general colour is pale reddish-brown or cinnamon, the head being greyish-white, but almost each feather has the shaft dark. The tail-feathers are broad, of a light red, barred with deep brown, and furnish the salmon-fisher with one of the choicest materials of his "flies." The nest, nearly always built in the crotch

¹ George, third earl of Orford, died in 1791, and Colonel Thornton, who with him had been the latest follower of this highest branch of the art of falconry, broke up his hawking establishment not many years after. There is no evidence that the parent of the Kite was in this or any other country reserved to kings or privileged persons, but the taking of it was quite beyond the powers of the ordinary trained Falconer, and in older days practically became limited to those of the sovereign. Hence the Kite had attached to it, especially in France, the epithet of "royal," which has still survived in the specific appellation of *regalis* applied to it by many ornithologists. The scandalous work of Sir Anthony Weldon (*Court and Character of King James*, p. 104) bears witness to the excellence of the Kite as a quarry in an amusing story of the "British Solomon," whose Master-Falconer, Sir Thomas Monson, being determined to outdo the performance of the French king's falconer, who, when sent to England to show sport, "could not kill one Kite, ours being more magnificent than the French Kite," at last succeeded, after an outlay of £1000, in getting a cart of Hawks that took nine Kites running—"never missed one." On the strength of this, James was induced to witness a flight at Royston, "but the Kite went to such a moult as all the field lost sight of Kite and Hawk and all, and neither Kite nor Hawk were either seen or heard of to this present."

² *Gleda*, cognate with *glide*, is also another English name.

of a large tree, is formed of sticks intermixed with many strange substances collected as chance may offer, but among them rags seem always to have a place. The eggs, three or four in number, are of a dull white, spotted and blotched with several shades of brown, and often lilac. It is especially mentioned by old authors that in Great Britain the Kite was resident throughout the year; whereas on the Continent it is one of the most regular and marked migrants, stretching its wings towards the south in autumn, wintering in Africa, and returning in spring to the land of its birth.

There is a second European species, not distantly related, the *Milvus migrans* or *M. ater* of most authors,¹ smaller in size, with a general dull blackish-brown plumage and a less forked tail. In some districts this is much commoner than the red Kite, and on one occasion it has appeared in England. Its habits are very like those of the species already described, but it seems to be more addicted to fishing. Nearly allied to this Black Kite are the *M. ægyptius* of Africa, the *M. goyinda* (the Pariah Kite of India),² the *M. melanotos* of Eastern Asia, and the *M. affinis* and *M. senegalensis*, the last is by some authors removed to another genus or subgenus as *Lophochelidon*, and is peculiar to Australia, while *M. affinis* also occurs in Ceylon, Burmah, and some of the Malay countries as well. All these may be considered true Kites, while those next to be mentioned are more aberrant forms. First there is *Elanus*, the type of which is *E. caeruleus*, a beautiful little bird, the Black-winged Kite of English authors, that comes to the south of Europe from Africa, and has several congeners—*E. acillaris* and *E. scriptus* of Australia being most worthy of notice. An extreme development of this form is found in the African *Nauclesus ricouri*, as well as in *Blanfordia furcata*, the Swallow-tailed Kite, a widely-ranging bird in America, and remarkable for its length of wing and tail, which gives it a marvellous power of flight, and serves to explain the unquestionable fact of its having twice appeared in Great Britain. To *Elanus* also *Ictinia*, another American form, is allied, though perhaps more remotely, and it is represented by *I. mississippiensis*, the Mississippi Kite, which is by some considered to be the northern race of the Neotropical *I. plumbea*. *Gampsonyx*, *Bostrhamus*, and *Cymindia*, all belonging to the Neotropical Region, complete the series of forms that seem to compose the subfamily *Milvinae*, though there may be doubt about the last, and some systematists would thereto add the Perna or Hume-Bazards, *Pernis*. (A. N.)

KITTO, JOHN (1804-1854), the author of various works connected with Biblical literature, was the son of a mason at Plymouth, where he was born December 4th, 1804. In childhood he was weak and sickly, and he received only a very meagre school education; but his untoward and miserable circumstances did not prevent the growth of a passionate love of books and an eager thirst for learning. By a fall sustained while assisting his father in his trade he received several general injuries and lost permanently the sense of hearing. No longer able to support himself by manual labour, he endeavoured to do so by preparing rude drawings and coloured cards in large capital letters, but at last in November 1819 he found it necessary to seek refuge in the workhouse, where he was employed in making

list shoes. In 1821 he was bound apprentice to a shoe-maker in Plymouth, who, however, treated him with such oppressive tyranny that he appealed to the magistrates, and got his indenture cancelled, upon which he again obtained admission to the workhouse. Not long afterwards a fund was raised in his behalf, and in 1823 he was sent to board with the clerk of the guardians, having his time at his own disposal, and the privilege of making use of a public library. After preparing a small volume of miscellanies, which was published by subscription, he became a pupil of Mr Groves, a dentist in Exeter, and in this art rapidly acquired proficiency. Through the same gentleman he in 1825 obtained more congenial employment in the printing office of the Church Missionary Society at Islington, from which he was after two years transferred to the same society's establishment at Malta. There he remained only six months, but shortly after his return to England he accompanied Mr Groves in the capacity of tutor to his two sons on a Christian mission to Baghdad, where he obtained that personal knowledge of Oriental life and habits which he afterwards applied with such tact and skill in the illustration of Biblical scenes and incidents. On account of the ravages of the plague the missionary establishment was broken up, and in 1832 Kitto returned to England. On arriving in London he was engaged in the preparation of various serial publications of the Society for the Diffusion of Useful Knowledge, the most important of which were the *Pictorial History of Palestine* and the *Pictorial Bible*. Henceforth his life was one of congenial but incessant literary labour. The *Cyclopedia of Biblical Literature*, edited under his superintendence, appeared in two volumes, 1843-45, and has passed through three editions; and his *Daily Bible Illustrations* (8 vols., 1849-53) still retain a wide popularity among general readers. On the morning after he had finished the last volume of this work Kitto was seized with a paralytic stroke, and from that time he was incapacitated for literary work. In 1850 he had received an annuity of £100 from the royal civil list; and on his illness an additional fund was raised on his behalf. In the autumn of 1854 he removed with his family to Gannstatt on the Neckar, where on the 26th November he was seized with an attack which in a few hours proved fatal.

See Dr Kitto's own work *The Lost Senses*, 1845; Ryland's *Memoirs of Kitto*, 1856; and *Endue's Life of Kitto*, 1867.

KITZINGEN, a town in the government district of Lower Franconia and Aschaffenburg, Bavaria, is situated on the Main, 95 miles south east of Frankfurt by rail. A bridge, 950 yards long, connects it with its suburb Etzhausen on the left bank of the river. A railway bridge also spans the Main at this point. Kitzingen has walls and towers, an old church of the 15th century, a trade school and a grammar school, a town house, a hospital (since 1344), and two old convents. Breweries (with large export of beer), a steam-mill for grain, tan, and timber, and manufactories of casks, chocolate, &c., employ the inhabitants. Considerable trade in wine, fruit, grain, and lumber is carried on by boats on the Main. The population in 1875 was 6393.

KIUNG-CHOU-FOO. See HAINAN.

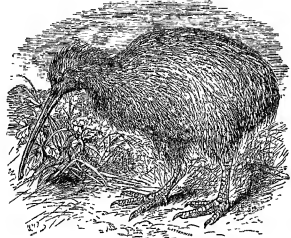
KIWI, or KIWĪ-KIWĪ, the Maori name—first apparently introduced to zoological literature by Lesson in 1828 (*Mém. d'Ornithologie*, ii. p. 210, or *Voy. de la "Coquille," Zoologie*, p. 418), and now very generally adopted in English—of one of the most characteristic forms of New Zealand birds, the *Apteryx* of scientific writers. This remarkable bird was unknown till Shaw, as almost his latest labour, very fairly described and figured it in 1818 (*Nat. Miscellany*, pla. 1067, 1068) from a specimen brought to him from the southern coast of that country by Captain

¹ Thus justifying the advice of Ambrosius (*Veneris Tule*, act. iv. sc. 3).—"When the Kite builds, look to lesser fowls."—very necessary no doubt to the landrassies of former days when the bird commonly frequented their drying grounds.

² Mr Sharpe (*Cat. Birds Brit. Museum*, i. p. 322) calls it *M. korakshu*; but the figure of S. G. Gmelin's *Acceptor korakshu*, whence the name is taken, unquestionably represents the Moor-Buzzard, *Circus aeruginosus*.

³ The Brahminy Kite of India, *Haliastur indicus*, seems to be rather a fishing Eagle.

Barely of the ship "Providence." At Shaw's death, in the same year, it passed into the possession of the then Lord Stanley, afterwards thirteenth Lord Derby, and president of the Zoological Society, and it is now with the rest of his collection in the Liverpool Museum. Considering the state of systematic ornithology at the time, Shaw's assignment of a position to this new and strange bird, of which he had but the skin, does him great credit, for he said it seemed "to approach more nearly to the Struthious and Gallinaceous tribes than to any other." And his credit is still greater when we find the venerable Latham, who is said to have examined the specimen with Shaw, placing it some years later among the Penguins (*Gen. Hist. Birds*, x p. 394), being apparently led to that conclusion through its functionless wings and the backward situation of its legs. In this false allocation Stephens also in 1826 acquiesced (*Gen. Zoology*, xiii p. 70). Meanwhile in 1820 Temminck, who had never seen a specimen, had ascribed it with the Podo in an Order to which he applied the name of *Iucetes* (*Atlas d'Ornithologie*, i p. cxxv). In 1831 Lesson, who had previously (*loc cit.*) made some blunders about it, placed it (*Traité d'Ornithologie*, p. 12), though only, as he says, "par analogie et a priori," in his first



KIWI

division of Birds, 'Oiseau Anomalous,' which is equivalent to what we now call *Ratite*, making of it a separate Family "Nullipennae." At that time no second example was known, and some doubt was felt, especially on the Continent, as to the very existence of such a bird!—though Lesson had himself when in the Bay of Islands in April 1821 (*Voy. "Coraille,"* *at supra*) heard of it, and a few years later Dumont d'Urville had seen its skin, which the naturalists of his expedition pronounced, worn as a tippet by a Maori chief at Tologa Bay (Houa-houa),² and in 1830 gave what proves to be on the whole very accurate information concerning it (*Voy. "Astrolabe,"* ii p. 107). To put all suspicion at rest, Lord Derby sent his unique specimen for exhibition at a meeting of the Zoological Society, 12th February 1833 (*Proc. Zool. Society*, 1833, p. 24), and a few months later (*loc. cit.*, p. 80) Yarrell communicated to that body a complete description of it, which was afterwards published in full with an excellent portrait (*Trans. Zool. Society*, i p. 71, pl. 10). Herein the systematic place of the species, as akin to the Struthious birds, was placed beyond cavil, and the author called upon all interested in

zoology to aid in further research as to this singular form. In consequence of this appeal a legless skin was within two years sent to the society (*Proceedings*, 1835, p. 61) obtained by Mr W. Yate of Waimate, who said it was the second he had seen, and that he had kept the bird alive for nearly a fortnight, while in less than another couple of years additional information (*op. cit.*, 1837, p. 24) came from Mr T. K. Short to the effect that he had seen two living, and that all Yarrell had said was substantially correct, except undervaluing its progressive powers. Not long afterwards Lord Derby received and in March 1838 transmitted to the same society the trunk and viscera of an *Apteryx*, which, being entrusted to Professor Owen, furnished that eminent anatomist, in conjunction with other specimens of the same kind received from Drs Lyon and George Bennett, with the materials of the masterly monograph laid before the society in instalments, and ultimately printed in its *Transactions* (ii p. 267, iii p. 277). From this time the whole structure of the Kiwi has certainly been far better known than that of nearly any other bird, and by degrees other examples found their way to England, some of which were distributed to the various museums of the Continent and of America.³

In 1847 much interest was excited by the reported discovery of another species of the genus (*Proceedings*, 1847, p. 51), and though the story was not confirmed, a second species was really soon after made known by Gould (*tom. cit.*, p. 93, *Transactions*, iii p. 379, pl. 57) under the name of *Apteryx owenii*—a just tribute to the great master who had so minutely explained the anatomy of the group. Three years later Mr Battlett drew attention to the manifest difference existing among certain examples, all of which had hitherto been regarded as specimens of *A. australis*, and the examination of a large series led him to conclude that under that name two distinct species were confounded. To the second of these, the third of the genus (according to his views), he gave the name of *A. mantelli* (*Proceedings*, 1850, p. 274), and it soon turned out that to this new form the majority of the specimens already obtained belonged. In 1851 this first Kiwi known to have reached England alive was presented to the Zoological Society by Mr Eyre, then lieutenant-governor of New Zealand. This was found to belong to the newly described *A. mantelli*, and some careful observations on its habits in captivity were published by Wollcy and another (*Zoologist*, pp. 3409, 3605).⁴ Subsequently the society has received several other live examples of this form, besides one of the real *A. australis* (*Proceedings*, 1872, p. 561), some of *A. owenii*, and one of a supposed fourth species, *A. haastii*, characterized in 1871 by Mr Potts (*Ibis*, 1873, p. 35, *Trans. N. Zeal. Institute*, iv, p. 204; v p. 195).⁵

The Kiwis form a group of the Subclass *Ratita* to which the rank of an Order may fitly be assigned, as they differ in many important particulars from any of the other existing forms of *Ratita* birds. The most obvious feature the *Apteryx* afford is the presence of a back toe, while the

² In 1842, according to Broderip (*Penny Cyclopaedia*, xxii p. 146), two had been presented to the Zoological Society by the New Zealand Company, and two more obtained by Lord Derby, one of which he had given to Gould. In 1844 the British Museum possessed three, and the sale catalogue of the Earl's Collection, which passed in 1846 to the Academy of Natural Sciences at Philadelphia, includes a single specimen—probably the first taken to America.

³ This bird in 1859 had an egg, and afterwards continued to lay one or two more every year. In 1856 a male of the same species was introduced, but though a strong disposition to breed was shown on the part of both, and the eggs, after the custom of the *Ratitae*, were incubated by him, no progeny was hatched (*Proceedings*, 1856, p. 329).

⁴ A fine series of figures of all these supposed species is given by Rowley (*Orn. Illustrations*, i, pls. 1-6). Some others, as *A. mazzoni*, *A. molle*, and *A. fuscus* have also been indicated, but proof of their validity has yet to be adduced.

¹ Quiver in the second edition of his *Rhine Animal* only referred to it in a footnote (i, p. 498).

² Cruise in 1822 (*Journal Residence in New Zealand*, p. 313) had spoken of an "Kineu" found in that island, which must of course have been an *Apteryx*.

extremely aborted condition of the wings, the position of the nostrils—almost at the tip of the maxilla—and the absence of an after-shaft in the feathers, are characters nearly as manifest, and others not less determinative though more reconcile will be found on examination. The Kiwis are peculiar to New Zealand, and it is believed that *A. mantelli* is the representative in the North Island of the southern *A. australis*, both being of a dark reddish-brown, longitudinally striped with light yellowish-brown, while *A. owenii*, of a light greyish-brown transversely barred with black, is said to occur in both islands. About the size of a large domestic Powl, they are birds of nocturnal habit, sleeping, or at least inactive, by day, feeding mostly on earth-worms, but occasionally swallowing berries, though in captivity they will eat flesh suitably minced. Mr Buller writes (*N. New Zealand*, p. 362) —

"The Kiwi is in some measure compensated for the absence of wings by its swiftness of foot. When running it makes wide strides and carries the body in an oblique position, with the neck stretched to its full extent and inclined forward. In the twilight it moves about cautiously and as unobtrusively as a rat, to which, at that time it bears some outward resemblance. In a quiescent posture, the body generally assumes a perfectly round appearance; and it sometimes, but only rarely, supports itself by resting the point of its bill on the ground. It often yawns when disturbed in the daytime, giving its mandibles in a very grotesque manner. When provoked it erects the body, and, raising the foot to the breast, strikes down with considerable force and rapidity, thus using its sharp and powerful claws as weapons of defence. . . . While hunting for its food the bird makes a continual snuffing sound through the nostrils, which are placed at the extremity of the upper mandible. Whether it is guided as much by touch as by smell I cannot safely say; but it appears to me that both senses are used in the action. That the sense of touch is highly developed seems quite certain, because the bird, although it may not be suddenly smitten, will always first touch an object with the point of its bill, whether in the act of feeling or of turning the ground; and when shut up in a cage or confined in a room it may be heard, all through the night, tapping softly at the walls. . . . It is interesting to watch the bird, in a state of freedom, foraging for worms, which constitute its principal food. It moves about with a slow action of the body; and the long, flexible bill is driven into the soft ground, generally some to the very root, and is either immediately withdrawn with a worm held at the extreme tip of the mandibles, or it is gently moved to and fro, by an action of the head and neck, the body of the bird being perfectly steady. It is amusing to observe the extreme care and deliberation with which the bird draws the worm from its hiding-place, coaxing it out as it were by degrees, instead of pulling roughly or breaking it. On getting the worm fairly out of the ground, it throws up its head with a jerk, and swallows it whole.

The foregoing extract refers to *A. mantelli*, but there is little doubt of the remarks being equally applicable to *A. australis*, and probably also to *A. owenii*, though the different proportion of the bill in the last points to some diversity in the mode of feeding. Did space allow much more should be said of the Kiwis—perhaps to ornithologists the most interesting group of birds now existing, and the more interesting in regard to the melancholy doom of extinction which almost inevitably awaits them. (A. N.)

KIZLIAR, KIZLYAR, or KIZLAR, a town of Russia, in the government of Stavropol, 32½ miles east of the government town, in the low-lying delta of the river Terek, about 35 miles from the shores of the Caspian. It lies to the left of the main stream between two of the larger secondary branches, and the whole is subject to flooding. The town proper, which spreads out round the citadel, has its Tartar, Georgian, and Armenian quarters; the Russians for the most part live in the soldiers' "sloboda" or village. Of the public buildings it is sufficient to mention the Greek cathedral, dating from 1786; the Greek nunnery of the Elevation of the Cross, founded by the Georgian chief Daniel in 1738; the Armenian church of SS. Peter and Paul, remarkable for its size and riches. The population, which has increased from 8309 in 1861 to 9176 in 1872, is mainly supported by the gardens and vineyards irrigated

by canals fed by the river. A Government vineyard and school of viticulture are situated 3½ miles from the town. About 1,200,000 gallons of Kizliar wine are sold annually at the fair of Nizhni Novgorod. Kizliar is mentioned as early as 1616, but the most notable accession of inhabitants (Armenians, Georgians, and Persians) took place in 1715; and its importance as a fortress dates from 1736, when it received the garrison formerly stationed at Sv. Kresta on the Sulak in Daghestan. In 1785 it was made a district town. The incursion of Kami Mulla in 1821, and the inundation in 1863, are the chief facts of more recent note. The fortress is no longer kept in repair.

KLADNO, a mining town in the district of Smichov, Bohemia, lies about 15 miles west-north-west of Prague, with which it is connected by the Buschtiehrad line of railway. There are few buildings of special interest, and the importance of the town is mainly due to the wealth of its iron-mines and coal-fields, which afford employment for some three thousand men. The average annual yield of iron is from 25,000 to 30,000 tons, and of coal 300,000 tons. About 3 miles to the north is the imperial chateau of Buschtiehrad. Population in 1880, 14,085.

KLAGENFURT, capital of the duchy of Carinthia, Austria, and seat of the provincial administration, financial direction, and court of appeal, is situated upon a plain at an elevation of 1450 feet above the sea-level, and about 40 miles north-north-west of Lailbach, with which, as with Vienna, Graz, Innsbruck, and other centres, it is connected by railway, in 46° 37' N. lat, 14° 19' E. long. Klagenfurt is for the most part well and symmetrically built, and comprises an inner town quadrangular in form, and four suburbs—St Veit (north), Viktring (south), Völkermarkt (east), and Villach (west), the last communicating with Lake Wörth by means of the Lend Canal. Among the more noteworthy edifices are the parish church of St Ägidius (erected 1709), with a tower 298 feet in height, the cathedral of SS. Peter and Paul (1582-83, burnt 1713, restored 1725); the churches of the Benedictines (1608) of the Capuchins (1646), and of the order of St Elizabeth (1710), and the fine structure standing in the Villach suburb, and belonging to the Protestant community. To these must be added the palace of the prince bishop of Gurk, originally built for the sisters of the emperor Joseph II., and containing in its chapel some fine fresco paintings completed in 1798 by the Carinthian artist Joseph von Pichler; the municipal hospital; the lunatic asylum; the burg or castle, existing in its present form since 1777; and the *Lendhaus* or house of assembly, dating from the end of the 14th century, and containing a museum of natural history, and the Klagenfurt Historical Society's library, and collection of minerals, antiquities, seals, paintings, and sculptures. The most interesting public monument is the great *Lindenturm* or Dragon, standing in the principal square (1690). Among the many educational establishments of Klagenfurt are an upper and lower gymnasium with public library; a theological seminary for priests; monastic and conventual houses; agricultural, industrial, technical, and mining schools; and an asylum for the instruction of the deaf and dumb. The industrial establishments comprise factories for the preparation of white lead, tobacco, woollen cloth, muslins, silk fabrics, and leather; also machines and iron foundries. Klagenfurt possesses, moreover, several banks, a chamber of industry and commerce, a central board of mining control, and a few scientific associations. The transit trade, which is considerable owing to the wealth of the mineral products of the province, is much facilitated by the position of Klagenfurt at a junction of the Crown-Prince-Rudolph and Austrian Southern Railways. The civil population in 1880 was 16,592; with the military, it was 18,749.

Upon the Zollfeld to the north of the city once stood the ancient Roman town of Virunum. In the middle of the 7th century the surrounding country was overrun by the Avars. During the Middle Ages Klagenfurt became the property of the crown, but by a patent of Maximilian I. of the 24th April 1518, it was conceded to the Carnian estates, and has since then taken the place of St. Yvet as capital of Carinthia. In 1535, 1538, 1733, and 1796 Klagenfurt suffered from destructive fires, and in 1690 from the effects of an earthquake. On March 29, 1797, the French took the city, and upon the following day it was occupied by Napoleon as his headquarters. The fortifications constructed in 1590 were destroyed by the French in 1809, and the ground that they formerly occupied is now laid out as a public promenade.

See Author and Jahrbuch Geograph. Anstalt, Wien, 1874; G. von Auerbach, *Handbuch der Geschichte des Herzogthums Kärnten*, Klagenfurt, 1867-74, vol. i. v; *Geographische Karte von Klagenfurt*, Vienna, 1878.

KLAPROTH, HEINRICH JULIUS W. (1783-1835), one of the founders of Oriental scholarship in Europe, was born at Berlin, October 11, 1783. His father, Martin Heinrich Klaproth (1743-1817), not only desired him to pursue the chemical studies by which he had himself attained to position and fame, but did all in his power to frown away what he deemed a foolish attachment to a profitless subject. But this boy-philologist received from a more indulgent or wiser mother the means of secretly satisfying his natural instinct, and by the time that in ordinary course he ought to have passed the gymnasial examination he was able to retort, when upbraided with ignorance of the usual subjects, that at least he knew Chinese. He was still in his teens when he published his *Asiatisches Magazin* (Weimar, 1802); and immediately after he was called to St. Petersburg as an adjunct to the academy of Oriental languages. In 1805 he accompanied Count Golowin's embassy to China; and though the travellers were stopped at the frontier he had a splendid opportunity of becoming acquainted with the tribes and languages of southern Asiatic Russia. On his return he was despatched by the academy to the Caucasus for the purposes of ethnographical and linguistic exploration (1807-1808), and when this mission was completed he was employed for several years in connexion with the academy's Oriental publications. In 1811 he came to Berlin; but in 1815 he settled in Paris, and in 1816 W. von Humboldt procured him from the king of Prussia the title and salary of professor of Asiatic languages and literature, with permission to remain in Paris as long as was requisite for the publication of his works. He died in that city August 23, 1835.

The principal feature of Klaproth's erudition was the vastness of the field which it embraced. To enormous industry he joined a somewhat reckless intellectual aggressiveness, and where more solid footing led to bridge the chasm by adventurous hypotheses. His great work *Asia polyglotta* (Paris, 1835, with *Synonymata*) not only served as a résumé of all that was known on the subject, but formed a new departure for the classification of the Eastern languages, more especially of the Russian empire. To a great extent, however, his work is now superseded. That he was sometimes not over-scrupulous in the use he made of his erudition is matter more than arguable. The *Itinerary of a Chinese Traveller*, which he published in 1821, a series of documents in the military archives of St. Petersburg purporting to be the travels of George Ludwig von —, and a similar series obtained from him in the London Foreign Office, are all judged to be spurious; and the learning displayed in the forgery was possessed by no one but himself.

A list of Klaproth's works will be found in *Nouv. Journ. Asiat.*, vol. xvii, and in Quérard, *La France littéraire*, vol. vi. Compare M. O. Landresse's "Notice" in *Nouv. Journ. Asiat.*, 1835.

KLATTAU (Latin, *Clatavia*; Bohemian, *Klatov*), chief town of a district of the same name in Bohemia, lies about 70 miles south-west of Prague, and on the railway between Eisen and Eisenstein, in 49° 23' N. lat., 18° 22' E. long. Klattau has six churches, an upper gymnasium, two hospitals, a large steam brewery, and an old-fashioned town-hall dating from the 16th century, and containing in its tower a bell weighing over 5 tons. Population 6087.

Klattau was an ancient Bohemian fortress, and afterwards became a royal free town. In 1421 it was destroyed by the Bohemian lord Ziska. Having refused to assist the emperor Ferdinand I., it was in 1546 deprived of many of its privileges. In 1620 it was taken by the emperor Maximilian. Until the early part of the 17th century it was a thriving place, but the depredations committed by the Swedes in 1641, 1645, and 1646, and the many confiscations which from time to time ravaged it, so seriously affected the town that it has never recovered its former prosperity.

KLÁUSENBURG, or CLAUSENBURG (Hungarian, *Kolozsár*; Latin, *Claudioopolis*), a royal free town of Hungary, the capital of the county of Kolozs, and also of the whole Transylvanian circle, is situated in a picturesque valley on the banks of the Little Szamos, and on the Hungarian eastern railway, 73 miles north-west-west of Hermannstadt, in 46° 44' 8" N. lat., 23° 34' 51" E. long. Klausenburg is the seat of a Unitarian bishop, of the superintendent of the Calvinists for the Transylvanian circle, of a royal court of justice, of a chamber of commerce, and of the county administration, as also the headquarters of the *honvéd* (militia) and regular infantry regiments of the military district. Klausenburg consists of an inner town (quadrangular in form, and divided into the old and new towns) and five suburbs now united with it in consequence of the removal of the old walls. With the exception of the old quarter, Klausenburg is generally well laid out, and contains many broad and fine streets, several of which diverge at right angles from the principal square or market-place, where stands a fine old Roman Catholic church, often described as a cathedral (Gothic style), dedicated to St. Michael, and founded by king Sigismund in the year 1414. Besides several other Roman Catholic, Calvinist, Lutheran, Unitarian, Greek Catholic, and Greek Orthodox churches, and a Jewish synagogue, Klausenburg comprises among its public edifices a national museum, county and town halls, a national theatre, several hospitals, a workhouse, and barracks. The educational establishments include the university (with four faculties, founded in 1872), the Unitarian college (with seminary), Calvinist and Roman Catholic upper gymnasia, training institutes, and many others. A special feature of Klausenburg is the large number of elegant private mansions belonging to the Transylvanian nobles who reside here during the winter months. The greater part of the town lies on the right bank of the river, while upon the other side is the so-called "Bridge Suburb" and the citadel. Klausenburg bears in general more the character of a seat of learning than of a business centre; but there are factories for the preparation of woollen and linen cloth, paper, tobacco, candles, and bone dust, as well as breweries, distilleries, oil mills, and beetroot sugar refineries; and tanning, and hat, cap, and boot making are largely carried on. The fairs are well attended, especially for the purchase of horses, and prepared skins, dressed fur, felt goods, delf, and crockery ware. The chief agricultural products of the neighbourhood are wheat, beetroot, and forage. On the more elevated portions of the communal lands are extensive vineyards and woods. At the end of 1880 the civil population amounted to 29,929 (with military it was 30,869); by far the greater majority were Magyars by nationality, the remainder being composed of Roumanians, Germans, Armenians, and Jews. Outside the town, upon the slope of the citadel hill, there is a Gipsy quarter.

Klausenburg is believed to occupy the site of a Roman settlement named *Claudia*, whence its modern Latin appellation of *Claudioopolis*. Colonized by Saxons in 1173, it then received its German name of *Klausenburg* from the old word *Klaus*, signifying a "mountain pass." In 1448 Matthias Corvino, king of Hungary, was born here. Subsequent to the defeat of the Hungarians by the Turks at Mohács (1526), Transylvania came under the protection of the Porte, and owing to the trade from the East passing through the principality to Bactria, the prosperity of Klausenburg much increased. Between the years 1545 and 1670 large numbers of the Saxon

population left the town in consequence of the introduction of Unitarian doctrines. In 1603 it fell into the hands of the usurper Macea Székely, but was soon regained by the imperialists under General Basta. In 1692 it was indeluctably besieged by the Transylvanian prince Michael Apafi I., but two years later it came into his power. The burg or citadel was erected between 1715-23, during the reign of King Charles III. (as emperor, Charles VI.) In 1798 the town was to a great extent destroyed by fire. As capital of Transylvania and the seat of the Transylvanian diets, Klausenburg from 1830-48 became the centre of the national movement in the grand principality, and in December 1848 it was taken and garriooned by the Hungarians under the Polish General Bem. After the conclusion of the war it was degraded from its position as capital of Transylvania, and subordinated to Nagyvárad (Hermannstadt), but in 1861 it was reinstated in its former rank. The official name is *Kolozsvár*.

KLAUSTHAL, or **CLAUSTHAL**, in the circle of Zellerfeld and the district of Hildesheim, Prussia, is the chief town and mining centre of the Upper Harz. It is situated on a bleak plateau, 1860 feet above sea-level, and unites to form one town with Zellerfeld on the opposite bank of the Zellbachi. The streets are broad, opportunity for improvement having been given by fires in 1844 and 1854; the houses are mostly of wood. Klausthal has a famous mining college, with a mineralogical museum, and a mining surveying and a mining school. There is also a disused mint. The men of the town are mainly employed in the neighbouring mines and smelting works, of the latter the most important is the Frankenscheuer silver smelting house, where American as well as German ore is worked. The population in 1875 was 8393; including Zellerfeld, it was 12,799.

Klausthal was founded about the middle of the 16th century, after the erection of the Benedictine monastery at Colla. Mining was carried on by the monks, and more energetically by the dukes of Brunswick, who brought miners from Franconia.

KLEBER, JEAN BAPTISTE (1753-1800), was born at Strasburg in 1753 or 1754, where his father was a builder. He was meant to be an architect, but his opportune assistance to two German nobles in a tavern brawl obtained for him a nomination to the military school of Munich. He soon obtained a commission, but resigned it in 1783 on finding his humble birth in the way of his promotion. On returning to France he was appointed inspector of public buildings at Belfort, where he studied fortification and military science. In 1792 he enlisted in the Haut-Rhin volunteers, and was from his military knowledge at once elected adjutant. At the siege of Mainz under Merlin de Thionville, he so distinguished himself that he was made general of brigade in July 1793. In that capacity he commanded in the Vendean war, and was instrumental in winning the victories of Torfou, Chollet, La Mans, and Savenay. For openly expressing his opinion that lenient measures ought to be pursued towards the Vendéens he was recalled; but in April 1794 he was made general of division, and sent to the army of the North. Under Jourdan he commanded the left wing at Fleurus, June 26, 1794, and Aldenhoven, October 3, and took Maestricht after a short siege on November 8. During the winter of 1794-95 he besieged Mainz, and on June 4, 1796, gained the victory of Altenkirchen over the prince of Würtemberg. Kleber now considered he had a fair claim to a command in chief, and, not receiving one in the spring of 1797, he resigned his division in disgust, and retired to Paris. There he allied himself with the reactionary party, and, according to Mathieu Dumas even offered to command any forces that could be raised against the coup d'état of Fructidor 1797, but there were no forces to command. He gladly accepted a division in the expedition to Egypt under Bonaparte, but was wounded in the head at Alexandria in the very first engagement, which prevented his taking any further part in the campaign of the Pyramids, and caused him to be appointed governor of Alexandria. In the

Syrian campaign of 1799, however, he commanded the vanguard, took El-Arish, Gaza, and Jaffa, and bore the brunt of the battle of Mount Tabor, April 15, 1799. Being left by Bonaparte in command of the army in Egypt, he made the convention of El-Arish, and, when Lord Keith refused to ratify the terms, attacked the Turks at Heliopolis, though with but 10,000 men against 60,000, and utterly defeated them on March 20, 1800. He then retook Cairo, which had revolted from the French, and was assassinated there by a fanatic on June 14, 1800, the very day on which Desaix fell at Marengo. Kleber was undoubtedly one of the greatest generals of the French revolutionary epoch, but hardly had a chance of showing his powers against a capable adversary, Napoleon's ejection on hearing of his death was "Eh bien; a rival the less."

Ernout, the grandson of Jourdan's chief of the staff, published in 1867 a valuable biography of Kleber. See also Reynaud's *Life of Merlin de Thionville*, Ney's *Memoirs*, Dumas's *Souvenirs*, Napoleon's *Memoirs*, dictated at St Helena, and Martha-Becker's *Denise*.

KLEIN, JULIUS LEOPOLD (1804-1876), a German writer of Jewish origin, was born at Miesdorf, in Hungary, in 1804. He was educated at the gymnasium in Pest, and studied medicine in Vienna and Berlin. After travelling in Italy and Greece, he settled as a man of letters in Berlin, where he remained until his death in 1876. He was the author of many dramatic works, among others the historical tragedies *Maria von Medici*, *Luynes*, *Zembla*, *Moreto*, *Maria*, *Strafford*, and *Heliodora*, and the comedies *Die Herzogin*, *Ein Schützling*, and *Voltaire*. These plays were published between 1841 and 1867. The tendency of Klein as a dramatist was to become bombastic and obscure, but many of his characters are vigorously conceived, and in nearly all his tragedies there are passages of brilliant rhetoric. He is chiefly known as the author of an elaborate *Geschichte des Dramas* (1805-1870), in which he undertook to record the history of the drama both in ancient and in modern times. He died when about to enter upon the Elizabethan period, to the treatment of which he had looked forward as the chief part of his task. The work, which is in 12 bulky volumes, gives proof of immense learning, but is marred by many eccentricities of style.

KLINTZKY, a town in Russia, situated in the government of Tchernigoff, 203 miles north-east of the capital of the province. It is one of the most important industrial centres in Little Russia. Its 8000 inhabitants are engaged in the manufacture of woollen cloth and knitted woollen goods (to the value of more than £100,000 per annum), morocco-leather, leather, and cast-iron wares.

KLOPSTOCK, FRIEDRICH GOTTLIEB (1724-1803), German poet, was born at Quiedlinburg on the 2d of July 1724. He was educated partly at the gymnasium of his native town, partly at Schulpforta. After studying theology for a short time at Jena, he went in 1746 to the university of Leipzig, where he made the acquaintance of Cramer, Schlegel, Rabener, and other young men of letters, who were conducting the *Brennische Beiträge*. At Schulpforta Klopstock had become conscious of a talent for poetry, and had resolved to write a great epic. His original intention was to make Henry the Fowler his hero, but this was soon abandoned in favour of the scheme to which he devoted the best years of his life. The first three cantos of *The Messiah*, which were planned in prose in Jena, he finished in Leipzig; and they were published anonymously in the *Brennische Beiträge* in 1748. The name of the author was soon known, and Klopstock suddenly found himself the most popular poet of his generation. In 1748 he accepted the position of tutor to a private family in Langensalz, and in 1750 he went to Zürich, whither he was invited by Bodmer, the translator of *Paradise Lost*, who had been deeply impressed by the early cantos of *The*

Messiah. In Zurich Klopstock received from Frederick V. of Denmark, on the recommendation of his minister Count Bernstorff, an invitation to settle in Copenhagen with a pension of 400 thalers. The invitation was accepted; and on his way to the Danish capital he met at Hamburg the lady who, in 1764, became his wife—Margarethe (Meta) Møller, an enthusiastic admirer of his poetry. She died in 1768; and after her death Klopstock edited her writings, which give evidence of a tender, sensitive, and deeply religious spirit. In 1771 Klopstock left Copenhagen, and followed his friend Count Bernstorff to Hamburg, where, in 1773, he issued the last five cantos of *The Messiah*. After spending about a year at the court of the margrave of Baden in Carlsruhe, he returned to Hamburg with the title of hofrath and a pension, which he retained along with the pension of the king of Denmark. During the rest of his life he remained in Hamburg, where in 1793 he married Johanna Elisabeth von Winthelm, a widow who had been for many years one of his most intimate friends. He died on the 14th of March 1803, and was buried beside his first wife in the village of Ottensen, near Hamburg. Besides *The Messiah* he wrote many odes, and in several dramas he celebrated the deeds of the ancient German hero, Arminius, while in others he dealt with the earliest narratives of the Old Testament. He was also the author of *Fragmente über Sprache und Dichtkunst, Grammatiche Gespräche*, and a book entitled *Gedehrten epublikt*. In these works he made important contributions to philology and to the history of German poetry. Klopstock's dramatic writings are without value; many of his odes, especially those on subjects taken from northern mythology, are so vague as to be hardly intelligible; and *The Messiah* lacks plastic force, unity of conception, and precision of style. His best odes, however, and many passages of *The Messiah* are still admitted to be marked by lyrical genius of a high order; and all German critics recognise that he exercised a salutary influence on the literature of his age by helping to deliver it from slavish adherence to foreign models.

An edition of his works in 12 octavo volumes was published in Leipzig, 1798–1817; and among later editions may be mentioned one in 12 volumes, 1828–29, another in 9 vols., 1836, and a third in 11 vols., 1844–45. Klopstock's writings are included in Hempel's *Nationalbibliothek*, and there is a new edition, with notes, by Bock (Stuttgart, 1879). See K. F. Cramer, *Klopstock, er und über ihn*, and Klopstock's *Jugendgeschichte in die Kleine Schriften* of D. F. Strauss.

KLOSTERNEUBURG, a town in the official district of Hernals, Austria, is situated on the right bank of the Danube, $\frac{5}{8}$ miles north-west of Vienna. It is divided by a small stream into an upper and a lower town, in the former of which are the ruins of a medieval fortress. The town has a local court, a hospital, an asylum for the insane, and a convent of Mekhitarists; among the schools is an academy of wine and fruit cultivation. As an important pioneer station, it has various military buildings and stores. On a hill rising directly from the banks of the Danube, stand the magnificent buildings (erected 1730–1834) of the Augustinian canonry, founded in 1106 by Margrave Leopold the Holy. This foundation is the oldest and richest of the kind in Austria; it owns much of the land upon which the north-western suburbs of Vienna stand. Among the points of interest within it are the old chapel of 1318, with Leopold's tomb and the altar of Verdun, the treasury and reliquary-chamber, the library with 30,000 volumes and many MSS., the picture gallery, the collection of coins, the theological hall, and the wine-cellar, containing an immense tun like that at Heidelberg. The inhabitants of Klosterneuburg are mainly occupied in making wine, of excellent quality. There is a large cement factory outside the town. The population in 1869 was 5330, but has increased. In Roman times the

castle of Citium stood in the region of Klosterneuburg. The town was founded by Charlemagne.

KNARESBOROUGH, a market-town and parliamentary borough in the West Riding of Yorkshire, is finely situated on a rocky elevation on the left bank of the Nidd, 17 miles west by north of York and 207 north of London. It is a station on the North-Eastern Railway, which crosses the valley near the town by a lofty viaduct. The town is built chiefly of stone, and contains several good streets and a spacious market-place. The parish church of St John is an old cruciform structure chiefly Perpendicular in style, restored in 1873; the free grammar school was founded in 1616. Knareborough Castle, now in ruins, but originally of great strength, was founded in 1170 by Serlo de Burgh. After the battle of Marston Moor it was taken by Fairfax, and in 1648 it was ordered to be dismantled. To the south of the castle is St Robert's chapel, an excavation in the rock constructed into an ecclesiastical edifice in the reign of Richard I. A little further down the river is St Robert's cave, which is supposed to have been the residence of the hermit, and in 1744 was the scene of the murder of Daniel Clarke by Eugene Aram. Opposite the castle is a petrifying spring called the "Drooping Well." Before the rise of Harrogate Knareborough was a favourite watering-place, but it is now dependent chiefly on its manufacture of towels, sheetings, and similar linen fabrics, and of wool rugs. There are also flour-mills and a considerable trade in corn. From the first year of the reign of Mary until 1867 Knareborough returned two members to parliament, but since then it has returned only one. The area of the parliamentary borough and local board district, which includes part of Scriven with Tentergate, is 481 acres, and the population, which in 1871 was 6205, was exactly 5000 in 1881.

KNELLER, SIR GODFREY (1648–1728), a portrait painter whose celebrity belongs chiefly to England, was born in Lübeck in the duchy of Holstein, of an ancient family, on August 8, 1648. He was at first intended for the army, and was sent to Leyden to learn mathematics and fortification. Showing, however, a marked preference for the fine arts, he studied in the school of Rembrandt, and under Ferdinand Bol in Amsterdam. In 1673 he removed to Italy, directing his chief attention to Titian and the Caracci; Carlo Maratti gave him some guidance and encouragement. In Rome, and more especially in Venice, Kneller earned considerable reputation, by historical paintings as well as portraits. He next went to Hamburg, painting with still increasing success. In 1674 he came over to England at the invitation of the duke of Monmouth, was introduced to Charles II., and painted that sovereign, much to his satisfaction, several times. Charles also sent him to Paris, to take the portrait of Louis XIV. When Lely died in 1680, Kneller, who produced in England little or nothing in the historical department, remained without a rival in the ranks of portrait painting; there was no native-born competition worth speaking of. Charles appointed him court painter; and he continued to hold the same post into the days of George I. Under William III. (1692) he was made a knight, under George I. (1715) a baronet, and by order of the emperor Leopold I. a knight of the Roman empire. Not only his court favour but his general fame likewise was large: he was lauded by Dryden, Addison, Steele, Prior, Tickell, and Pope. Kneller's gains also were very considerable, aided by habits of frugality which approached stinginess: he left property yielding an annual income of £2000. His industry was maintained till the last. His studio had at first been in Covent Garden, but in his closing years he lived in Kneller Hall, Twickenham. He died of fever, the date being generally given as 7th November 1728, though

some accounts say 1726. He was buried in Twickenham church, and has a monument in Westminster Abbey. An elder brother, John Zachary Kneller, an ornamental painter, had accompanied Godfrey to England, and had died in 1702. The style of Kneller as a portrait painter represented the decline of the art as practised by Vandyck; Lely marks the first grade of descent, and Kneller the second. His works have much freedom, and are well drawn and coloured; but they are essentially slight in manner, and to a great extent monotonous, this arising partly from the habit which he had of lengthening the oval of all his heads. The colouring may be called brilliant rather than true. He indulged much in the commonplace of allegory; and, though he had a quality of dignified elegance not unalloyed with simplicity, genuine simple nature is seldom to be traced in his works. His fame has greatly declined now, and could not but do so after the advent of Reynolds. Among Kneller's principal paintings are the Forty-three Celebrities of the Kit-Cat Club, and the Ten Beauties of the Court of William III., now at Hampton court; these were painted by order of the queen; they match, but match unequally, the Beauties of the Court of Charles II., painted by Lely. He executed altogether the likenesses of ten sovereigns. It is said that Kneller's own favourite performance was the portrait of the Converted Chinese in Windsor Castle. His works are confined almost entirely to England, not more than two or three specimens having gone abroad after he had settled there.

KNIGHT, CHARLES (1791–1878), publisher and author, was the son of a bookseller and printer at Windsor, where he was born 15th March 1791. After acquiring some knowledge of Latin and French at a common day school, he was sent at the age of twelve to the classical school of Dr Nicholas of Ealing. There, according to his own account, he imbibed such a tincture of learning as made him desirous to be a scholar; and it was very much in opposition to his wishes that in 1805 he was withdrawn from school to be bound apprentice to his father. In editing *The Windsor and Eton Express*, commenced by his father in 1812, some gratification was afforded to his literary ambition, and thus received additional stimulus when he became the publisher of *The Etonian*, edited by Frazer, with Macaulay, Moultrie, and Derwent and Nelson

Coleridge as principal contributors. After editing *The Guardian* from 1826 to 1829, Knight was induced by the Etonians already mentioned, now undergraduates at Cambridge, to set up in business at Pall-Mall East, and to become for them editor of *Knight's Quarterly Magazine*. As far as the magazine was concerned the venture was unsuccessful, for it was brought to a close with its sixth number, but it initiated for Knight a literary career as publisher and author which extended over forty years, and the unselfish enterprise of which conferred lasting intellectual benefit on the general mass of his fellow countrymen. In 1827 Knight became the superintendent of the publications of the Society for the Diffusion of Useful Knowledge, for whom he projected and edited *The British Almanac and Companion*, commenced in 1828. In 1829 he began the publication of *The Library of Entertaining Knowledge*, he himself writing several volumes of the series. 1832 and 1833 saw respectively the commencement of *The Penny Magazine* and *The Penny Cyclopædia*, two literary ventures which so far as circulation was concerned were highly satisfactory in their results, but the latter of which, on account of the heavy excise duty, was completed at a great pecuniary sacrifice. Besides a considerable number of illustrated editions of other standard works, Knight completed in 1843 *The Pictorial Shakespeare*, which, although now superseded in regard to critical scholarship, is still valued for the research and taste displayed in its illustrations. *The Pictorial Shakespeare* was followed by various other editions of the same author. The energy of Knight also found scope in the compilation of a variety of illustrated series, such as *Old England* and *The Land We Live in*. In 1858 he became editor of *The English Cyclopædia*, and conjointly with the multifarious duties of such an office he was also engaged in writing his *Popular History of England*, published in eight volumes, 1854–61. In 1864 he withdrew from the business of publisher, but he continued his active literary career nearly to the close of his long life, publishing *The Shadows of the Old Bookellers* (1865), an autobiography under the title *Passages of a Working Life During Half a Century* (3 vols., 1864–65), an historical novel *Begg'd at Court* (1868) and subsequently various papers in *The British Almanac and Companion*. He died at Addlestone, Surrey, March 9, 1873.

K N I G H T H O O D

KNIGHTHOOD and CHIVALRY are two words which are nearly but not quite synonymous; that is, they may often, although they cannot always, be used precisely in the same way and exactly in the same sense. What we mean by the order of knighthood is to all intents and purposes what we mean by the order of chivalry. But in some of the more special applications of the several terms diversities in their respective significations manifest themselves. We could not, for example, say of anybody that he had received the honour of chivalry, or that he had lived in the age of knighthood. Again, we should speak of lands as held in chivalry not in knighthood, and of the rank or degree of knighthood not of chivalry. But taken together the two words knighthood and chivalry designate a single subject of inquiry, which presents itself under three different although connected and in a measure intermingled aspects. It may be regarded in the first place as a mode or variety of feudal tenure, in the second place as a personal attribute or dignity, and in the third place as a scheme of manners or social arrangements. It is under these three general aspects that the subject is to be dealt with here. For the more important religious as distinguished from the military orders of knighthood or chivalry the reader is

referred to the headings ST JOHN (KNIGHTS OF), TRISTRION KNIGHTS, and TEMPLARS.

Our words *knight* and *knighthood* are merely the modern Derivatives of the Anglo-Saxon or Old English *cniht* and *cnihtlād*. Of these the primary signification of the first was a boy or youth, and of the second that period of life which intervenes between childhood and manhood. But some time before the middle of the 12th century they had acquired the meaning they still retain of the French *chevalier* and *chevalerie*. In a secondary sense *cniht* meant a servant or attendant answering to the German *Knecht*, and in the Anglo-Saxon Gospels a disciple is described as a *learning cniht*. In a tertiary sense the word appears to have been occasionally employed as equivalent to the Latin *miles*—usually translated by *thegn*—which in the earlier Middle Ages was used as the designation of the domestic as well as of the martial officers or retainers of sovereigns and princes or great personages.¹ Sharon Turner suggests that *cniht* from meaning "an attendant simply may have come to mean more especially a military attendant, and that in this sense it may have gradually superseded the word *thegn*." But the word *thegn*

¹ Du Cange, *Gloss.*, s. v. "Miles."

² *History of England*, vol. III. chap. 12.

itself, that is, when it was used as the description of an attendant of the king, appears to have meant more especially a military attendant. As Dr Stubbs says, "the thegn seems to be primarily the warrior gæst"—the gæstas forming the chosen band of companions (*comites*) of the German chiefs (*principes*) noticed by Tacitus—"he is probably the gæst who had a particular military duty in his master's service", and he adds that from the reign of Athelstan "the gæst is lost sight of except very occasionally, the more important class having become thegns, and the lesser sort sinking into the rank of mere servants of the king."¹ It is pretty clear, therefore, that the word *cnicht* could never have superseded the word thegn in the sense of a military attendant, at all events of the king. But besides the king, the ealdormen, bishops, and king's thegns themselves had their thegns, and to these it is more than probable that the name of *cnicht* was applied. Under the singular system of joint responsibility and suretyship which was characteristic of the Anglo-Saxon government, the practice of commendation had attained to extraordinary dimensions. He who was unattached to some superior—the lordless man—was indeed regarded as a kind of outlaw, and, if he refused or neglected to choose a lord for himself, his kindred were bound to present him to the county court and select a lord for him. Hence a relation which was for the most part merely personal, but which only required the addition of land holding—an addition, it can scarcely be doubted, sometimes made—to render it in all respects feudal, was widely and firmly established in England long before the Norman Conquest. The mutual rights and obligations of lord and man, in a far more advanced condition than they appear as between hlaford and gæst at an earlier period, were perfectly familiar to the Anglo-Saxons, and it was only in part due to the influence of the Normans that they were subsequently transformed into the mutual rights and obligations of lord and tenant. Around the Anglo-Saxon magnates were collected a crowd of retainers and dependants of all ranks and conditions; and there is evidence enough to show that among them were some called *cnichtas* who were not always the humblest or least considerable of their number.² The testimony of Domesday also establishes the existence in the reign of Edward the Confessor of what Dr Stubbs describes as a "large class" of landholders who had commended themselves to some lord, and he regards it as doubtful whether their tenure had not already assumed a really feudal character. But in any event it is manifest that their condition was in many respects similar to that of a vast number of unquestionably feudal and military tenants who made their appearance after the Norman Conquest. If consequently the former were called *cnichtas* under the Anglo-Saxon régime, it seems sufficiently probable that the appellation should have been continued to the latter—practically their successors—under the Anglo-Norman régime. And if the designation of knights was first applied to the military tenants of the earls, bishops, and barons—who although they held their lands of mesne lords owed their services to the king—the extension of that designation to the whole body of military tenants need not have been a very violent or prolonged process. Assuming, however, that *knicht* was originally used to describe the military tenant of a noble person, as *cnicht* had sometimes been used to describe the thegn of a noble person, it would, to begin with, have defined rather his social status than the nature of his services. But those whom the English called *knights* the Normans called *chevaliers*, by which term the nature of their services was defined, while their social status was left out of considera-

tion. And at first *chevalier* in its general and honorary signification seems to have been rendered not by *knicht* but by *ruler*, as may be inferred from the Saxon Chronicle, wherein it is recorded under the year 1068 that William the Conqueror "dubbed his annu Herrie to ridere."³ But, as Mr Freeman says, "no such title is heard of in the earlier days of England. The thegn, the ealdorman, the king himself, fought on foot; the horse might bear him to the field, but when the fighting itself came he stood on his native earth to receive the onslaught of her enemies."⁴ In this perhaps we may behold one of the most ancient of British insular prejudices, for on the Continent the importance of cavalry in warfare was already abundantly understood. It was by means of their horsemen that the Anstrasian Franks established their superiority over their neighbours, and in time created the Western empire anew, while from the word *caballarius*, which occurs in the *Capitularies* in the reign of Charlemagne, came the words for knight in all the Romance languages.⁵ In Germany the chevalier was called *Ritter*, but neither *rider* nor *chevalier* prevailed against *knicht* among ourselves. And it was long after *knighthood* had acquired its present meaning with us that *chivalry* was incorporated into our language. It may be remarked too in passing that in official Latin, not only in England but all over Europe, *milites* held its own against both *eyes* and *caballaries*.

Concerning the origin of knighthood or chivalry as it existed in the Middle Ages, implying as it did a formal assumption of and initiation into the profession of arms,—nothing beyond more or less probable conjecture is possible. The mediæval knights had nothing to do in the way of derivation with the "equites" of Rome, the knights of King Arthur's Round Table, or the Paladins of Charlemagne. But there are grounds for believing that some of the rudiments of chivalry are to be detected in early Teutonic customs, and that they may have made some advance among the Franks of Gaul. We know from Tacitus that the German tribes in his day were wont to celebrate the admission of their young men into the ranks of their warriors with much circumstance and ceremony. The people of the district to which the candidate belonged were called together; his qualifications for the privileges about to be conferred upon him were inquired into; and, if he were deemed fitted and worthy to receive them, his chief, his father, or one of his near kinsmen presented him with a shield and a lance. Another custom apparently common to the Goths and the Franks was the ceremony of adoption by arms. By means of a solemn investiture with warlike weapons, the two parties to the formality or rite thenceforth acquired the artificial characters of father and son, not, as in the Roman practice of adoption, for any purpose of succession or inheritance, but in a purely honorary and complimentary manner. Salden and Du Cange concur in tracing the ceremony of "dabbling to knighthood" directly to the ceremony of the "adoptio per arma."⁶ Among the Lombards the sons of their kings were forbidden to sit at the tables of their fathers until they had been invested with arms, and this, it is further said, by some foreign prince or potentate.⁷ But among the Franks we find, from the authorities cited by Du Cange, Charlemagne girding his son Louis the Pious, and Louis the Pious girding his son Charles the Bald with the sword, when they arrived at manhood.⁸ These cases can hardly be referred, as the Lombard usage may, to the "adoptio per arma." Yet it is indisputable that in the investiture of Louis and Charles with the sword some ceremony was observed which was deemed worthy of record,

¹ Stubbs, *Constitutional History*, vol. I. p. 156.

² Stubbs, vol. I. pp. 166, 366; Turner, vol. III. pp. 126-132.

³ Ingram's edition, p. 290.

⁴ *Comparative Politics*, p. 74.

⁵ Baluze, *Capitulare Regum Francorum*, vol. II. pp. 794, 1069.

⁶ Salden, *History of Chivalry*, vol. I. p. 36.

⁷ *Scriptores*, p. 4. "Adm."

Origin of
medieval
knights' hood.

not for its novelty, but as a thing of recognized importance. It does not follow that a similar ceremony extended to personages less exalted than the sons of kings and emperors. But if it did we must naturally suppose that it applied in the first instance to the mounted warriors who formed the most formidable portion of the warlike array of the Franks. It was among the Franks indeed, and possibly through their experiences in war with the Saracens, that cavalry first acquired the pre-eminent place which it long maintained in every European country. In early society, where the army is not a paid force but the armed nation, the cavalry must necessarily consist of the noble and wealthy, and cavalry and chivalry, as Mr Freeman observes,¹ will be the same. Since then we discover in the *Capitularies* of Charlemagne actual mention of "caballarii" as a class of warriors, it may reasonably be concluded that formal investiture with arms applied to the "caballarii," if it was a usage extending beyond the sovereign and his heir apparent. "But," as Hallam says, "he who fought on horseback and had been invested with peculiar arms in a solemn manner wanted nothing more to render him a knight;" and so he concludes, in view of the verbal identity of "chevalier" and "caballarius," that "we may refer chivalry in a general sense to the age of Charlemagne."² Yet, if the "caballarii" of the *Capitularies* are really the precursors of the later knights, it remains a difficulty that the Latin name for a knight is "miles," although "caballarius" became in various forms the vernacular designation.

Knighthood in England.

Before it was known that the chronicle ascribed to Ingulf of Croyland is really a fiction of the 13th or 14th century, the knighting of Eward or Hereward by Brand, abbot of Burgh (now Peterborough), was accepted from Selden to Hallam as an historical fact, and knighthood was supposed, not only to have been known among the Anglo-Saxons, but to have had a distinctively religious character which was contemned by the Norman invaders. The genuine evidence at our command altogether fails to support this view. When William of Malmesbury describes the knighting of Athelstan by his grandfather Alfred the Great, that is, his investiture "with a purple garment set with gems and a Saxon sword with a golden sheath," there is no hint of any religious observance. In spite of the silence of our records, Dr Stubbs thinks that kings so well acquainted with foreign usages as Ethelred, Canute, and Edward the Confessor could hardly have failed to introduce into England the institution of chivalry then springing up in every country of Europe; and he is supported in this opinion by the circumstance that it is nowhere mentioned as a Norman innovation. Yet the fact that Harold received knighthood from William of Normandy³ makes it clear either that Harold was not yet a knight, which in the case of so tried a warrior would imply that "dubbing to knighthood" was not yet known in England even under Edward the Confessor, or, as Mr Freeman thinks, that in the middle of the 11th century the custom had grown in Normandy into "something of a more special meaning" than it bore in England. William of Normandy was knighted by his overlord Henry I. of France, and of the Conqueror's sons he himself, as we have already seen, knighted Henry Beaufort,⁴ while William Rufus was knighted by Archbishop Lanfranc.⁵

It was under William Rufus, according to Mr Freeman, that the chivalrous and financial sides of feudalism sprang together into sudden prominence in England—the first as represented by the Red King, and the second as represented by his minister Ranulf Flambard.⁶

In one sense tenure in chivalry was practically co-extensive with European feudalism, while in another sense it was strictly speaking peculiar to England after the Norman Conquest, and Ireland after the English Conquest. We have no earlier information of the details of the feudal organization of Normandy than we have of the feudal organization of England, and therefore it is impossible to say how far the second was copied from the first, or the first assimilated to the second. But at all periods there was apparently sufficient difference between the Norman "fief de hauberc" and the English knight's fee to prevent the one from being pronounced in the proper meaning of the term the counterpart of the other. Into Ireland, however, the English system of tenures was imported without change of conditions.⁷ But the process of feudalization commenced in England under William I. was only completed under Henry II., and at the time of the subjugation of Ireland there was already established a distinction between the feudal arrangements which had been made before and after the death of Henry I., as the "old" and the "new" feoffments. That Henry II.'s method of dealing with the conquered lands of Ireland was an exact imitation of William I.'s method of dealing with the conquered lands in England cannot therefore be assumed. But both kings knighted⁸ had at their disposal a large extent of territory which they granted to their vassals on terms necessarily very similar. In the reign of Henry II. the knight's fee was what may be called the "unit" of the system of tenures which had grown up in England since the Norman Conquest. In the *Modes Tenendi Paravementis*,⁹ for instance, a treatise which pretended to date from the 11th and which really dates from the 14th century, it is laid down that an earldom consisted of twenty knight's fees, and that a barony consisted of thirteen and a third knight's fees, a statement which seems to have been accepted without misgiving until it was refuted by Selden.¹⁰ It is, however, beyond question that some, although not all, of the feudal services and obligations of the tenants of earldoms and baronies were determined by the number of the knight's fees which they comprised. It was certainly not a fixed number, for it varied in every or nearly every recorded example.¹¹ But it was in each instance a specified number, by which the earl's or baron's military contribution to the king's army was settled and the emoluments payable in the event of its being absent or incomplete were computed.¹² Hallam is inclined to attribute the invention of what he terms the "reasonable and convenient" principle of the knight's fee to the administrative genius of William the Conqueror.¹³ But Domesday proves that at the time when the survey was made nothing approaching to a regular distribution of the country into knight's fees had been attempted. On two occasions indeed the expression "servitium unius militis," which was afterwards the technical designation of a knight's fee in legal phraseology, is

¹ Freeman, *Comparative Politics*, p. 78.

² Hallam, *Middle Ages*, vol. iii. p. 399.

³ Freeman, *History of the Norman Conquest*, vol. v. p. 454.

⁴ The Saxon Chronicle so records. But Ordericus Vitalis says that he received his arms from Lanfranc, and Dr Stubbs seems to think that both statements may be true (*Const. Hist.*, vol. i. p. 337).

⁵ William of Malmesbury is the authority for the knighting of William Rufus by Archbishop Lanfranc. "Accessit scilicet sicutque maximam reuerentiam monachum archiepiscopum Lanfrancum eo quod cum auctoritate et multum honeste, quo auctoritate et auctoritate de Sancto Romano Caesare et Damiani coronatus."—*Guilelmi Rufi Hist. Anglorum* lib. v.

sec. 305. Dr Stubbs notices, in this connection, that abbots were forbidden to make knights in the Council of London in 1102. He adds that "Thomas Becket knighted the count of Guines, and William, bishop of Ely, knighted Ralph Besechamp as late as 1191" (*Cant. Hist.*, vol. i. p. 307).

⁶ *Norman Conquest*, vol. v. p. 465.

⁷ *Medieval Baronies Anglo-Norm.*, p. 28.

⁸ Stubbs, *Selden's Charters*, p. 602.

⁹ *Notes of Henry*, pp. 611, 612.

¹⁰ *Medieval Baronies Anglo-Norm.*, p. 21 sq.; and Selden, *de regis*.

¹¹ *Medieval Hist.*, vol. i. p. 116 sq.

¹² *Medieval Middle Ages*, vol. i. p. 121.

employed. But even the word "miles" had not as yet acquired the special meaning which was subsequently assigned to it. Among the "militēs" of Domesday are persons of very various conditions, from ordinary soldiers and the inferior tenants of manors to Hamo the sheriff and the earl of Eu.¹ But when the returns contained in the Black Book of the Exchequer were made in the reign of Henry II., both the principle and system of knights' fees were fully and definitely established. Hence this change must have been effected in the interval between the compilation of these two records. It cannot be supposed that the numerous grants of land made by William I. to his adherents were exempt from military obligation of one kind or another. But no original grant of his or of either of his immediate successors to any lay vassal is in existence to inform us what the exact nature of those military obligations was; and, arguing from the grants to various ecclesiastical vassals, Dr Stubbs regards it as unlikely that such gifts were made on any expressed condition or accepted with a distinct pledge to provide a certain contingent of knights for the king's service.² Before the Norman Conquest, he contends, all landholders having been bound to the duty of national defence, and a certain quantity of land having customarily furnished a fully armed man, the old rate of military obligation was in all probability continued in the case of the new grantees after the Conquest. Nothing in Domesday implies that the conditions of military service differed under the old and the new monarchy, and hence Dr Stubbs concludes that "the form in which knights' fees appear when called on by Henry II. for scutage was most probably the result of a series of compositions by which the great vassals relieved their lands from a general burden by carrying out particular estates the holders of which performed the services due from the whole; it was a matter of convenience and not of tyrannical pressure." And, although Selden, and Madox after him, adhere to the common and ancient tradition that William the Conqueror made his grants conditional on the service of some particular number of knights in every case, they substantially agree in regarding the knight's fee in its special meaning as the consequence of subinfeudation. From the reign of Henry II. to the reign of Edward I., indeed, what may be called grants in gross from the king and grants in detail from the mesne lords were the ordinary methods of erecting knights' fees and providing for the discharge of the personal and pecuniary obligations with which they were burdened.

Although the feudal services and incidents of a knight's fee appear to have been ascertained with perfect clearness, the exact nature of a knight's fee itself—what it was or in what it consisted—has been the subject of a great deal of controversy. As the demands both personal and pecuniary

which were made on the holder of each knight's fee were uniform, it is reasonable to conclude that all such fees were in some way equivalent to one another. But whether their equivalence was inferred from the quantity of land they contained or from the amount of revenue derived from them has been much debated, and cannot be said to be even now finally settled. Selden, indeed, roundly affirms that "the legal value of knights' fees was never in truth estimable either by any certain number of acres or quantity of revenue (though some have erroneously determined them by both), but only by the services or number of knights reserved."³ But if this were the case it is difficult to understand how parts of a knight's fee such as a half or a third could have been held, as they unquestionably were held, under reduced burdens calculated in proportion to the full burdens of a whole knight's fee. According to the analogies of the Anglo-Norman policy in other departments of its manifestation, it might have been expected with some degree of confidence that the knight's fee would have been a combination of the property qualification of the thegn and the feudal attributes of the "fief de haubert," that is, of the latter superinduced upon the former. Before the Norman Conquest the property qualification of a thegn was five hides of land, for which a fully equipped warrior was to be furnished for the national defence in the king's host or "fyrd"; and there is no evidence to rebut the presumption that after the Norman Conquest a similar rate of military obligation was continued. It is not, however, without hesitation that Dr Stubbs arrives at what seems to be rather a provisional than a final determination on the subject.

In one passage he observes that "the name of thegn covers the whole class which after the Conquest appears under the name of knights, with the same qualification in land and nearly the same obligations."⁴ In another passage, on the contrary, he says that "it cannot even be granted that a definite area of land was necessary to constitute a knight's fee; for although at a later period and in local computations we may find four or five hides adopted as a basis of calculation, where the particular knight's fee is given exactly, it affords no ground for such a conclusion."⁵ On the whole he thinks it must be held that its extent was determined not by acreage but by rent or valuation, and that "the common quantity was really expressed in the twenty librates, the twenty pounds' worth of annual value, which until the reign of Edward I. was the qualification for knighthood." That this was the established appraisement of the knight's fee very soon after the Norman Conquest Dr Stubbs infers from the circumstance that Archbishop Lanfranc maintained ten knights to answer for the military service due from the convent of Christ Church in consideration of land worth two hundred pounds a year which on that account was assigned to him.⁶ But, although, as Coke says, the annual value of a knight's fee was twenty pounds at the enactment of both Magna Charta and the statute "De Militibus," he cites various writs of distrain of knight-hood which, if indeed some of them were not merely writs of array, would show that it varied irregularly from ten to forty pounds in amount between the reigns of Edward I. and Henry VI.⁷ It was computed at forty pounds in the reign of Elizabeth, and again when Charles I. resorted to "knight-moneys" as a means of raising a revenue. The aggregate number of knights' fees throughout England in feudal times is very variously stated by tradition. The assertion of Ordericus Vitalis in the reign of Stephen that the Conqueror settled his military fiefs so as to provide 60,000 knights for his service was accepted, not only

¹ Ellis, *General Introduction to Domesday*, vol. i. p. 53 *sq.*, where examples are noticed. "There is no ground," says Mr Freeman, "for thinking that William directly or systematically introduced any new kind of tenure into the holding of English lands. There is nothing to suggest any such belief either in the chronicles of his reign, in the survey which is his greatest monument, in the genuine, or even in the spurious, remains of his legislation. The code of laws which bears William's name, but which is assuredly none of his enactment, is in all but a very few points a mere confirmation of the old English law. And the few points of innovation have nothing to do with feudal tenures. But when we come to the reign next but one we are met by a document which shows us that within thirteen years after the Conqueror's death not only the military tenures but the worst abuses of the military tenures were in full force in England. The great charter of Henry I., the groundwork of the greater charter of John, and thereby the groundwork of all later English legislation, is filled with promises to abolish the very same class of abuses which were at last swept away by the famous statute of Charles II." (Freeman, *Norm. Cong.*, vol. v. p. 572 *sq.*; *Feignve, Normandy and England*, vol. iii. p. 809 *sq.*; *Dugby, History of the Law of Real Property*, p. 51).

² Stubbs, *Con. Hist.*, vol. i. p. 261 *sq.*

³ *Notes of Honor*, p. 618.

⁴ Stubbs, *Con. Hist.*, vol. i. p. 158.

⁵ *Ibid.*, p. 264 *sq.*

⁶ *Ibid.*, p. 283. ⁷ Coke, *Second Institute*, p. 556, ed. 1688.

popularly and in an uncritical age, but by writers of weight from Selden to Hallam. But 60,000 knights' fees at £20 a year gives about twelve times the whole national income from land as it appears in Domesday; or, if the knight's fee is reckoned at five hides, the aggregate amounts to thirty millions of acres, leaving something more than two millions for royal demesnes, all other tenures, forests, waste, and the rest.¹ The Red Book of the Exchequer, which dates from the first third of the 13th century, mentions a tradition, which the compiler himself rejects as unsupported by evidence, that William I. created not 60,000 but 32,000 knights' fees.² According to the Black Book of the Exchequer the number of knights furnished at the date of its compilation by the tenants in chief of twenty counties taken at random was 3991, and of the ten counties south of the Thames and Avon 2047.³ As it is probable that these ten counties contained about a fourth of the population, and as the proportion of knights' fees is not very materially departed from in the twenty unselected counties, we should not be far wrong in assuming perhaps that the entire number of knights' fees in the kingdom was between eight and nine thousand.⁴

Knight-
service.

All tenure in chivalry was founded on homage and fealty, to which were added the various services and liabilities under which the different fiefs or tenements were held. Homage consisted in the mutual acknowledgment by the lord and tenant that the latter was the vassal or man of the former, accompanied as evidence thereof by certain solemn acts of obeisance on the one hand and of acceptance and patronage on the other. Hence homage could be done only by the tenant in person to the lord in person. Connected with and following on homage was fealty, which was an undertaking or oath on the part of the tenant that he would be true and faithful to his lord in consideration of the lands which he held of him, and that he would duly and fully observe the several conditions of his tenure, which declaration might be received on behalf of the lord by anybody whom he might appoint for the purpose. Every tenant in chivalry owed service to his lord in peace as well as in war, and was bound to attend him in his court not less than in the field. The civil obligations of tenants by knight-service were to assist their lords in the administration of justice and to support them on occasions of ceremony and display. The chief vassals of the king, the earls and barons, were the homagers and peers of the great court-barons of the kingdom, and in turn their under-tenants were the homagers and peers of their palatine and baronial courts. The military obligations of tenants by knight-service were discharged either in the king's armies or in the castles of the king and his principal feudatories. In the first case the holder of a knight's fee was bound to serve in the royal host fully equipped and on horseback at his own expense for forty days in every year when called upon,—a tenant in chief serving under the direct command of the sovereign or his officers, and an under tenant in the martial retinue of his immediate lord. But in the second case the duties of the tenant were not defined by any general rule or custom, and the terms of his service of "castle guard" depended on the special stipulations of his grant or feoffment.⁵ Besides all this, however, tenants by knight-service were subjected to various other burdens which in course of time became the most important incidents of their tenure. On the death of a tenant, his

heir, if he was of full age, was compelled on taking up his inheritance to pay a fine to his lord. This was called a relief if he was an under tenant, or "primer seisin" if he was a tenant in chief, and amounted in the first instance to one quarter's profits, and in the second to one whole year's profits, of his estate.⁶ The tenant was also liable to render what were called aids to his lord for three purposes, namely, to ransom him from captivity, to make his eldest son a knight, and to provide a portion for his eldest daughter on her marriage. Of these three aids ransom was only a very rare and exceptional demand, while those "pur faire fize chivalier" and "pur faire marier" were of course of frequent and ordinary occurrence. Wardship and marriage, however, were the main incidents of tenure by knight-service after the military obligations which formed its essential characteristic, and they were always the most unpopular and oppressive of them. When on the death of the tenant the heir was under the age of twenty-one or the heiress under the age of fourteen, the lord became the "guardian in chivalry" of his or her person and lands until he reached the age of twenty-one or she reached the age of sixteen, when on the payment of half a year's income of their estate in lieu of all reliefs and "primer seisins" the wards were entitled to sue out their livery or "ouster-lmain." In the meantime the lord had all the profits of the lands, and was not bound to render any account of them, while he was at liberty to assign or sell his guardianship with its attendant rights and immunities unimpaired. Moreover, he was entitled to dispose of his male, as well as his female, wards in marriage to any person of equal or similar rank to their own, and if they rejected the match recommended by him, or married without his consent, they incurred the forfeiture to him of a sum of money equivalent to what was termed the value of their marriage, that is, the price which was to have been given or might have been reasonably expected to be given for it. Nor could the tenant by knight-service part with his lands without the payment of a fine on alienation to his lord, to whom they altogether passed on his neglect to fulfil his feudal obligations or on the extinction of his heirs. Again, whether he was an under tenant or a tenant in chief, his lands escheated to the king if he was convicted of treason, while if he was convicted of any other felony they escheated to his immediate lord, the king—if he were not the immediate lord—entering into possession of them for a year and a day. It had also become customary from a comparatively early period to compel the tenants of knights' fees to take upon themselves the honorary distinction of knighthood, and it is remarkable that this appears to have been most systematically insisted on after the actual render of military service had been universally committed to a money equivalent, and when even that money equivalent itself under its original name of escuage orutage was passing or had passed away.⁷ Neglect or refusal to be knighted by any

¹ *Magna Carta*, sect. 2.

² "In the reign of Henry III., all the sheriffs of England were commanded by close writ under the great seal to make proclamation that all they who held of the king in chief one knight's fee or more and were not as yet knighted should get themselves knighted before the ensuing Christmas, as they loved the tenants and fees they held of the king. Two years before the king had seized the lands and castles of Roger de Somery, including the honour of Drailly, because he did not come to the king to be girded with the belt of knighthood" (*Medley, Baron's Anglica*, p. 180). "There can be no doubt," Dr Stubbs says, "that this practice was one of the influences which blended the minor fiefholder-in-chief with the general body of the free holders; possibly it led also to the development of the military spirit which in the following century [he is speaking of the reign of Edward I.] manifested the extravagant designs of Edward I., and was embodied under the name of chivalry" (*Const. Hist.*, vol. ii. p. 228). The statute "De Militibus" was passed in the reign of Edward II., just at the period whenutage was being abandoned as a special mode of taxation (*Stubbs, Const. Hist.*, vol. ii. p. 522).

¹ *Pearson, Early and Middle Ages*, vol. ii. p. 496.

² *Medley, Baron's Anglica*, p. 30.

³ *Pearson, ib. cit.*, vol. ii. p. 209 et.

⁴ *Pearson, ib. cit.*, vol. i. p. 876. *Stubbs, Const. Hist.*, vol. ii. p. 244.

⁵ *Magna Carta*, sect. 29; *Stubbs, Select Charters*, p. 300; *Selden, Titles of Honor*, p. 611.

tenant in chivalry who was thereunto commanded by the king's writ subjected the offender, if he was capable of bearing arms, and between the ages of twenty-one and sixty, to a fine. And thus in the progress of events knight-service tended to become more and more divorced from its primary uses and intentions, and to survive merely as a series of oppressive exactions and idle ceremonies. During the centuries which followed the enactment of the statute of "Quia Emptores," the king gradually added the character of immediate lord over nearly all the lands held in chivalry within the realm to the character of lord paramount which had been his from the beginning. When feudalism was as firmly established and as fully developed as it ever was in England, a single officer in each county, called the king's escheator, who was appointed annually by the lord treasurer, was considered sufficient to watch over the royal "droits of seignory" and to prevent the evasion of them. But when nothing save the name and the hardships of feudalism remained, the Court of Wards and Liveries was erected, and the scandals and abuses to which its jurisdiction gave rise under the Tudors and the first two Stuarts speedily assumed the proportions of an almost intolerable grievance. Towards the end of the reign of James I the general discontent resulted in an attempt to abolish tenures in chivalry altogether, compensation being proposed to the king and the means lords in the form of a fixed rent in the place of their feudal dues, "which motion, though it proceeded not to effect," says Coke, "yet we thought it well to remember, hoping that so good a motion . . . will come time or other . . . take effect and be established."¹ This hope was in part realized by the Long Parliament, which by resolution of both Houses in 1645 put an end to the Court of Wards and Liveries, and converted all tenures in chivalry into free and common socage. But it was not until eleven years later that, by an Act of the Commonwealth in 1656, legislative sanction was conferred on these ordinances. Their substance, however, had been embodied in one of the articles of the treaty of Newport between Charles I. and the Parliamentarians, and the king was then to have been indemnified by means of a revenue charged on the lands relieved, amounting to a hundred thousand pounds a year. At the Restoration a tax on lands held in chivalry was proposed in place of knight-service, but an alternative scheme for an excise on beer and some other liquors received the preference. It was not, however, until the abolition of purveyance as well as knight-service had been included in the measure, since known as the 12th Charles II. cap. 24, by way of concession to the claims of the yeomanry and peasantry, that it was permitted to pass, and then only amid vigorous protests from many quarters.

Regarded as a method of military organization, the feudal system of tenures was always far better adapted to the purposes of defensive than of offensive warfare. Against invasion it furnished a permanent provision both in men-at-arms and strongholds; nor was it unsuited for the campaigns of neighbouring counts and barons which lasted for only a few weeks, and extended over only a few leagues. But when kings and kingdoms were in conflict, and distant and prolonged expeditions became necessary, it was speedily discovered that the unassisted resources of feudalism were altogether inadequate. The barons and knights who fought on horseback were in their own country attended by the yeomen and townsmen who fought on foot. But in foreign wars the feudal cavalry alone were available, and the infantry were nearly all and always mercenary troops. Again, although the period for which the holders of fiefs were bound to military service had originally been

uncertain and unlimited, it gradually became an established rule, to which the exceptions were everywhere trifling and rare, that it should be restricted in various countries to from forty to sixty days in each year.² Hence warlike operations on anything like an extended scale would have been impossible if the terms of the feudal engagement had been strictly observed. In these circumstances it became customary to retain the feudal tenants under arms as stipendiaries after their ordinary and legitimate obligations had been fulfilled. But this arrangement was exceedingly inconvenient in practice to sovereigns and their feudatories alike. It implied to the former the expenditure of large sums of money, then very difficult to raise, on what was frequently an inferior commodity, and to the latter the neglect of their estates and of all their peaceful duties and diversions. It became therefore the manifest interest of both parties that personal services should be commuted into pecuniary payments. In the early times of feudalism the refusal or omission to discharge the military obligations attached to a fief entailed immediate forfeiture. But the usage of fining the delinquents in such cases, at first arbitrarily and afterwards in a fixed amount, grew up all over Europe, while in England from the reign of Henry II. to the reign of Edward II. scutage or socage was regularly levied, originally as an amercement and subsequently as an ordinary war-tax on tenants by knight-service.³ In this way funds for war were placed at the free disposal of sovereigns, and, although the feudatories and their retainers still formed the most considerable portion of their armies, the conditions under which they served were altogether changed. Their military service was now the result of special agreement, by which they undertook in consideration of certain payments to themselves and their followers, with whom they had entered into similar arrangements, to attend in a particular war or campaign with a retinue of stipulated composition and strength. In the reign of Edward I., whose warlike enterprises after he was king were confined within the four seas, this alteration does not seem to have proceeded very far, and Scotland and Wales were enfeebled by what was in the main if not exclusively a feudal militia raised as of old by writ to the earls and barons and the sheriffs.⁴ But the armies of Edward III., Henry V., and Henry VI. during the century of intermittent warfare between England and France were recruited and sustained entirely on the principle of contract. On the Continent the systematic employment of mercenaries was both an early and a common practice. But the transition from the feudal régime to the régime of standing armies was everywhere sudden and abrupt as compared with the same process among ourselves.

Besides consideration for the mutual convenience of the sovereigns and their feudatories, there were other causes, which materially contributed towards bringing about the changes in the military system of Europe which were finally accomplished in the 13th and 14th centuries. During the crusades vast armies were set on foot in which feudal rights and obligations had no place, and it was

¹ *De Cange, Gloss.*, s.v. "Hostis"; Brussel, *Usages Généraux des Fiefs*, p. 162 sq.

² Henry II. adopted the knight's fee instead of the hide as the basis of rating (in levying taxes) for the knights and barons, and under him socage or socageage became "as honourable commutation for personal service." Littleton defines knight-service as tenure by "homage, fealty, and socage"; and, although socage may have been the name for the personal service represented by the tax, it had of course long been replaced by the tax itself when he wrote in the reign of Henry VI. See Coke-Littleton, bk. II. chap. 4, sect. 108; Medox, *Baronia Anglica*, pp. 216-226; Pearson, *Early and Middle Ages*, vol. I. p. 521; Stubbs, *Constitutional History*, vol. I. p. 551-560.

³ Stubbs, *Const. Hist.*, vol. II. p. 278; also compare Green, *Military Antiquities*, vol. I. p. 66 sq.

¹ *Institutes* 4, vol. III. p. 208.

seen that the volunteers who flocked to the standards of the various commanders were not less but even more efficient in the field than the vassals they had hitherto been accustomed to lead. It was thus established that pay, the love of enterprise, and the prospect of plunder,—if we leave zeal for the sacred cause which they had espoused for the moment out of sight,—were quite as useful for the purpose of enlisting troops and keeping them together as the tenure of land and the solemnities of homage and fealty. Moreover, the crusaders who survived the difficulties and dangers of an expedition to Palestine were seasoned and experienced although frequently impoverished and landless soldiers, ready to hire themselves to the highest bidder, and well worth the wages they received. Again, it was owing to the crusades that the church took the profession of arms under her peculiar protection, and thenceforward the ceremonies of initiation into it assumed a religious as well as a martial character. Nor was this by any means a merely gratuitous patronage of bloodshed on her part. In the ages of faith and chivalry, magic and sorcery were the terrors alike of the pious and the brave, and the blessings of the priest on the warrior, his weapons, and his armour were always regarded as the surest safeguards against the influence of hostile spells and enchantments. To distinguished soldiers of the cross the honours and benefits of knighthood could hardly be refused on the ground that they did not possess a sufficient property qualification,—of which perhaps they had in fact denuded themselves in order to their own and their retinue's equipment for the Holy War. And thus the conception of knighthood as of something wholly distinct from and independent of feudalism both as a social condition and a personal dignity arose and rapidly gained ground. It was then that the analogy was first detected which was afterwards more fully developed between the order of knighthood and the order of priesthood, and that an actual union of monachism and chivalry was effected by the establishment of the religious orders of which the Knights Templars and the Knights Hospitallers were the most eminent examples. As comprehensive in their polity as the Benedictines or Franciscans, they gathered their members from, and soon scattered their possessions over, every country in Europe. And in their indifference to the distinctions of race and nationality they merely accommodated themselves to the spirit which had become characteristic of chivalry itself, already recognized, like the church, as a universal institution which comprised and knit together the whole warrior caste of Christendom into one great fraternity irrespective alike of feudal subordination and territorial boundaries. Somewhat later the adoption of hereditary surnames and armorial bearings marked the existence of a large and noble class who either from the subdivision of fiefs or from the effects of the custom of primogeniture were very insufficiently provided for. To them only two callings were generally open, that of the churchman and that of the soldier, and the latter as a rule offered greater attractions than the former in an era of much licence and little learning. Hence the favourite expedient for men of birth, although not of fortune, was to attach themselves to some prince or magnate in whose military service they were sure of an adequate maintenance, and might hope for even a rich reward in the shape of booty or of ransom.¹ It is probably to this period and these circumstances that we must look for at all events the rudimentary beginnings of the military as well as the religious orders of chivalry. Of the existence of any regularly constituted companionships of the first kind there is no trustworthy evidence until between two and three

Knighthood independent of feudalism.

centuries after fraternities of the second kind had been organized. Soon after the greater crusading societies had been formed similar orders, such as those of St James of Compostella, Calatrava, and Alcantara, were established to fight the Moors in Spain instead of the Saracens in the Holy Land. But the members of these orders were not less monks than knights, their statutes embodied the rules of the cloister, and they were bound by the ecclesiastical vows of celibacy, poverty, and obedience. From a very early stage in the development of chivalry, however, we meet with the singular institution of brotherhood in arms; and from it the ultimate origin if not of the religious fraternities at any rate of the military companionships is usually derived.² By this institution a relation was created between two or more knights by voluntary agreement which was regarded as of far more intimacy and stringency than any which the mere accident of consanguinity implied. Brothers in arms were supposed to be partners in all things save the affections of their "lady-loves." They shared in every danger and every success, and each was expected to vindicate the honour of another as promptly and zealously as his own. Their engagements usually lasted through life, but sometimes only for a specified period or during the continuance of specified circumstances, and they were always ratified by oath, occasionally reduced to writing in the shape of a solemn bond and often sanctified by their reception of the eucharist together. Romance and tradition speak of strange rites—the mingling and even the drinking of blood—as having in remote and rude ages marked the inception of these martial and fraternal associations.³ But in later and less barbarous times they were generally evidenced and celebrated by a formal and reciprocal exchange of weapons and armour. In warfare it was customary for knights who were thus allied to appear similarly accoutred and bearing the same badges or cognizances, to the end that their enemies might not know with which of them they were in conflict, and that their friends might be unable to accord more applause to one than to another for his prowess in the field. It seems likely enough therefore that, at or soon after the period when the crusades had initiated the transformation of feudalism into chivalry as a military system, bodies banded together by engagements of fidelity, although free from monastic obligations, wearing a uniform or livery, and naming themselves after some special symbol or some patron saint of their adoption, were neither unknown nor even uncommon. And such bodies raised by or placed under the command of a sovereign or grand master, regulated by statutes, and enriched by ecclesiastical endowments would have been precisely what in after times such orders as the Garter in England, the Golden Fleece in Burgundy, the Annuniation in Savoy, and the St Michael and Holy Ghost in France actually were.⁴ The knight too who had "won his spurs" was very differently esteemed from the knight who succeeded to them as an incident of his feudal tenure. In rank and the external ensigns of rank under the sumptuary regulations of the age they were equal. But it was the first and not the second who was welcomed in court and camp, who was invited to the "round tables" which the Arthurian romances brought into fashion among the potentates of mediæval Europe, and more particularly Edward III. and Philip VI. And thus it became the ambition of every aspirant to knighthood to gain it by his exploits rather than to claim it merely as his right by virtue of his position and estate. But there was one qualification for knighthood

¹ Du Cange, *Dissertation sur Joinville*, xxi.; Sainte Palaye, *Mémoires*, vol. i. p. 272; Belz, *Mémoires of the Order of the Garter*, p. xxvii.

² Du Cange, *Dissertation*, xxx., and *Lancelot du Lac*, among other romances.

³ Austin, *Register of the Order of the Garter*, vol. i. p. 68.

¹ Sainte Palaye, *Mémoires sur l'Antienne Chevalerie*, vol. i. pp. 263, 264, ed. 1751.

which was theoretically exacted even in England, and which was rigorously exacted abroad. Nobody could be legitimately created a knight who was not a gentleman of "name and arms," that is, who was not descended on both sides at the least from grandparents who were entitled to armorial bearings. And this condition is embodied in the statutes of every order of knighthood, religious or military, which can trace its origin to a period when chivalry was a social institution.¹

grades
of
knight-
hood.

During the 14th and 15th centuries, as well as somewhat earlier and later, the general arrangements of a European army were always and everywhere pretty much the same.² Under the sovereign the constable and the marshal or marshals held the chief commands, their authority being partly joint and partly several. Attendant on them were the heralds, who were the officers of their military court, wherein offences committed in the camp and field were tried and adjudged, and among whose duties it was to carry orders and messages, to deliver challenges and call truces, and to identify and number the wounded and the slain. The main divisions of the army were distributed under the royal and other principal standards, smaller divisions under the banners of some of the greater nobility or of knights banneret, and smaller divisions still under the pennons of knights or, as in distinction from knights banneret they came to be called, knights bachelor. All knights whether bachelors or bannerets were escorted by their squires. But this banner of the banneret always implied a more or less extensive command, while every knight was entitled to bear a pennon and every squire a penceil. All three flags were of such a size as to be conveniently attached to and carried on a lance, and were emblazoned with the arms or some portion of the bearings of their owners. But while the banner was square the pennon, which resembled it in other respects, was either pointed or forked at its extremity, and the penceil, which was considerably less than the others, always terminated in a single tail or streamer.³ As we have already indicated, it became the custom from the time of the crusades to seek out and as far as possible to establish analogies between the institutions of chivalry and the church. In the military grades of the squire, the knight, and the banneret, therefore, were of course seen the representatives of the

clerical grades of the deacon, the priest, and the bishop.⁴ But despite that the ceremonies of ordination were unquestionably imitated in the ceremonies of knighting, there is no reason for supposing that the resemblances, such as it was, which obtained between the chivalrous and the ecclesiastical series of degrees was otherwise than accidental. Moreover, it failed in at least two material respects, namely, that squirehood although the usual was not the necessary preliminary to knighthood, and that in all the attributes of knighthood as knighthood a knight bachelor was as fully and completely a knight as a knight banneret. If indeed we look at the scale of chivalric subordination from another point of view, it seems to be more properly divisible into four than into three stages, of which two may be called provisional and two final. The bachelor and the banneret were both equally knights, only the one was of greater distinction and authority than the other. In like manner the squire and the page were both in training for knighthood, but the first had advanced further in the process than the second. It is true that the squire was a combatant while the page was not, and that many squires voluntarily served as squires all their lives owing to the insufficiency of their fortunes to support the costs and charges of knighthood. But in the ordinary course of a chivalrous education the successive conditions of page and squire were passed through in boyhood and youth, and the condition of knighthood was reached in early manhood. Every feudal court and castle was in fact a school of chivalry in which the sons of the sovereign and his vassals, or of the feudatory and his vassals, together commonly with those of some of their allies or friends, were reared in its principles and habituated to its customs and observances. And, although princes and great personages were rarely actually pages or squires, the moral and physical discipline through which they passed was not in any important particular different from that to which less exalted candidates for knighthood were subjected.⁵ This page, or, as he was more anciently and more correctly called, the "valet" or "damoiseau," commenced his service and instruction when he was between seven and eight years old, and the initial phase continued for seven or eight years longer. He acted as the constant personal attendant of both his master and mistress. He waited on them in their hall and accompanied them in the chase, served the lady in her bower and followed the lord to the camp.⁶ From the chaplain and his mistress and her damsels he learnt the rudiments of religion, of rectitude, and of love; from his master and his squires the elements of military exercise, to cast a spear or dart, to sustain a shield, and to march with the measured tread of a soldier, and from his master and his huntmen and falconers the "mysteries of the

¹ Being made to "ride the barriers" was the penalty for anybody who attempted to take part in a tournament without the qualification of name and arms. Hence the importance of the decesses in geometrical progression commonly referred to as "sixteen quarters," beginning with "three decesses" in England, "four lines" in France, "four quarters" in the empire, and "four branches" in Scotland. The books where this subject may be pursued are far too numerous to mention. Guillemin (*History of Heraldry*, p. 66) and Niebet (*System of Heraldry*, vol. II, p. 147) speak of it as concerning England and Scotland. See also Ashmole's *Order of the Garter*, p. 284. But in England knighthood has always been conferred to a great extent independently of these considerations. At almost every period there have been men of obscure and illegitimate birth who have been knighted. Ashmole often Sanders's *Flandria Illustrata* to the effect that "the degree of knighthood is of so great splendour and fame that it bestows gentility not only upon a man newly born but also upon his descendants, and very much increaseth the honour of those who are well descended." And he adds that "it is a maxim laid down by a learned civilian (Tiraqueau, *De Nobilitate*) that knighthood ennobles, inasmuch that whosoever is a knight it necessarily follows that he is also a gentleman (*Miles nobilitat et quousque et Miles a quoque continuo est nobilis*), for, when a king gives the dignity to an ignoble person whose merit he would thereby recompense, he is understood to have conferred whatsoever is requisite for the completing of that which he bestows." By the common law, if a villan were made a knight he was thereby enfranchised and accounted a gentleman, and if a person under age and in wardship were knighted both his minority and wardship terminated.—*Order of the Garter*, p. 48; Nicolson, *British Orders of Knighthood*, vol. I, p. v.

² Grose, *Military Antiquities*, vol. I, p. 207 sq.; Stubbs, *Const. Hist.*, vol. II, p. 270 sq., and vol. III, p. 278 sq.

³ Grose's *Military Antiquities*, vol. II, p. 266.

⁴ The same analogy may be drawn between bachelors, masters, and doctors; barristers, sergeants, and judges; or pageants, heralds, and kings of arms.

⁵ Sainte Palaye, *Mémoires*, vol. I, p. 38, Froissart, bk. III, chap. 6. Sainte Palaye, *Mémoires*, part I, and Mills, *History of Chivalry*, vol. I, chap. 2.

⁶ "Le petit Jehan de Sainct" is the great example of this point, especially the homily addressed to him by Le Dame des Balle-Cousines. Therein she instructs him how he ought to love her pageant. But Sir Walter Scott says that "so pure was the nature of the flame which she recommended that she maintained it to be innocent even with the servile sin of chambering and wantonness to which it might seem too nearly allied. The least dishonest thought or action was, according to her doctrine, sufficient to forfeit the chivalrous lover the favour of his lady. It seems, however, that the greater part of her charges concerning incontinence is levelled against such as haunted the receptacles of open vice, and that she reserved an exception (of which in the course of the history she made liberal use) in favour of the intercourse which in all love, honour, and secrecy might take place when the favoured and faithful knight had obtained by long service the boon of amorous mercy from the lady whom he loved *per amorem*" (article CHIVALRY in 7th and 8th editions of the *Encyclopædia Britannica*).

woods and rivers," or in other words the rules and practices of hunting and hawking. When he was between fifteen and sixteen he became a squire. But no sudden or great alteration was made in his mode of life. He continued to wait at dinner with the pages, although in a manner more dignified according to the notions of the age. He not only served but carved and helped the dishes, proffered the first or principal cup of wine to his master and his guests, and carried to them the basin, ewer, or napkin when they washed their hands before and after meat. He assisted in clearing the hall for dancing or minstrelsy, and laid the tables for chess or draughts, and he also shared in the pastimes for which he had made preparation. He brought his master the "vin de coucher" at night, and made his early refection ready for him in the morning. But his military exercises and athletic sports occupied an always increasing portion of the day. He accustomed himself to ride the "great horse," to tilt at the quintain, to wield the sword and battle-axe, to swim and climb, to run and leap, and to bear the weight and overcome the embarrassments of armour. He inured himself to the vicissitudes of heat and cold, and voluntarily suffered the pains or inconveniences of hunger and thirst, fatigue, and sleeplessness. It was then too that he chose his "lady-love," whom he was expected to regard with an adoration at once earnest, respectful, and the more meritorious if concealed. And when it was considered that he had made sufficient advancement in his military accomplishments, he took his sword to the priest, who laid it on the altar, blessed it, and returned it to him.¹ Afterwards he either remained with his early master, relegating most of his domestic duties to his younger companions, or he entered the service of some valiant and adventurous lord or knight of his own selection. He now became a "quire of the body," and truly an "armiger" or "écuyer," for he bore the shield and armour of his leader to the field, and, what was a task of no small difficulty and hazard, cared and secured him in his panoply of war before assisting him to mount his courser or charger. It was his function also to display and guard in battle the banner of the baron or banneret or the pennon of the knight he served, to raise him from the ground if he were unhorsed, to supply him with another or his own horse if his was disabled or killed, to receive and keep any prisoners he might take, to fight by his side if he was unequally matched, to rescue him if captured, to bear him to a place of safety if wounded, and to bury him honourably when dead. And after he had worthily and bravely borne himself for six or seven years as a squire, the time came when it was fitting that he should be made a knight.

Modes of
confer-
ring
knight-
hood

Two modes of conferring knighthood appear to have prevailed from a very early period in all countries where chivalry was known. In both of them the essential portion seems to have been the accolade. But while in the one the accolade constituted the whole or nearly the whole of the ceremony, in the other it was surrounded with many additional observances. As soon as we have any historical evidence of their separate and distinct existence, we discover them as severally appropriated, the first to time of war and the second to time of peace.²

In one of the oldest records of chivalry quoted by Selden, under the heading of "Comment on doit faire et creer ung Chevalier," it is stated that, "quant ung Escuyer que a longement voyage at este en plusieurs fairs d'armes et que a de quoy entretenir son estat et qu'il est de grant maison et rich et qu'il se trouve en un bataille on reconter il doit adviser le chief de l'armée ou vaillant chevalier. Alors doit venir devant luy et demander 'chevalier au nom de Dieu et de Saint George donnez moy le ordre' et le dit chevalier on chief de guerre doit tirer l'espee nue vers le dit demandeur et doit dire on frappant trois fois sur l'ecuy: 'Je te fais chevalier au nom de Dieu et de mon seigneur Saint George, pour la foy et justis loyement garder et l'eglise, femes, vesves, et orphelins defendre.'"³ But the words of creation were various as well as the words of the exhortation. Sometimes the first were "avancez chevalier au nom de Dieu," or "an nom de Dieu, Saint Michel, et Saint George je te fais chevalier"; and the second "coyez preux, hardi, et loyal," "be a good knight in the name of God"; or "coyez bon chevalier," or "be a good knight," merely. In this form a number of knights were made before and after almost every battle between the 11th and the 16th centuries, and its advantages on the score of both convenience and economy gradually led to its general adoption both in time of peace and time of war. On extraordinary occasions indeed the more elaborate ritual continued to be observed. But recourse was had to it so rarely that among us about the beginning of the 15th century it came to be exclusively appropriated to a special kind of knighthood. When Segar, garter king of arms, wrote in the reign of Queen Elizabeth, this had been accomplished with such completeness that he does not even mention that there were two ways of creating knights bachelors. "He that is to be made a knight," he says, "is striken by the prince with a sword drawn upon his back or shoulder, the prince saying, 'Soys Chevalier,' and in times past was added 'Saint George.' And when the knight rises the prince sayeth 'Avancez.' This is the manner of dubbing knights at this present, and that term 'dubbing' was the old term in this point, not 'creating.' This sort of knights are by the heralds called knights bachelors."⁴ In our days when a knight is personally made he kneels before the sovereign, who lays a sword drawn, ordinarily the sword of state, on either of his shoulders, and says, "Rise," calling him by his Christian name with the addition of "Sir" before it.⁵

Very different were the solemnities which attended the creation of a knight when the complete procedure was observed. "The ceremonies and circumstances at the giving this dignity," says Selden, "in the elder time were of two kinds especially, which we may call courtly and sacred. The courtly were the feasts held at the creation, giving of robes, arms, spurs, and the like, whence in the stories of other nations so in those of ours 'armis militibus donare' or 'cingulo militari,' and such more phrases are the same with 'militem facere' or to make a knight. The sacred were the holy devotions and

¹ Sainte Palaye, *Mémoires*, vol. i. p. 11 sq.—"C'est peut-être à cette cérémonie et non à celles de la chevalerie qu'on doit rapporter ce qui se lit dans nos historiens de la première et de la seconde race au sujet des premières armes que les Rois et les Princes remettoient aux seigneurs ou jeunes Princes leurs enfants."
² There are several obscure points as to the relation of the longer and shorter ceremonies, as well as the origin and original relation of their several parts. There is nothing to show whence came "dubbing," or the "accolade." It seems certain that the word "dub" means to strike, and the usage is as old as the knighting of Henry by William the Conqueror (*supra*, pp. 111, 112). So, too, in the empire a dubbed knight is "ritter geschlagen." The "accolade" may etymologically refer to the embrace, accompanied by a blow with the hand, characteristic of the longer form of knighting. The derivation of "adonbuer," corresponding to "dub," from "adonbare," which is given by Du Cange, and would connect the ceremony with "adoption per arma," is certainly inaccurate. The investiture with arms, which formed a part of the longer form of knighting, and which we have seen to exist on very ancient usage, may originally have had a distinct meaning. We have observed that Laurence invested Henry I. with arms, while William "dubbed him to ride." If there was a difference in the meaning of the two ceremonies, the difficulty as to the knighting of Earl Harold (*supra*, p. 112) is at least partly removed.
³ *Titles of Honor*, p. 465; *ibid.*, p. 385.
⁴ Segar, *Honor Civil and Military*, p. 74.
⁵ Nicolson, *British Orders of Knighthood*, p. vii.

what else was used in the church at or before the receiving of the dignity, whence also 'consecrare militem' was to make a knight. Those of the first kind are various in the memories that preserve them, and yet they were rarely or never without the girding with a sword until in the later ages wherein only the stroke on the neck or shoulder according to the use at this day hath most commonly supplied it.¹ Of these "ceremonies and circumstances" Selden gives several examples, especially those of the knightings of Geoffrey of Anjou by Henry I., of Alexander III. of Scotland by Henry III. of England, and of Edward Prince of Wales (afterwards Edward II.) by his father Edward I. But the leading authority on the subject is an ancient tract written in French, which will be found at length either in the original or translated by Sagar, Dugdale, Byshe, and Nicols, among other English writers.² Daniel explains his reasons for transcribing it, "tant à cause du détail que de la naïveté du stile et encore plus de la barbarie des ceremonies que se faisoient pource lors fort serieusement," while he adds that these ceremonies were essentially identical in England, France, Germany, Spain, and Italy.

The process of inauguration was commenced in the evening by the placing of the candidate under the care of two "seignours of honour grave and well seen in courtship and nurture and also in the feats of olivier," who were to be "governors in all things relating to him." Under their direction, to begin with, a barber shaved him and cut his hair. He was then conducted by them to his appointed chamber, where a bath was prepared hung within and without with linen and covered with rich cloths, into which after they had undressed him he entered. While he was in the bath two "ancient and grave knights" attended him "to inform, instruct, and counsel him touching the order and feats of olivier," and when they had fulfilled their mission they poured some of the water of the bath over his shoulders, signing the left shoulder with the cross, and retired.³ He was then taken from the bath and put into a plain bed without hangings, in which he remained until his body was dry, when the two esquires put on him a white shirt and over that "a robe of russet with long sleeves having a hood thereto like unto that of an hermit." Then the "two ancient and grave knights" returned with him to the hall, the esquires going before them "sporting and dancing" with "the minstrels making melody." And when they had been served with wines and spiced they went away leaving only the candidate, the esquires, "the priest, the chandler, and the watch" who kept the vigil of arms until sunrise, the candidate passing the night "bestowing himself in orations and prayers." At daybreak he confessed to the priest, heard matins, and communicated in the mass, offering a taper and a piece of money stuck in as he near the lighted and as possible, the first "to the honour of God" and the second "to the honour of the person that makes him a knight." Afterwards he was taken back to his chamber, and remained in bed until the knights, esquires,

and minstrels went to him and aroused him. The knights then dressed him in distinctive garments, and they then mounted their horses and rode to the hall where the candidate was to receive knighthood, his future squire was to ride before him bareheaded bearing his sword by the point in its scabbard with his spurs hanging from his left. And when everything was prepared the prince or subject who was to knight him came into the hall, and, the candidate's sword and spurs having been presented to him, he delivered the right spur to the "most noble and gentle" knight present, and directed him to fasten it on the candidate's right heel, which he kneeling on one knee and putting the candidate's right foot on his knee accordingly did, signing the candidate's knee with the cross, and in like manner by another "noble and gentle" knight the left spur was fastened to his left heel. And then he who was to create the knight took the sword and girded him with it, and then embracing him he lifted his right hand and smote him on the neck or shoulder, saying, "Be thou a good knight," and kissed him. When thus was done they all went to the chapel with much merriment, and the new knight laying his right hand on the altar promised to support and defend the church, and upgirding his sword offered it on the altar. And as he came out from the chapel the master cook awaited him at the door and claimed his spurs as his fee, and said, "If you do anything contrary to the order of chivalry (which God forbid), I shall knock the spurs from your heels."

As may be gathered from Selden, Fyryn, La Colombiers, Menestrier, and Sainte Palays, there were several differences of detail in the ceremony at different times and in different places. But in the main it was everywhere the same both in its military and its ecclesiastical elements. In the *Pontificals Romanum*, the old *Ordo Romanus*, and the manual or Common Prayer Book in use in England before the Reformation forms for the blessing or consecration of new knights are included, and of these the first and the last are quoted by Selden.⁴ But the full solemnities for conferring knighthood seem to have been so largely and so early superseded by the practice of dubbing or giving the accolade alone that in England it became at last restricted to such knights as were made at coronations and some other occasions of state. And to them the particular name of knights of the bath was assigned, while knights made in the ordinary way were called in distinction from them knights of the sword, as they were also called knights bachelors in distinction from knights banneret.⁵ It is usually supposed that the first creation of Knights of the Bath under that designation was at the coronation of Henry IV.; and before the Order of the Bath as a companionship or cephalic body was instituted the last creation of them was at the coronation of Charles II. But all knights were also knights of the spur or "equites aurati," because their spurs were golden or gilt,—the spurs of esquires being of silver or white metal,—and these became their peculiar badge in popular estimation and proverbial speech. In the form of their solemn inauguration too, as we have noticed, the spurs together with the sword were always employed as the leading and most characteristic emblems of knighthood.⁶

With regard to knights banneret various opinions have been entertained as to both the nature of their dignity and the qualifications they were required to possess for receiving it at different periods and in different countries. On the Continent the distinction which is commonly but incorrectly made by us between the nobility and the gentry has never arisen, and it was unknown here while olivier existed and heraldry was understood. Here, as elsewhere in the old time, a nobleman and a gentleman meant the

¹ Selden, *Titles of Honor*, p. 639.

² Daniel, *Histoire de la Milice Française*, vol. 1. pp. 99-104; Byshe's Upton, *De Studio Militari*, pp. 21-24; Dugdale, *Warwickshire*, vol. II. pp. 708-710; Sagar, *Honor Civil and Military*, p. 69 sq.; and Nicols, *Orders of Knighthood*, vol. II. (*Order of the Bath*), p. 19 sq. It is given as "the order and manner of creating Knights of the Bath in time of peace according to the custom of England," and consequently dates from a period when the full ceremony of creating knights bachelors generally had gone out of fashion. But as Ashmole, speaking of Knights of the Bath, says, "If the ceremonies and circumstances of their creation be well considered, it will appear that this king [Henry IV.] did not institute but rather restore the ancient manner of making knights, and consequently that the Knights of the Bath are in truth no other than knights bachelors, that is to say, such as are created with those ceremonies wherewith knights bachelors were formerly created" (Ashmole, *Order of the Garter*, p. 16). It is singular that Dugdale in his translation of this ancient formulary has accidentally omitted the actual dubbing or accolade. See also Selden, *Titles of Honor*, p. 678; and the *Archæological Journal*, vol. v. p. 258 sq.

³ In another formulary in the Cotton MSS. (Tib. B. vii. f. 72), which is printed in full in the *Archæological Journal*, vol. v. p. 267 sq., the shoulders of the candidate are to be signed with the sign of the cross, and in still another formulary among the Astley MSS. the cross was to be signed on the candidate's left shoulder only by the senior of the ancient and grave knights "in nomine patris," &c. In both, however, the cross is to be kissed by the officiating knight after he had signed it with the water.

⁴ *Titles of Honor*, pp. 369 and 648. See also p. 367 for the ceremonies observed at the knightings of William, count of Holland, when he was elected king of the Romans in 1247, and Selden's remarks and authorities with respect to the descent from the ancient form of investiture with arms in the east.

⁵ Selden, *Titles of Honor*, p. 678; Ashmole, *Order of the Garter*, p. 16; Fyryn, *Traktat d'Ordonnance*, vol. II. p. 1038.

⁶ "If we sum up the principal emblems of knighthood, ancient and modern, we shall find they have been or are a horse, gold ring, shield and lance, a belt and sword, gilt spurs, and a gold chain or collar"—Ashmole, *Order of the Garter*, pp. 12, 13.

same thing, namely, a man who under certain conditions of descent was entitled to armorial bearings. Hence Du Cange divides the medieval nobility of France and Spain into three classes:—first, barons or *ricos hombres*; secondly, chevaliers or caballeros; and thirdly, écuyers or infanzons, and to the first, who with their several special titles constituted the greater nobility of either country, he limits the designation of banneret and the right of leading their followers to under a banner, otherwise a "drapeau carré" or square flag.¹ Selden mentions as an instance of "the nearness and sometimes community of the title of banneret and baron" the "bannerier" or "dominus vexillifer" of the empire. And he also shows especially from the parliament rolls that the term banneret has been occasionally employed in England as equivalent to baron, where, for example, in the reign of Richard II. among "divers other earls and barons there mentioned by name" "plusieurs autres barons et bannerets estants an dit parlement assemblez" are referred to.² In Scotland even as late as the reign of James VI., lords of parliament were always created bannerets as well as barons at their investiture, "part of the ceremony consisting in the display of a banner, and such 'barones majores' were thereby entitled to the privilege of having one borne by a retainer before them to the field of a quadrilateral form."³ In Scotland, too, lords of parliament and bannerets were also called bannerets, baronets, or baronets, and in England banneret was often corrupted to baronet. "Even in a patent passed to Sir Ralph Fane, knight under Edward VI., he is called 'baronetus' for 'banneretus'."⁴ In this manner it is not improbable that the title of baronet may have been suggested to the advisers of James I. when the Order of Baronets was originally created by him, for it was a question whether the recipients of the new dignity should be designated by that or some other name.⁵ But there is no doubt that as previously used it was merely a corrupt synonym for banneret, and not the name of any separate dignity. On the Continent, however, there are several recorded examples of bannerets who had an hereditary claim to that honour and its attendant privileges on the ground of the nature of their feudal tenure.⁶ And generally, at any rate to commence with, it seems probable that bannerets were in every country merely the more important class of feudatories, the "*ricos hombres*" in contrast to the knights bachelors, who in France in the time of St Louis were known as "*pauvres hommes*." In England all the barons or greater nobility were entitled to bear banners, and therefore Du Cange's observations would apply to them as well as to the barons or greater nobility of France and Spain. But it is clear that from a comparatively early period bannerets whose claims were founded on personal distinction rather than on feudal tenure gradually came to the front, and much the same process of substitution appears to have gone on in their case as that which we have marked in the case of simple knights. According to the *Sallade* and the *Division du Monde*, as cited by Selden, bannerets were clearly in the beginning feudal tenants of a certain magnitude and importance and nothing more, and different forms for their creation are given in time of peace and in time

of war.⁷ But in the French *Gesta Romanorum* the warlike form alone is given, and it is quoted by both Selden and Du Cange. From the latter a more modern version of it is given by Daniel as the only one generally in force. "Quand un bachelier," says the *caemonial* in question, "a grandement servi et survi la guerre et que il a terre assez et qu'il puisse avoir gentilshommes ses hommes et pour accompagner sa bannière il peut licitement lever bannière et non autrement; car nul homme ne doit lever bannière en bataille s'il n'a du moins cinquante hommes d'armes, tous ses hommes, et les archiers et les arbalétriers qui y appartiennent, et s'il les a, il doit à la première bataille ou il se trouva apporter un pennon de ses armes et doit venir an connetable ou aux maréchaux ou à celui qui sera lieutenant de l'ost pour le prince et requérir qu'il porte bannière, et s'il lui octroyent doit sommer les herauts pour temoigner et doivent couper la queue du pennon."⁸ The earliest contemporary mention of knights banneret is in France, Daniel says, in the reign of Philip Augustus, and in England, Selden says, in the reign of Edward I. But in neither case is reference made to them in such a manner as to suggest that the dignity was then regarded as new or even uncommon, and it seems pretty certain that its existence on one side could not have long preceded its existence on the other side of the Channel. Sir Alan Plokenet, Sir Ralph Danbney, and Sir Philip Danbney are entered as bannerets on the roll of the garrison of Caermarthen castle in 1282, and the roll of Carlewarock records the names and arms of eighty-five bannerets who accompanied Edward I. in his expedition into Scotland in 1300. Selden quotes some and refers to many of the wardrobe accounts of Edward II. in which contracts with and payments to bannerets are mentioned, observing that "under these bannerets divers knights bachelors and esquires usually served, and according to the number of them the bannerets received wages."⁹ What the exact contingent was which they were expected to supply to the royal host is doubtful. In the authorities collected by Selden, Du Cange, and Daniel it varies from ten and twenty-five to fifty men-at-arms with their attendants. Grose seems to prefer the medium estimate of a hundred mounted combatants in all, that number forming a square of ten in each face, and being the lowest equivalent of the more modern squadron.¹⁰ But, however this may be, in the reign of Edward III. and afterwards bannerets appear as the commanders of a military force raised by themselves and marshalled under their banners—although paid through them by the sovereign—who were moreover always persons of property and soldiers of distinction. At the same time their status and their relations both to the crown and their followers were the consequences of voluntary contract not of feudal tenure. It is from the reigns of Edward III. and Richard II. also that the two best descriptions we possess of the actual creation of a banneret have been transmitted to us. During Edward the Black Prince's expedition of 1367 into Spain, Sir John Chandos, one of the founder Knights of the Garter, was made a banneret on the morning of the day on which the battle of Navarrete was fought. When the troops were drawn up in order before the action commenced, "Sir John Chandos," says Froissart, "advanced in front of the battalions with his banner unrolled in his hand. He presented it to the prince, saying, 'My lord, here is my banner; I present it to you that I may display it in whatever manner shall be most agreeable to you; for, thanks to God, I have

¹ On the banner see Grose, *Military Antiquities*, vol. II. p. 257; and Nicolas, *British Orders of Knighthood*, vol. I. p. xxxvii.

² *Titles of Honor*, pp. 865 and 608. See also Hallam, *Middle Ages*, vol. III. p. 126 m.; and Stubbs, *Const. Hist.*, vol. III. p. 440 m.

³ Riddell's *Laws and Privileges in Scottish Peerages*, p. 578. Also Riddell's *System of Heraldry*, vol. II. p. 48; and Selden's *Titles of Honor*, p. 702.

⁴ See "Project concerning the confering of the title of vidom," wherein it is said that "the title of vidom (vidomcom) was an ancient title used in this kingdom of England both before and since the Norman Conquest" (*State Papers*, James I. Domestic Series, vol. lxiii. p. 150 B, probable date April 1611).

⁵ Selden, *Titles of Honor*, p. 452 m.

⁷ Selden, *Titles of Honor*, p. 449 m.

⁸ Du Cange, *Dissertation IX.*; Selden, *Titles of Honor*, p. 452; Daniel, *Mémoires Français*, vol. I. p. 86.

⁹ Selden, *Titles of Honor*, p. 666.

¹⁰ *Military Antiquities*, vol. II. p. 206.

now sufficient lands to enable me to do so and maintain the rank which it ought to hold.' The prince, Don Pedro, being present took the banner in his hands, which was blazoned with a sharp stake gules on a field argent, after having cut off the tail to make it square, he displayed it, and returning it to him by the handle said, 'Sir John, I return you your banner. God give you strength and honour to preserve it.' Upon this Sir John left the prince, went back to his men with the banner in his hand, and said to them, 'Gentlemen, behold my banner and yours; you will therefore guard it as it becomes you.' His companions taking the banner replied with much cheerfulness that 'if it pleased God and St George they would defend it well and act worthily of it to the utmost of their abilities.'¹ At a later period some distinction appears to have been made between bannerets who were created under the royal standard, the king himself being present with his army in open war, and bannerets who were created only by the king's lieutenants, as Sir John Chandos and Sir Thomas Trivet were created. But no such distinction seems to have existed in the reigns of Edward III. and Richard II., and, although it was doubtless of more ancient origin, the earliest contemporary evidence of its existence is the reign of James I., when bannerets whether of one or two classes had practically disappeared. Sir Thomas Smith, writing towards the end of the 16th century, says, after noticing the conditions to be observed in the creation of bannerets, 'but this order is almost grown out of use in England';² and during the controversy which arose between the new order of baronets and the crown early in the 17th century respecting their precedence³ it was alleged without contradiction in an argument on behalf of the baronets before the privy council that 'there are not bannerets now in being, peradventure never shall be.'⁴ Sir Ralph Fane, Sir Francis Bryan, and Sir Ralph Sadler were created bannerets by the Lord Protector Somerset after the battle of Pinkie in 1547, and the better opinion is that this was the last occasion on which the dignity was conferred. It has been stated indeed that Charles I. created Sir John Smith a banneret after the battle of Edgehill in 1642 for having rescued the royal standard from the enemy. But of this there is no sufficient proof. It was also supposed that George III. had created several naval officers bannerets towards the end of the last century, because he knighted them on board ship under the royal standard displayed.⁵ This, however, is unquestionably an error. Knights bannerets were not distinguished from knights bachelors merely because they were created under the standard or banner of the sovereign, but further because their own pensions were converted into or exchanged for banners.

On the Continent the degree of knight bachelor disapp-

¹ Froissart, bk. I. chap. 241. The other case is that of Sir Thomas Trivet in 1380 (Froissart, bk. II. chap. 58).

² *Compendium of English History*, p. 48, ed. 1640.

³ By the decree of 1612 on the precedence of baronets they are placed after the younger sons of viscounts and barons, who came next to "bannerets made by the sovereign in person under the royal standard and displayed in an army royal in open war," and immediately before "baronets not made by the sovereign in person," and are still so ranked in all the "Tables of Precedence" (see Saladin, *Titles of Honor*, p. 749, 750).

⁴ *State Papers, Domestic Series*, James the First, vol. lxvii. p. 118.

⁵ Thursday, June 24th: His Majesty was pleased to confer the honour of knights bachelor on the following flag officers and commanders under the royal standard, who kneeling kissed hands on the occasion: Admirals Fyfe and Sprye, Captains Knight, Bickerton, and Vernon (*Gentleman's Magazine*, vol. xliii. p. 299, 1773). Sir Harris Nicolas remarks on these and the other cases (*British Orders of Knighthood*, p. xliii.), and Sir William Fitzherbert published anonymously a pamphlet on the subject, *A Short Inquiry into the Nature of the Titles conferred at Portsmouth, &c.* which is very scarce, but is to be found under the name of "Fitzherbert" in the catalogue of the British Museum Library.

peared with the military system which had given rise to it. It is now therefore peculiar to the United Kingdom, where, although very frequently conferred by letters patent, it is yet the only dignity which is still even occasionally created—as every dignity was formerly created—by means of a ceremony in which the sovereign and the subject personally take part. Everywhere else dubbing or the accolade seems to have become obsolete, and no other species of knighthood, if knighthood it can be called, is known except that which is dependent on admission to some particular order. It is a common error to suppose that baronets are hereditary knights. Baronets are not knights unless they are knighted like anybody else; and, so far from being knights because they are baronets, one of the privileges granted to them shortly after the institution of their dignity was that they, not being knights, and their successors and their eldest sons and heirs apparent should, when they attained their majority, be entitled if they desired to receive knighthood.⁶ It is a maxim of the law indeed that, as Coke says, "the knight is by creation and not by descent," and, although we hear of such designations as the "knight of Kerry" or the "knight of Glin," they are no more than traditional nicknames, and do not by any means imply that the persons to whom they are applied are knights in a legitimate sense. Notwithstanding, however, that simple knighthood has gone out of use abroad, there are innumerable grand crosses, commanders, and companions of a formidable assortment of orders in almost every part of the world,⁷ from that of the Golden Fleece of Spain and Austria to those of St Charles of Monaco and of King Kamehameha of the Sandwich Islands. But, with the exception of the orders of the Golden Fleece founded by Philip II., duke of Burgundy, in 1429, and of the Ammannation founded by Charles III., duke of Savoy, in 1618—now that the orders of St Michael founded by Louis XI. and of the Holy Ghost founded by Henry III. of France, in 1469 and 1578, are either extinct or in abeyance—none of the foreign military as distinguished from the religious orders of knighthood have any actual historical connexion with chivalry. The orders of the Genet of France and the Oak of Navarre of course are to be classed as mere fictions with the order of the Round Table of Britain. But the pretensions of almost every other foreign order to extreme antiquity, as for example of the Elephant and Dannebrog of Denmark, the White Eagle of Poland, or the Seraphim of Sweden, if they are less obviously extravagant, are not more susceptible of verification. It has nearly always been the practice even in modern days to represent the establishment as the revival or reorganization of an order. We ourselves have seven orders of knighthood, the Garter, the Thistle, St Patrick, the Bath, the Star of India, St Michael and St George, and the Indian Empire; and, while the first is undoubtedly the oldest as well as the most illustrious anywhere existing, a fictitious antiquity has been claimed

⁶ "Sir Henry Ferrers, Baronet, was indicted by the name of Sir Henry Ferrers, Knight, for the murder of one Stone whom one Nightingale feloniously murdered, and that the said Sir Henry was present aiding and abetting, &c. Upon this indictment Sir Henry Ferrers being arraigned said he never was knighted, which being confessed, the indictment was held not to be sufficient, wherefore he was indicted *de novo* by the name of Sir Henry Ferrers, Baronet." Brydall, *Jus Imaginis apud Anglos, or the Law of England relating to the Nobility and Gentry*, p. 60, London, 1776. After the dispute between the baronets and the younger sons of viscounts and barons for precedence in 1613, it was declared by James I., among other concessions to them, that "his Majesty is pleased to knight the present baronets that are no knights," and that for the future all baronets and their eldest sons and heirs apparent should be knighted if they pleased to apply for knighthood when they came of age or were of age.—*Pointe d'Or*, 10 Jan. I., part x. No. 181, Saladin, *Titles of Honor*, p. 687.

⁷ Louis XIV. introduced the practice of dividing the military orders into several degrees when he established the order of St Louis in 1693.

and is even still frequently conceded to the second and fourth, although the third, fifth, sixth, and seventh appear to be as contentedly as they are unquestionably recent.

Order
of the
Garter.

It is, however, certain that the "most noble" Order of the Garter at least, was instituted in the middle of the 14th century, when, to use Hallam's words, the court of England "was the sun as it were of that system which embraced the valour and nobility of the Christian world," when "chivalry was in its zenith, and in all the virtues which adorned the knightly character none were so conspicuous as Edward III. and the Black Prince." But in what particular year this event occurred is and has been the subject of much difference of opinion. All the original records of the order until after 1416 have perished, and consequently the question depends for its settlement not on direct testimony but on inference from circumstances. The dates which have been selected vary from 1344 to 1351, and it is a matter of some historical interest and importance to determine so far as it is practicable which of them is probably accurate, since Dr Stubbs cites the fact of "Edward III. celebrating his great feast on the institution of the Order of the Garter in the midst of the Black Death" as a "typical illustration" of the heartlessness and want of sympathy between classes which he holds to have been characteristic of the age.¹ The Black Death made its appearance on the coast early in August 1348, reached the capital in the following November, and spreading over the country raged until the end of September 1349. Hence Dr Stubbs apparently agrees with Ashmole (who based his opinion on the preamble to the two earliest but evidently not contemporary copies of the statutes) in referring the institution of the order and the accompanying feast to St George's Day in the April of the second of these two years.² Mr Longman thinks that the order was "finally established" in 1347,³ Mr Belz contends that it was founded in 1344, as Froissart, who wrote in the reign of Edward III. and Richard II., affirms, while Sir Harris Nicolas maintains that, although it is not impossible that Edward III. may have determined to found an order of knighthood in 1344, when he invited knights of all countries to jousts at Windsor and revived the feast of the Round Table, of which Froissart speaks, yet "the details of the Order of the Garter were not settled (even if the institution itself was contemplated), the companions appointed, nor the name or ensigns established until the latter part of 1347 or early in 1348."⁴ And, without going fully into the evidence, which may be examined at length in Nicolas and Belz, it is indubitable that in the wardrobe account from September 1347 to January 1349, the 21st and 23d Edward III., the issue of certain habits with garters and the motto embroidered on them is marked for St George's Day, that similar vestments for the king and others on occasions not connected with the order are recorded as having been delivered in 1347 at the Christmas games at Guildford and the tournaments at Bury, Windsor, Lichfield, and Eatham, that the letters patent relating to the preparation of the royal chapel of Windsor are dated in August 1348, and that in the treasury accounts of the Prince of Wales there is an entry in November 1348 of the gift by him of "twenty-four garters to the knights of the Society of the Garter."⁵ But that the order, although from this manifestly already fully constituted in the

autumn of 1348, was not in existence before the summer of 1346 Sir Harris Nicolas holds on the ground that nobody who was not a knight could under its statutes have been admitted to it, and that neither the Prince of Wales nor several others of the original companions were knighted until the middle of that year. Mr Belz, following a suggestion of Anstis, had endeavoured to overcome this difficulty by assuming that the Black Prince had been knighted in his infancy, and that he was made a banneret at the age of fifteen. But, although it was not unusual for the sons of sovereigns and great feudatories to be knighted when they were children, and even at their baptism, it is beyond question, as Sir Harris Nicolas points out, that in England only commoners could be formally created bannerets. All knights of or above the rank of a baron were at once entitled to bear their banners in the field. And that the Prince of Wales was knighted on the landing of Edward III.'s expedition against France at La Hogue in July 1346 there can be no doubt. It seems pretty clear, however, that the Order of the Garter was instituted and the great feast celebrated, not in the midst of the Black Death, but at any rate some months before its ravages commenced. Regarding the occasion there has been almost as much controversy as regarding the date of its foundation. The "vulgar and more general story," as Ashmole calls it, is that of the countess of Salisbury's garter. But commentators are not at one as to which countess of Salisbury was the heroine of the adventure, whether she was Katherine Montacute or Joan the Fair Maid of Kent, while Haylyn rejects the legend as "a vain and idle romance derogatory both to the founder and the order, first published by Polydore Vergil, a stranger to the affairs of England, and by him taken upon no better ground than *fama vulgi*, the tradition of the common people, too trifling a foundation for so great a building," and Anstis says that "it is now no more credited than the absurd, ridiculous relation of Micheli Marqnez that this order, termed from the Greek language *Periokheidis Ordo*, was erected to the memory of one Periokheidis, a true fairy queen, or the whimsical dream of Mr Joshua Barnes in his far-fetched derivation of it from the Cabiri among the Samothracians."⁶ Ashmole, however, while denying that any such accident became the principal cause of creating the order, will not altogether repudiate the allegation that "the king may have picked up a garter at some solemn ball or festivity,"—the queen's garter, as some have said,—while she and not he made use of the memorable words "*Honi soit qui mal y pense*."⁷ Another legend is that contained in the preface to the Register or Black Book of the order, compiled in the reign of Henry VIII., by what authority supported as unknown, that Richard I., while his forces were employed against Cyprus and Acre, had been inspired through the instrumentality of St George with renewed courage and the means of animating his fatigued soldiers by the device of tying about the legs of a chosen number of knights a leathern thong or garter, to the end that being thereby reminded of the honour of their enterprise they might be encouraged to redoubled efforts for victory. This was supposed to have been in the mind of Edward III when he fixed on the garter as the emblem of the order, and it was stated so to have been by Taylor, master of the rolls, in his address to Francis I. of France on his investiture in 1527.⁸ According to Ashmole the true account of the matter is that, "King Edward having given forth his own garter as the signal for a battle which sped fortunately (which wish Dr Chenevix we conceive to be that of Cressy, fought almost three years after the setting

¹ *Const. Hist.*, vol. ii. p. 524.

² Ashmole, *Order of the Garter*, p. 187; Anstis, *Order of the Garter*, vol. i. p. 92. Saladin, in the first edition of *Notes of Henry*, gives 1347, and in the last edition 1344. Barnes in his *Life of Edward III.*, and Belz in his *Memorials*, p. xxx., collect the various older authorities.

³ *Life of Edward III.*, vol. i. p. 298.

⁴ *Order of Knighthood*, vol. i. p. lxxi. and pp. 8-16.

⁵ *Belz's Memorials*, p. 383.

⁶ Haylyn, *Genealogical and History of the Whole World*, book i.

⁷ p. 286; Anstis, *Order of the Garter*, vol. i. p. 62.

⁸ *Order of the Garter*, p. 182.

⁹ *Belz's Memorials*, p. xlv.

up of the Round Table at Windsor, rather than with the author of the 'Nouveau Théâtre du Monde' that of Poitiers, which happened about seven years after the foundation of the order and whereat King Edward was not present), the victory, we say, being happily gained, he thence took occasion to institute this order, and gave the garter (assumed by him for the symbol of unity and society) pre-eminence among the ensigns of it, whence that select number whom he incorporated into a fraternity are frequently styled 'équites aures periscelides' and vulgarly knights of the garter."¹ Ashmole and Belz also see in the order a reference to the king's French claims, and remark that the colour of the garter is the tincture of the field of the French arms. But, as Sir Harris Nicolas points out,—although Ashmole is not open to the correction,—this hypothesis rests for its plausibility on the assumption that the order was established before the invasion of France in 1346. And he further observes that "a great variety of devices and mottoes were used by Edward III., they were chosen from the most trivial sources and were of an amorous rather than of a military character. Nothing," he adds, "is more likely than that in a crowded assembly a lady should accidentally have dropped her garter; that the circumstance should have caused a smile in the bystanders, and that on its being taken up by Edward he should have reproved the levity of his courtiers by so happy and chivalrous an exclamation, placing the garter at the same time on his own knee, as 'Dishonoured be he who thinks ill of it.' Such a circumstance occurring at a time of general festivity, when devices, mottoes, and conceits of all kinds were adopted as ornate or badges of the habits worn at jousts and tournaments, would naturally have been commemorated as other royal expressions seem to have been by its conversion into a device and motto for the dresses at an approaching hastilude."² Moreover, Sir Harris Nicolas contends that the order had no loftier immediate origin than a joust or tournament. It consisted of the king and the Black Prince, and twenty-four knights divided into two bands of twelve like the tilsters in a hastilude—at the head of the one being the first, and of the other the second; and to the companions belonging to each, when the order had superseded the Round Table and had become a permanent institution, were assigned stalls either on the sovereign's or the prince's side of St George's Chapel. That Sir Harris Nicolas is accurate in this conjecture seems probable from the selection which was made of the "founder knights." As Mr Belz observes, the fame of Sir Reginald Cobham, Sir Walter Manny, and the earls of Northampton, Hereford, and Suffolk was already established by their warlike exploits, and they would certainly have been among the original companions had the order been then regarded as the reward of military merit only. But, although these eminent warriors were subsequently elected as vacancies occurred, their admission was postponed to that of several very young and in actual warfare competitively unknown knights, whose claims to the honour may be most rationally explained on the assumption that they had exalted in the particular feats of arms which preceded the institution of the order. The order was dedicated to St George of Cappadocia and St Edward the Confessor, and its feast or solemn annual convention was kept at Windsor on St George's Day, the 23d of April, with little interruption from the reign of Edward III. to the reign of Queen Elizabeth. But a few years after the Restoration the celebration was altogether discontinued. The original companionship had consisted of the sovereign and twenty-five knights, and no change was made in this respect until 1786, when the sons of George III. and his

successors were made eligible notwithstanding that the chapter might be complete. In 1805 another alteration was effected by the provision that the lineal descendants of George II. should be eligible in the same manner, except the Prince of Wales for the time being, who was declared to be "a constituent part of the original institution"; and again in 1831 it was further ordained that the privilege accorded to the lineal descendants of George II. should extend to the lineal descendants of George I. The power of making and modifying the statutes of the order as exemplified in these innovations had from the beginning belonged to the whole fraternity, and it was only in the reign of Charles II. that it was surrendered to the sovereign. But the knights still continued at any rate formally to elect their companions, and the gorgeous and elaborate ceremonies of installation were still regarded as requisite to the full reception of knights elect. Since the beginning of the reign of George III., however, both chapters and installations became more and more occasional, and it is now the established custom for the sovereign altogether to dispense with them. Although, as Sir Harris Nicolas observes, nothing is now known of the form of admitting ladies into the order, the description applied to them in the records during the 14th and 15th centuries leaves no doubt that they were regularly received into it. The queen consort, the wives and daughters of knights, and some other women of exalted position, were designated "Dames de la Fraternité de St George," and entries of the delivery of robes and garters to them are found at intervals in the Wardrobe Accounts from the 50th Edward III. (1376) to the 10th of Henry VII. (1495), the first being Isabel, countess of Bedford, the daughter of the one king, and the last being Margaret and Elizabeth, the daughters of the other king. The effigies of Margaret Byron, wife of Sir Robert Harcourt, K.G., at Stanton Harcourt, and of Alice Chaucer, wife of William de la Pole, duke of Suffolk, K.G., at Ewelme, which date from the reigns of Henry VI. and Edward IV., have garters on their left arms. At a chapter in 1637 an attempt was made to revive the practice of issuing the ensigns of the order to ladies. Sir James Palmer, acting as deputy for Sir Thomas Rowe, the chancellor of the order, moved the sovereign that the wives of the knights companions might have the privilege of wearing "a garter of the order about their arms and an upper robe at festival times, according to ancient usage." The matter was referred by Charles I. to the queen, and another chapter was appointed for the purpose of taking it into final consideration. But owing to the civil war nothing further was done in the matter. At present the officers of the order are five—the prelate, chancellor, register, king of arms, and usher—the first, third, and fifth having been attached to it from the commencement, while the fourth was added by Henry V. and the second by Edward IV. The prelate has always been the bishop of Winchester; the chancellor was formerly the bishop of Salisbury, but is now the bishop of Oxford; the registership and the deanery of Windsor have been united since the reign of Charles I.; the king of arms, whose duties were in the beginning discharged by Windsor herald is garter principal king of arms; and the usher is the gentleman usher of the Black Rod.

The other orders of knighthood subsisting in the British empire must be spoken of more briefly. The "most ancient" Order of the Thistle was founded by James II. in 1687, and dedicated to St Andrew. It consisted of the sovereign and eight knights companions, and fell into abeyance at the Revolution of 1688. In 1708 it was revived by Queen Anne, when it was ordained to consist of the sovereign and twelve knights companions, the number being increased to sixteen by statute in 1827. The "most illustrious" Order

¹ *Order of the Garter*, p. 189.

² *Orders of Knighthood*, vol. i. p. xxxiii.

of St Patrick was instituted by George III. in 1788, to consist of the sovereign, the lord lieutenant of Ireland as grand master, and fifteen knights companions, enlarged to twenty-two in 1833. The "most honourable" Order of the Bath was established by George I. in 1726, to consist of the sovereign, a grand master, and thirty-six knights companions. This was a pretended revival of an order supposed to have been created by Henry IV. at his coronation in 1393. But, as we have before shown, no such order existed. Knights of the Bath, although they were allowed precedence before knights bachelors, were rarely knights bachelors who were knighted with more elaborate ceremonies than others and on certain great occasions. After the so called revival the grand mastership merged in the crown on the death of John, duke of Montagu, the first tenant of the office in 1749, and in 1816 and again in 1847 the constitution of the order was remodelled. Exclusive of the sovereign, royal princes, and distinguished foreigners, it is limited to fifty military and twenty-five civil knights grand crosses, one hundred and twenty-three military and eighty civil knights commanders, and six hundred and twenty military and two hundred and fifty civil companions. The "most distinguished" Order of St Michael and St George was founded by the prince regent, afterwards George IV., in 1818, in commemoration of the British protectorate of the Ionian Islands, "for natives of the Ionian Islands and of the island of Malta and its dependencies, and for such other subjects of his majesty as may hold high and confidential situations in the Mediterranean." By statute of 1832 the lord high commissioner of the Ionian Islands was to be the grand master, and the order was directed to consist of fifteen knights grand crosses, twenty knights commanders, and twenty-five cavaliers or companions. After the repudiation of the British protectorate of the Ionian Islands, the order was placed on a new basis, and by letters patent of 1868 and 1877 it was extended and provided for such "the natural born subjects of the crown of the United Kingdom as may have held or shall hold high and confidential offices within her Majesty's colonial possessions, and in reward for services rendered to the crown in relation to the foreign affairs of the empire." It is now limited to fifty knights grand crosses, of whom the first or principal is grand master, exclusive of extra and honorary members, of one hundred and fifty knights companions, and two hundred and sixty companions. It ranks between the "most exalted" Order of the Star of India and the Order of the Indian Empire, of both of which the viceroy of India for the time being is *ex officio* grand master. Of these the first was instituted in 1861 and enlarged in 1876, and the second was established in 1878 in commemoration of the Queen's assumption of the imperial style and title of the empress of India. Of the Star of India there may be thirty knights grand commanders, seventy-two knights commanders, and one hundred and fifty-four companions, while of the Indian Empire there may be an unlimited number of companions, among whom the councillors of her majesty for her Indian empire are included by virtue of their office and for life.

Persons empowered to confer knight-hood.

It has been the general opinion, as expressed by Sainte Palaye and Mills, that formerly all knights were qualified to confer knight-hood.¹ But it may be questioned whether the privilege was thus indiscriminately enjoyed even in the earlier days of chivalry. It is true that as much might be inferred from the testimony of the romance writers; historical evidence, however, tends to limit the proposition, and the sounder conclusion appears to be, as Sir Harris Nicolas says, that the right was always restricted in opera-

tion to sovereign princes, to those acting under their authority or sanction, and to a few other personages of exalted rank and station.² In several of the writs for distraint of knight-hood from Henry III. to Edward III. a distinction is drawn between those who are to be knighted by the king himself or by the sheriffs of counties respectively, and we have seen that bishops and abbots could make knights in the 11th and 12th centuries.³ At all periods the commanders of the royal armies had the power of conferring knight-hood; as late as the reign of Elizabeth it was exercised among others by Sir Henry Sidney in 1583, and Robert, earl of Essex, in 1585, while under James I. an ordinance of 1622, confirmed by a proclamation of 1623, for the registration of knights in the college of arms, is rendered applicable to all who should receive knight-hood from either the king or any of his lieutenants.⁴ Many sovereigns, too, both of England and of France, have been knighted after their accession to the throne by their own subjects, as, for instance, Edward III. by Henry, earl of Lancaster, Edward VI. by the Lord Protector Somerset, Louis IX. by Philip, duke of Burgundy, and Francis I. by the Chevalier Bayard. But when in 1643 Henry VIII. appointed Sir John Wallop to be captain of Guisnes, it was considered necessary that he should be authorized in express terms to confer knight-hood, which was also done by Edward VI. in his own case when he received knight-hood from the duke of Somerset.⁵ In like manner Henry, earl of Arundel, under special commission from the queen, created the Knights of the Bath and other knights at the coronation of Elizabeth in 1559, and in the patent from James II. nominating Christopher, duke of Albemarle, governor of Jamaica in 1686 he is empowered to confer knight-hood on any persons "not exceeding six in number within the said island whom he may think deserving of the same in the king's service."⁶ But at present the only subject to whom the right of conferring knight-hood belongs is the lord-lieutenant of Ireland, and to him it belongs merely by long usage and established custom. It was called in question in 1821 by the Lords of the Admiralty on the occasion of Earl Talbot knighting Sir John Phillimore, a captain in the navy, and the point, having been submitted to the law officers of the crown in England and Ireland, was the subject of contradictory opinions from them. In 1823, however, it was referred by order in council to the English judges, who unanimously reported in favour of the lord-lieutenant of Ireland's claims.⁷ But, by whomsoever conferred, knight-hood at one time endowed the recipient with the same status and attributes in every country wherein chivalry was recognized. In the Middle Ages it was a common practice for sovereigns and princes to dub each other knights much as they were afterwards, and are now, in the habit of exchanging the stars and ribbons of their orders. Henry II. was knighted by his great-uncle David I. of Scotland, Alexander III. of Scotland by Henry III., Edward I. when he was prince by Alphonso X. of Castile, and Ferdinand of Portugal by Edmund of Langley, earl of Cambridge.⁸ And, long after the military importance of knight-hood had practically disappeared, what may be called its cosmopolitan character was maintained. Writing in the 17th century, Mr Justice Doddridge lays it down as a principle of law in which he is supported by all the older

¹ *Orders of Knight-hood*, vol. i. p. xi.

² Belden, *Tales of Honor*, p. 538.

³ *Hutton MS. 6088*, *Hargrave MS. 825*.

⁴ *Patent Rolls*, 35th Hen. VIII., part xvi., No. 24; *Barnet, Hist. of Reformation*, vol. i. p. 15.

⁵ *Rymer, Fœdera*, vol. xv. p. 497; *Patent Rolls*, 4th Jac. II., part vi., No. 20.

⁶ *Nicolas, Orders of Knight-hood*, vol. i. p. xiv.

⁷ *Spelman, "De Militie Dissertation," Posthumous Works*, p. 181.

⁸ *Alfonso*, vol. i. p. 67, vol. i. p. 23; *History of Chivalry*; *Gibson, Decline and Fall*, vol. vii. p. 306.

authorities that "the highest and the lowest dignities are universal, for if the king of a foreign nation come into England by leave of the king of this realm (as it ought to be), in this case he shall sue and be sued by the name of a king, so shall he sue and be sued by the name of a knight whosoever he received that degree of dignity, but otherwise it is as of a duke, marquess, earl, or other title of honour given by any foreign king."¹ The well-known story told by Camden about Queen Elizabeth and Sir Thomas Arundel afterwards Lord Arundel of Wardour, and her disinclination that "her sheep should bear a stranger's mark," and "dance after the whistle of every foreigner," had reference to a countship of the empire, and not to knighthood or an order of chivalry. Even to the end of the last century indeed any knight duly dubbed abroad was fully accepted as a knight in England. Hence when in 1793, at the request of the king of Sweden, George III. invested Sir Sidney Smith with the grand cross and collar of the Swedish Order of the Sword, it was expressly announced that he "was not knighted on this occasion, that ceremony having been performed by his late Swedish majesty."² By certain regulations, however, made in 1823, and repeated and enlarged in 1865, not only is it provided that the sovereign's permission by royal warrant shall be necessary for the reception by a British subject of any foreign order of knighthood, but further that such permission shall not authorize "the assumption of any style, appellation, rank, precedence, or privilege appertaining to a knight bachelor of the United Kingdom." Moreover, no permission of the kind will be granted "unless the foreign order shall have been conferred in consequence of active and distinguished service before the enemy either at sea or in the field," or unless the person receiving it shall have been "actually and entirely" employed beyond the British dominions "in the service of the foreign sovereign by whom the order is conferred."³

Since knighthood was accorded either by actual investiture or its equivalent, a counter process of degradation was regarded as necessary for the purpose of depriving anybody who had once received it of the rank and condition it implied. And in this respect there can be no doubt that the order of chivalry was designedly assimilated to the order of priesthood.⁴ Hence, as Selden points out, "as by the canon laws the ceremony of degradation from any degree of any order is by the solemn taking away those things from the clerk wherewith he was so invested at his taking the order from which he is to be degraded, so the ceremonies of degradation of a knight were in ancient times such as that the sword with which he was girt at his knighting and the spurs that were put on him were to be publicly taken off from him, and some other solemnities were sometimes in it."⁵ The cases in which a knight has been formally degraded in England are exceedingly few, so few indeed that two only are mentioned by Segar, writing in 1602, and Dallaway says that only three were on record in the College of Arms when he wrote in 1793. But in illustration of the statement of Coke that "when a knight is degraded one of his punishments is 'quod clypeus suus gentilicis reversus erit,' and how his arms be reversed that he beareth none," Sir Harris Nicolas states that in an illuminated copy of Matthew Paris's *Historia Major*, among the royal manuscripts in the British Museum, there is a representation of Sir William de Marisco, who was convicted of treason in the reign of Henry III., with his sword and

the staff of his banner broken and his shield hewn asunder.⁶ With this exception, however, the earliest known example of degradation from knighthood is that of Sir Andrew Barclay, who was created earl of Carlisle by Edward II., and was attainted of high treason in the year following his creation. He was tried and condemned at Carlisle in 1323 by special commission under Edmund of Woodstock, earl of Kent, the king's half-brother. A part of his sentence, as preserved in the record, was in the following words "que vous soiez degradez, que vous perdoiez nonn de count pur vous et pur vous heirs a tous jours que vous soiez deceynt del espie que vous esporeus d'orrees soient conpez de talours," which having been done, according to Holingshead, Sir Anthony Lucy, the sheriff of Cumberland, said to him, "Andrew, thou art no knight, but thou art a knave," when judgment for treason was pronounced on him, and he was immediately beheaded.⁷ The next case was that of Sir Ralph Grey, which occurred in the reign of Edward IV. He was tried and convicted of treason, before John Tiptoft, earl of Worcester, constable of England in 1468, but the sentence as preserved by Stowe seems to indicate that the ceremonies of degradation were to be remitted.⁸ The last case was that of Sir Francis Michall in 1621, whose spurs were hacked from his heels, his sword belt cut, and his sword broken over his head by the heralds in Westminster Hall.⁹ The ceremony of degrading a knight who is a companion of an order which as a capital body has a chapel assigned to it applies to his achievements therein displayed more markedly than to him in person. On the degradation of a Knight of the Garter, indeed, a deputation of the companions are (Ashmole says) to go to him, attended by Garter King of arms, who "in a solemn manner first takes from him his George and riband and then his garter."¹⁰ But the principal observances are that his banner, helm, and armorial plate are torn down from above and from off his stall by the officers of arms, and are by them spurned or kicked out of the building.¹¹ From the Order of the Garter William Lord Paget, who was subsequently reinstated, was degraded in 1562, "chiefly," according to the diary of Edward VI., "because he was no gentleman of blood neither of father's side or mother's side."¹² The degradation in due form of James, duke of Monmouth, and of James, duke of Ormond, for treason occurred severally in 1685 and 1716. Thomas Lord Cochrane and Sir Eyre Cooto were similarly degraded from the Order of the Bath in 1814 and 1816. But in all these cases the knights retained their knighthood, although they were expelled from the orders to which they had belonged.

Roughly speaking, the age of chivalry properly so called Decline may be said to have extended from the beginning of the crusades to the end of the Wars of the Roses. Within the limits of that period, which comprised about four hundred years, all that was peculiarly characteristic of it arose, attained to maturity, and fell into decay. It is true that some of its spirit and many of its external forms lingered on throughout the greater part of the 16th century. But the chivalry of Francis I. and Charles V. bore much the same relation to the obivary of Edward III. and the Black Prince that the romances of Don Quixote bears to the romance of Amadis de Gaul. As a practical military system chivalry was entirely at an end. The revol-

¹ Nicolas, *British Orders of Knighthood*, p. xxvii.

² Selden, *Titles of Honor*, p. 654.

³ Nicolas, *Orders of Knighthood*, p. xxvii; Selden, *Titles of Honor*, p. 655.

⁴ Dallaway's *Heraldry*, p. 803.

⁵ *Order of the Garter*, p. 631.

⁶ *Lives of Nobility*, p. 120.

⁷ *London Gazette*, May 19, 1792.

⁸ *London Gazette*, December 6, 1828, and May 18, 1856.

⁹ On the Continent very elaborate ceremonies, partly heraldic and partly religious, were observed in the degradation of a knight, which are described by Sainte Palaye, *Memoires*, vol. i. p. 316 sq., and after him by Mills, *History of Chivalry*, vol. i. p. 80 sq.

¹⁰ *Notes of Honor*, p. 668.

¹¹ Warrants for taking down the achievements and for the degradation of John Dugles, duke of Northumberland, and Edward Stafford, duke of Buckingham, are given by Ashmole, *Appendix* xxxviii. and xxxix.

¹² Selden, *Memoriale*, p. xxi.

tion in the mode of warfare which had commenced under Edward III. was completed under Henry VIII., and it was on their infantry and artillery rather than on their cavalry that commanders had come principally to rely. Knights still disported themselves in the lists as bravely and gallantly as of old, but neither their arms nor their armour availed them aught against the cannon and muskets they were compelled to encounter in the field. And even in the way of pageantry and martial exercise chivalry was not destined to be of long continuance. In England tilts and tournaments, in which her father had so much excelled, were patronised to the last by Queen Elizabeth, and were even occasionally held until after the death of Henry, Prince of Wales. But on the Continent the Comte de Montgomerie's lance proved as fatal to them as it did to the French king Henry at Paris. By that time, however, chivalry had ceased to exist as a social institution as well as a military régime. Its standard of conduct, the code of honour, indeed remained as it in some measure still remains, the test of propriety and the guide of manners in the higher ranks of society all over Europe. But the order of knighthood as an order formally and particularly dedicated to the service of "God and the Ladies,"—"I blush," says Gibbon, "to unite such discordant names,"—and bound by solemn and express engagements to vindicate justice, to avenge wrong, and to defend the weak, the unprotected, and the oppressed, had disappeared. It was under this shape, however, that chivalry manifested itself during the earlier and more vigorous stages of its development, and played its part among the chief and certainly among the most remarkable of those influences which moulded the form and directed the course of Western civilization in mediæval times. The common offspring of feudalism and the church, it derived its resources and its sanctions from each of its parents in turn, and stood forth as at once the spiritual representative of the one and the temporal representative of the other. Whatever may have been its inherent vices and defects, it is at any rate indisputable that it embodied some of the noblest sentiments and engendered many of the worthiest actions of contemporary mankind. It animated poetry and art; it created romance and heraldry; it determined individual ethics, modified the policy of states, and generally inspired the energies while it controlled the destinies of all those nations, especially England and France, which were then as they now are the most enlightened as well as the most powerful in the world. Under ecclesiastical teaching war came to be regarded from a judicial standpoint as, to use the words of Bacon, "the highest trial of right when princes and states that acknowledge no superior on earth shall put themselves upon the justice of God for the deciding of their controversies by such success as it please Him to give on either side."¹ Battles were commenced with religious celebrations, and armies esteemed themselves happy if they marched beneath a consecrated standard. Even in the field and while engaged in mortal conflict Christian knights acknowledged the duties and courtesies of their order. And if they were taken prisoner they could count on consideration from their captors, and on their freedom when they paid their stipulated ransom. Moreover, when they took prisoners they knew that they could safely release them on parole to raise their ransom, and that they would return to captivity if their ransom could not be raised.² It is indeed from the customs of chivalry that the best and most humane portions of the laws of war in so far as actual combatants are concerned have their origin. But

war, although it was the principal, was not the exclusive or the continuous occupation of mediæval knighthood. When not in the camp the home of the knight was in the court or the castle, and it was there that his prowess in the past campaign or present tournament was rewarded, often it might be rather generously than discreetly by the ladies in whose cause he was partly enrolled. Hence, although at no period were women held in greater outward respect by men, it is probable that at no period did more licence in the association of the sexes prevail, and it is a strange comment on the manners of the times that the single word "gallantry" should have grown to signify both bravery and illicit love.³ But, if chastity was not among the cardinal virtues of chivalry, the catalogue of them included valour, loyalty, courtesy, and munificence; and, had they been practised with the zeal with which they were inculcated, they would have gone far towards redeeming the dissoluteness of private manners with which they were connected. Valour was of course the primary qualification of a knight, and the imputation of cowardice the most damaging that could be cast upon him. But loyalty, which implied the strictest fidelity to all his engagements to his sovereign or lord, his "lady-love," and his friends and foes alike, was only second to it in importance. Next came courtesy, which meant not only ceremonious politeness but also spontaneous modesty of carriage, self-denial, and careful respect for the feelings of others. And last came munificence, a disdain for money, readiness to relieve want and reward services, hospitality, and liberality in all things. In a celebrated passage Burke describes chivalry as "the unbought grace of life, the cheap defence of nations, the nurse of manly sentiment and heroic enterprise." "Never never more," he says, "shall we behold that generous loyalty to rank and sex, that proud submission, that dignified obedience, that subordination of the heart which kept alive even in servitude itself the spirit of an exalted freedom;" and, he adds, "that sensibility of principle, that chastity of honour which felt a stain like a wound, which inspired courage whilst it mitigated ferocity, which ennobled whatever it touched, and under which vice itself lost half its evil by losing all its grossness."⁴ A very different estimate of chivalry is expressed by Mr. Freeman. "The chivalrous spirit," he contends, "is above all things a class spirit. The good knight is bound to endless fantastic courtesies towards men and still more towards women of a certain rank; he may treat all below that rank with any degree of scorn and cruelty. The spirit of chivalry implies the arbitrary choice of one or two virtues to be practised in such an exaggerated degree as to become vices, while the ordinary laws of right and wrong are forgotten. The false code of honour supplants the laws of the commonwealth, the law of God, and the eternal principles of right. Chivalry again in its military aspect not only encourages the love of war for its own sake without regard to the cause for which war is waged, it encourages also an extravagant regard for a fantastic show of personal danger which cannot in any way advance the objects of the siege or campaign which is going on. Chivalry in short is in morals very much what feudalism is in law: each substitutes purely personal obligations, obligations devised in the interests of an exclusive class, for the more homely duties of an honest man and a good citizen."⁵ Between these two views,—which, indeed, may be taken to represent the extremes of praise and of depreciation,—it may be assumed that at all events an approximation to the truth concerning the ethical effects of chivalry or knighthood is somewhere to be found.

(Z. DR.)

¹ "Observations on a Libel," *Works*, vol. v. p. 384.

² Gastie Palays, *Annuaire*, vol. 1. pp. 308 and 364; Mills, *History of Chivalry*, vol. 1. p. 136; Groce, *Military Antiquities*, vol. II. p. 348 sq.

³ Hallam, *Middle Ages*, vol. III. p. 398.

⁴ Burke, *French Revolution*, p. 115, & vol. 1790.

⁵ Freeman, *Norman Conquest*, vol. v. p. 459.

KNITTING is the art of forming looped fabrics or textures with the use of needles or wires and a single continuous thread. Crochet is an analogous art, differing from knitting in the fact that the separate loops are thrown off and finished successively, whereas in knitting the whole series of loops which go to form one length or round of the fabric are retained on one or more needles while a new series is being formed from them on a separate needle. The origin and history of the art of knitting are referred to under the heading **HOSIERY**, vol. xii, p. 299. The wires, needles, or pins used are of different lengths and gauges, according to the work for which they are intended, and are made either of steel, ivory, bone, or wood. Some are headed, to prevent loops from slipping over their ends, but on these can be woven only flat pieces of work; others are pointed at both ends, and with the use of three or more of these circular webs can be made. The materials used in knitting are specially twisted for the purpose, and consist of twines, threads, cotton, silk, wools, and worsteds, the latter being the most important and largely used substance. Ordinary stockings and socks, which are the staple hand-knit articles, are worked in "lambewool," "fingering," and "wheeling" worsteds respectively, these differing in size and fineness of quality; and for other articles of under-clothing and fancy knitting the worsteds most commonly used are "fleece," "Berlin," and "Lady Betty" wool. Shetland wool is a thin hairy undyed and very tenacious and strong worsted, spun in the Shetland Islands from the wool of the native sheep, and very extensively used in the knitting of fine shawls, veils, scarfs, and small articles by the islanders, among whom the industry is of much local consequence. "Crewels" are closely twisted coloured worsteds of the same size as Shetland wool, and capable consequently of being knit into the same fabric. Much spun silk is also knit into patterns and articles similar in form and appearance to Shetland wool goods. In Ayrshire the hand-knitting of Scotch caps is extensively prosecuted as a domestic industry, the knit work being collected and "waniked" or felted and otherwise finished in factories. The methods by which, with plain knitting, "purling," "slipping" loops, "taking up" and "casting off," &c., materials can be shaped and worked into varied and variegated forms are endless, and patterns and directions for working are to be found in all magazines and papers devoted to ladies' work, as well as in numerous special cheap publications.

Standard works, from which many of the patterns and directions in smaller manuals are copied, are Mrs Gangin's *Knitting and Crochet Work*, and Esther Coyley's *Comprehensive Knitting Book*, London, 1849.

KNOLLES, RICHARD (c. 1545-1610), author of the *History of the Turks*, was a native of Northamptonshire, and was born about 1545. In 1580 he entered Lincoln's College, Oxford, of which four years later he was elected fellow. After graduating M.A. he left Oxford to become master of the free school at Sandwich in Kent, where he died in 1610.

In 1603 Knolles published *A General History of the Turks*, a second edition of which appeared in 1610. The work was continued up to date in several editions subsequently published, the best known being that by Sir Paul Rycaut, 1687-1700, who gives a continuation to 1699. The history of Knolles was highly praised by Dr Johnson, and, though now entirely superseded, it lies for the time in which it was written considerable merits at least as regards style and arrangement. Knolles also published a translation of Bodin's *Republique* in 1606, but the *Grammatica Latinae, Graecae, et Hebraeorum Compendium*, and the *Endiments of Hebraeo Grammar*, attributed to him by Anthony Wood and in most works of reference, were, as is shown in the *Autograph* of August 6th, 1881, the works of the Rev. Hansard Knollys, a Baptist minister.

KNOT. In the scientific sense, a knot is an endless physical line which cannot be deformed into a circle. A

physical line is flexible and inextensible, and cannot be cut,—so that no lap of it can be drawn through another.

The founder of the theory of knots is undoubtedly Listing. In his "Vorstudien zur Topologie" (*Göttinger Studien*, 1847), a work in many respects of startling originality, a few pages only are devoted to the subject. He treats knots from the elementary notion of twisting one physical line (or thread) round another, and shows that from the projection of a knot on a surface we can thus obtain a notion of the relative situation of its coils. He distinguishes "reduced" from "reducible" forms, the number of crossings in the reduced knot being the smallest possible. The simplest form of reduced knot is of two species, as in figs. 1 and 2. Listing points out that these are formed, the first by right-handed, the second by left-handed twisting. In fact, if three half twists be given to a long strip of paper, and the ends be then pasted together, the two edges become one line, which is the knot in question. We may free it by slitting the paper along its middle line, and then we have the juggler's trick of putting a knot on an endless unknotted band. One of the above forms cannot be deformed into the other. The one is, in Listing's language, the "perversion" of the other, i.e., its image in a plane mirror. He gives a method of symbolizing reduced knots, but shows that in this method the same knot may, in certain cases, be represented by different symbols. It is clear that the brief notice he has published contains a mere sketch of his investigations.

The most extensive dissertation on the properties of knots is that of Tait (*Trans. Roy. Soc. Edin.*, 1876-7). It was for the most part written in ignorance of the work of Listing, and was suggested by an inquiry concerning vortex atoms (see **ATOM**). Tait starts with the almost self-evident proposition that, if any plans closed curve have double points only, in passing continuously along the curve from one of these to the same again an even number of double points has been passed through. Hence the crossings may be taken alternately over and under. On this he bases a scheme for the representation of knots of every kind, and employs it to find all the distinct forms of knots which have, in their simplest projections, 3, 4, 5, 6, and 7 crossings only. Their numbers are shown to be 1, 1, 2, 4, and 8. The unique knot of three crossings has been already given as drawn by Listing. The unique knot of four crossings merits a few words, because its properties lead to a very singular conclusion. It can be deformed into any of the four forms—figs. 3 and 4 and their perversions. Knots which can be deformed into their own perversion Tait calls "amphichiral," and he has shown that there is at least one knot of this kind for every even number of crossings. He shows also that "links" (in which two endless physical lines are linked together) possess a similar property; and he then points out that there is a third mode of making a complex figure of endless physical lines, without either knotting or linking. This may be called "lacing" or "locking." Its nature is obvious from fig. 5, in which it will be seen that no one of the three lines is knotted, no



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

two are linked, and yet the three are inseparably fastened together.

The rest of Tait's paper deals chiefly with numerical characteristics of knots, such as their "knotiness," "be-knottedness," and "knotfulness." He also shows that any knot, however complex, can be fully represented by three closed plane curves, none of which has double points, and no two of which intersect. It may be stated here that the notion of beknottedness is founded on a remark of Gauss, who in 1833 considered the problem of the number of interlinkings of two closed circuits, and expressed it by the electrodynamic measure of the work required to carry a unit magnetic pole round one of the interlinked curves, while a unit electric current is kept circulating in the other. This original suggestion has been developed at considerable length by Boeddicker (*Erweiterung der Gauß'schen Theori in der Verschlingungen*, Stuttgart, 1876). This author treats also of the connexion of knots with Riemann's surfaces.

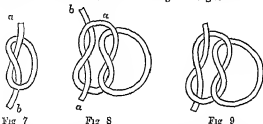
It is to be noticed that, although every knot in which the crossings are alternately over and under is irreducible, the converse is not generally true. This is obvious at once from fig 6, which is merely the three-crossing knot with a doubled string—what Listing calls "pairedromic."

Klein, in the *Mathematische Annalen*, ix 478, has proved the remarkable proposition that knots cannot exist in space of four dimensions.

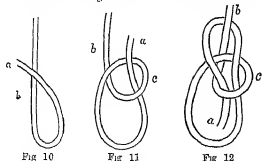
SAILORS' KNOTS.—The knots used by sailors are of many kinds. The following are the most useful.—

Overhand Knot (fig 7).—Take the end a of the rope round the end b .

Reef Knot (figs 8, 9).—Form an overhand knot as above. Then take the end a over the end b and through the bight. If the end a



was taken under the end b a *granny* would be formed. This knot is so named from being used in tying the reef-points of a sail. **Beeline** (figs. 10-12).—Lay the end a of a rope over the standing part b . Form with b a bight c over a . Take a round behind b and



down through the bight c . This is a most useful knot employed to form a loop which will not slip.

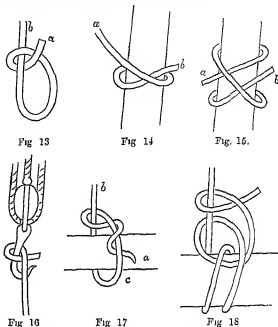
Half Hitch (fig 13).—Pass the end a of the rope round the standing part b and through the bight.

Clove Hitch (figs. 14, 15).—Pass the end a round a spar and cross it over b . Pass it round the spar again and put the end a through the second bight.

Blackwall Hitch (fig. 16).—Form a bight at the end of a rope, and put the hook of a tackle through the bight so that the end of the rope may be jammed between the standing part and the back of the hook.

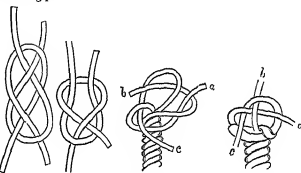
Painter Hitch (fig. 17).—Take the end a of a rope round a spar, then round the standing part b , then several times round its own part a .

Parker's Bend (fig. 18).—Take two turns round a spar, then a half hitch round the standing part and between the spar and the turns, lastly a half hitch round the standing part.



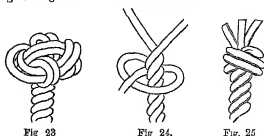
Carrick Bend (fig. 19).—Lay the end of one rope over its own standing part so as to form a bight. Put the end of the other rope through this bight, under the standing part, over the end beyond the bight, under the standing part beyond the bight, and down through the bight over its own standing part.

Sheet Bend (fig. 20).—Pass the end of one rope through the bight of another, round both parts of the other, and under its own standing part.



Single Wall Knot (fig. 21).—Unlay the end of a rope, and with the stand a form a bight. Take the next strand b round the end of a . Take the last strand c round the end of b and through the bight made by a . Haul the ends taut.

Single Wall Crowned (fig. 22).—Form a single wall, and lay one of the ends, a , over the knot. Lay b over a , and c over b and through the bight of a . Haul the ends taut.



Double Wall and Double Crown (fig. 23).—Form a single wall crowned; then let the ends follow their own parts round until all the parts appear double. Put the ends down through the knot.

Matthew Walker (figs. 24, 25).—Unlay the end of a rope. Take the first strand round the rope and through its own bight; the

second strand round the rope, through the light of the first, and through its own light, the third through all three lights. Hail the ends taut!

See Nares, *Seamanship*, 4th ed., 1868; Dana, *Seaman's Manual*, 9th ed., 1868; A. H. Alston, *Seamanship*, Portsmouth, 1871; Kipping, *Masting and Rigging*, 8th ed., 1864; Yachts and Yachting, by "Yachters' Club" (William Cooper), 1878; *Book of Knots*, by "Tom Bowling" (J. Bonwick), 1860.

KNOT, a Limicoline bird very abundant at certain seasons on the shores of Britain and many countries of the northern hemisphere. Camden in the edition of his *Britannia* published in 1607 (p. 408) inserted a passage not found in the earlier issues of that work, connecting the name with that of King Canute, and this account of its origin has been usually received. But no other evidence in its favour is forthcoming, and Camden's statement is merely the expression of an opinion,¹ so that there is perhaps ground for believing him to have been mistaken, and that the clue afforded by Sir Thomas Blount, who (*circa* 1675) wrote the name "Gnatte or Knole," may be the true one.² Still the statement was so determinedly repeated by successive authors that Linnaeus followed them in calling the species *Tringa canutus*, and so it remains with nearly all modern ornithologists.³ Rather larger than a Snipe, but with a short, flover-like bill and legs, the Knot visits the coasts of some parts of Europe, Asia, and North America at times in vast flocks; and, though in temperate climates a good many remain throughout the winter, these are nothing in proportion to those that arrive towards the end of spring, in England generally about the 15th of May, and after staying a few days pass northward to their summer quarters, while early in autumn the young of the year throng to the same places in still greater numbers, being followed a little later by their parents. In winter the plumage is ash-grey above (save the rump, which is white) and white beneath. In summer the feathers of the back are black, broadly margined with light orange-red, mixed with white, those of the rump white, more or less tinged with red, and the lower parts are of a nearly uniform deep bay or chestnut. The birds which winter in temperate climate seldom attain the brilliancy of colour exhibited by those which arrive from the south; the luxuriance generated by the heat of a tropical sun seems needed to develop the full richness of hue. The young when they come from their birthplace are clothed in ash-grey above, each feather banded with dull black and ochraceous, while the breast is more or less deeply tinged with warm buff. Much curiosity has long existed among zoologists as to the egg of the Knot, of which not a single identified or authenticated specimen is known to exist in collections. Yet more than sixty years ago the species was found breeding abundantly on the North Georgian (now commonly called the Parry) Islands by Parry's memorable expedition, as well as soon after on Melville Peninsula by Captain Lyons, and again during the recent voyage of Sir

George Nares on the northern coast of Grinnell Land and the shores of Smith Sound, where Major Feilden obtained examples of the newly hatched young (*Ibis*, 1877, p. 407), and observed that the parents fed largely on the buds of *Saxifraga oppositifolia*. These are the only localities in which this species is known to breed, for on none of the arctic lands lying to the north of Europe or Asia has it been unquestionably observed.⁴ In winter its wanderings are very extensive, as it is recorded from Surinam, Brazil, Walvisch Bay in South Africa, China, Queensland, and New Zealand. Formerly this species was extensively nested in England, and the birds fattened for the table, where they were esteemed a great delicacy, as witness the entries in the Northumberland and Le Strange Household Books, and the British Museum contains an old treatise on the subject—"The manner of keeping of knotts, after Sir William Askew and my Lady, given to my Lord Darcy, 25 Hen. VIII." (*MSS. Sloane*, 1592, 8. ant. 563). (A. S.)

KNOWLES, JAMES SHERIDAN (1784-1862), dramatic author, was born at Cork, 21st May 1784. His father was the lexicographer James Knowles, cousin-german of Richard Brinsley Sheridan. Not long after the removal of the family to London in 1789, young Knowles began his dramatic career by composing a play which was performed by himself and his juvenile companions. At the age of fourteen he published a ballad entitled *The Welsh Harp*, which was set to music and obtained great popularity; and about the same time his precocious talents secured him the friendship of Hazlitt, through whom he also formed an intimacy with Lamb and Coleridge. Of his early career little else is known except that for some time he served in the Wills and afterwards in the Tower Hamlets militia, and that he left the latter corps to become pupil of Dr Willan the physician, through whom he was appointed vaccinator to the Jennerian Society. Although, however, he was generously offered by Dr Willan a share in his practice, he resolved to forsake medicine for the stage, making his debut at the Crow Theatre, Dublin. At Waterford he in October 1800 married Maria Charteris, an actress from the Edinburgh Theatre. About this time he wrote *Leo*, which was played at Waterford with great success by Edmund Kean; but, although another piece, *Brian Boroihme*, which he wrote for the Belfast Theatre also drew crowded houses, his labours as an actor and author secured him so little pecuniary return that he found it advisable to become assistant to his father at the Belfast Academical Institution. In 1817 he removed from Belfast to Glasgow, where, besides conducting a flourishing school, he continued his dramatic authorship. His first important dramatic success was *Caius Gracchus*, produced at Belfast in 1815; and by *Virginia*, written for Edmund Kean, and first performed in 1820, he obtained a very high place among the dramatic authors of the century. Besides *William Tell*, in which Macready performed one of his most successful parts, the other principal plays of Knowles are *The Hunchback*, *Love*, and *The Wife*. In some of his own pieces he acted with a just appreciation of the character and with considerable vigour and fire, but he failed in the power of personation. He achieved some success, however, as a lecturer on elocution. In his later years he forsook the stage for the pulpit, and as a Baptist preacher attracted large audiences at Exeter Hall and elsewhere, while he also entered the field of polemical theology, publishing two works,—*The Rock of Rome*, and the *Idol Demolished by its own Priests*,—in both of which he combated the special doctrines of the Romish Church. Knowles was for some years in the receipt of an annual

¹ His words are simply "Knotts, I. Canutt aues, vt opinore Dana enim adulatore credendum." In the margin the name is spelt "Gnatte," and he possibly thought it had to do with a well-known story of that king. Knots undoubtedly frequent the sea-shore, where Canute is said on one occasion to have taken up his station, but they generally retreat, and that stumbly, before the advancing surf, which he is said in the story not to have done.

² In this connection we may compare the French *marin-pigeon*, ordinarily a gnat or mosquito, but also, among the French Creoles of America, a small shore-bird, either a *Tringa* or an *Squataria*, according to Descourtils (*Voyage*, ii. p. 349). See also Littré's *Dictionnaire*, sub voce.

³ There are few of the *Linnæus*, to which group the Knot belongs, that present greater changes of plumage according to age or season, and hence before these phases were understood the species became commemorated with many synonyms, as *Tringa cinerea*, *strigata*, *strigata*, *strigata*, *strigata*, and so forth. The confusion thus caused was mainly cleared away by Montagu and Temminck.

⁴ The *Tringa canutus* of Fayer's expedition seems more likely to have been *T. macularia*, which species is not named among the birds of Franz-Josef Land, though it can hardly fail to occur there.

pension of £200, bestowed by Sir Robert Peel. He died at Torquay, November 30, 1862.

A full list of the works of Knowles and of the various notices of him will be found in his *Life*, by his son Richard Knowles, of which twenty-five copies were printed privately.

KNOX, JOHN (1505-1572), the great Reformer of Scotland, was born at Haddington, the county town of East Lothian, in the year 1505.¹ His father was William Knox, commonly said to have been descended from the Knoxes of Ranfurly in Herefordshire, but there is no evidence to prove what rests solely upon the authority of David Buchanan. The name of his mother was Sinclair, and some of his letters, written in seasons of danger, were signed "John Sinclair." Whatever might be their lineage, Knox's relations were in such circumstances as secured for him a liberal education in the grammar school of his native town; and, when about sixteen years of age, he was sent to pursue his studies at the university of Glasgow, where Dr John Mair or Major was principal regent, or professor of philosophy and divinity. Owing to some undiscovered cause he left the university without qualifying himself to take the degree of master of arts. It has been usual to state that from Glasgow Knox proceeded to St Andrews and there taught philosophy and theology, but no evidence can be adduced to show that he was officially connected in any way whatever with the university of that city. Not having qualified himself by taking his degree, he would be excluded from acting as a regent or professor, so that if he taught it can only have been in the way of private tuition. In truth, for some years about this time the course of life pursued by Knox is involved in obscurity. The probability is that he took orders in the Church of Rome as a secular priest about 1530, and was connected for upwards of ten years with one of the religious establishments in the neighbourhood of Haddington. In the Protocol books of that town the name of John Knox occurs among the witnesses to deeds of the years 1540, 1541, and 1542, in one deed under the style of *Schir*, that being the designation of priests who had not attained the higher academical degree of *Magister*, and as late as March 27, 1543, he pens and signs a notarial instrument as an apostolic notary, describing himself as "sacri alicuius minister, Sanctiandree diocesis, auctoritate apostolica notarius."

The martyrdom of Wishart in 1546 was the turning point in the spiritual life of Knox, determining him to renounce scholastic theology and to profess his adherence to the Protestant faith. As this subjected him to suspicion and trouble, he resolved to leave Scotland and visit the schools of Germany; but Douglas of Longliddrie and Cookburn of Ormiston, to whose sons Knox had for some time been acting as private tutor, prevailed on him

to relinquish his design, and, along with his pupils, to enter the castle of St Andrews as a place of safety from the Romanist clergy. It was there that Knox received a public call to the ministry, "wharist," to use his own graphic description of the scene in the great church, "the said Johnne abashed, byryst furth in most abundant tearis, and withdrew him self to his chamber."

In June of the same year (1547) the Catholics of Scotland and France joined their forces to avenge the death of Cardinal Beaton by capturing the Protestant garrison of St Andrews, the French fleet appeared in the bay, and the castle surrendered. It was stipulated that the lives of the refugees should be spared, that they should be removed to France, and that such of them as declined entering into the French service should be conveyed to any other country except Scotland. Knox, sharing the fate of his companions, was conveyed on board one of the French ships to Rouen; but the terms of the capitulation were grossly violated, and the captives were treated as prisoners of war. Knox and some others were sent on board the galleys, and, after being loaded with chains, were compelled to labour at the oar. Here they were subjected to many indignities and much suffering; but, in spite of every hardship and every threat, not one of their number renounced his faith. During the ensuing winter the galley in which he was confined lay in the Loire; and in the summer of 1548 it sailed for Scotland, and cruised off the east coast. The hardships to which he was now subjected produced a very serious effect upon his health: he was seized with a violent fever, and no hope was entertained of his recovery. He, however, regained his strength, and during his captivity had sufficient energy of mind to engage in literary work. In the winter of 1548 Henry Balnave of Halhill, who remained a prisoner in the old palace of Rouen, had sent to Knox a treatise on the doctrine of justification by faith. With this work Knox was so much pleased that, having revised it carefully, divided the contents into chapters, and added a brief summary of the book, he sent it to Scotland for publication with an epistle addressed by "the bound Servant of Jesus Christ unto his best beloved Brethren of the Congregation of the Castle of St Andrews, and to all Professours of Christie true Evangel" (*Works of John Knox*, vol. iii.). As the old copy of this epistle bears the title of "The Confession of Faith," this work may have been the "confession of his faith, containing the substance of what he had taught at St Andrews," which "he found means to convey to his religious acquaintances in Scotland," and which, Dr McOris thinks, "appears to have been lost." If so, leaving out of view the notices of his first sermon and of his disputation with Friar Arbuckle in St Leonard's Yards, contained in his *Historie*, this epistle will rank as the earliest specimen of the Reformer's composition that has been preserved.

After an imprisonment of eighteen or nineteen months Knox obtained his release from the French galleys in February or March 1549. As he probably owed his freedom to the intercession of Edward VI. or the English Government, he came to London on obtaining his liberty, and was favourably received by Archbishop Cranmer and the lords of council. Of the English section of his life, extending over five years, Knox himself disposes in few words: "The said Johnne was first appointed preacher to Berwick, then to Newcastle; last he was called to London, and to the south partes of England, whar he remained to the death of King Edward the Sixth" (*Historie*, book i.). At Berwick, where he laboured for two years, he preached with his characteristic fervour and zeal, exposing the errors of Romanism with unsparring severity. The tendency of his zeal was not, however, calculated to recommend him to the bishop of the diocese, Dr Cuthbert Tunstall or Tonstall.

¹ Founding upon the designation "Giffordensis" applied to him by Beza in his *Lectione* of 1580, and the statement of Spottiswood in his *History* (1527) that Knox "was born in Gifford in the Lothians," later writers, beginning with David Buchanan, have given Gifford, a village a few miles to the south of Haddington, as the birthplace of Knox. On the other hand two contemporary Romanist writers—Archibald Hamilton (1677) and James Leing (1831)—assign to Haddington itself the honour in question. "Presbyter Joannes Knoxius natus in Hallintona oppido in Lothlania"; "Joannes Knox natus prope Haddington, quo est urbs in Lothlania." In 1786 the Rev. Dr Barclay of Haddington directed attention to Giffordgate, one of the suburbs of Haddington, as the locality which popular tradition has uniformly maintained to have been the spot where the Reformer was born, and with, with the grounds adjoining, is called "Knox's Walls" in a charter of 1607. Recent investigations prove that no village of the name of Gifford was in existence until the latter half of the 17th century, whereas in the Geneva Register of 1558, when Knox was admitted a bourgeois of Geneva, his name is thus entered, "Jehan, fils de Guillaume Choze, natif de Haddington en Escosse." David Leing, who in 1846 followed McOris in preferring Gifford, in 1864 gave his verdict in favour of the Giffordgate, stating that a visit to the locality led him to the conclusion that the question now admits of no dispute.

who was strongly attached to the old faith. Having been accused of asserting that the sacrifice of the mass is idolatrous, the preacher was cited to appear before the bishop, and to give an account of his preaching. Accordingly, on the 4th of April 1550, Knox entered into a full defence of his opinions, and with the utmost boldness proceeded to argue that the mass is a superstitious and idolatrous substitute for the sacrament of the Lord's Supper. The bishop did not venture to pronounce any ecclesiastical censure, and the fame of the obnoxious preacher was extended by this feeble attempt to restrain the boldness of his attacks on the doctrines of Rome. The confession or vindication of his doctrine made by Knox on this occasion will be found in vol. iii. of his collected *Works*—"A Vindication of the Doctrine that the Sacrifice of the Mass is Idolatry," 1550.

Upon Knox's reforming work while a preacher at Berwick some interesting light has recently been thrown by the late Dr Lorimer's *John Knox and the Church of England*, 1875. When looking through the "Morrice" collection of manuscripts in Dr Williams's library, London, Dr Lorimer came upon four papers never before published. One of these is a letter from "Johns Knokks to the Congregation of Berwick," and another is "The practice of the Lord's Supper used in Berwick by John Knox, 1550." With this "practice," which is nothing more than a fragment, Dr Lorimer associates "A Summary, according to the Holy Scriptures, of the Sacrament of the Lord's Supper," to be found in the third volume of the *Works*, and to which Dr Laing has assigned the date 1550. Founding upon these documents, Dr Lorimer maintains that the very beginning of Puritan practice in the Church of England in the administration of the Lord's Supper is to be found in the order followed by Knox at Berwick, inasmuch as he not only substituted common bread for "water-breads," thus anticipating by several years the substitution as authorised by Edward's second Prayer-Book, published in 1552, but gave the first example of the substitution of sitting instead of kneeling in the act of communion, which has ever since continued to be a characteristic Puritan practice. At the close of 1550, or early in 1551, Knox was transferred to Newcastle-upon-Tyne, where he remained, with occasional absences in London, till the spring of 1553. In the closing month of 1551 he was appointed one of six chaplains to Edward VI., and in virtue of this appointment he was consulted in the preparation of the formularies of the Church of England. A book of forty-five articles of religion, forming the basis of the thirty-nine articles of the Anglican Church, drawn up by Cranmer, was submitted to the royal chaplains for their opinion. An original copy of these articles is preserved in H.M. State Paper Office with the autographs of the chaplains, the sixth being "Jo. Knox." Shortly after this the duke of Northumberland originated a proposal to make Knox a bishop. The letters bearing upon the proposal, not known to Dr M'Crie, were discovered by the late Mr Tytler, and published by him in his *England under the Reigns of Edward and Mary*, vol. ii. The duke's wish was that the king would "appoint Mr Knokks to the office of Rochester Bishoprick." When, however, the Scotch chaplain was informed of what was in contemplation, and was instructed to wait upon Northumberland, the latter did not find the man he thought to benefit eager to grasp at promotion, and the matter ultimately came to nothing by default of Knox himself. The last year of work in England was spent mainly in London and the southern counties. As royal chaplain Knox preached in turn before the court, and found favour with his royal hearer; but he was twice summoned before the privy council, first to answer complaints made by his would-be ducal patron, and

then to vindicate his declination of the vacant living of All Hallows in London.

Edward VI. having died in July 1553, and, the Marian persecutions having shortly afterwards broken out, Knox was persuaded to withdraw from England, and sailed for Dieppe, landing at that town in January 1554. The enforced leisure of exile gave the refugee an opportunity of completing and publishing several treatises during two sojourns in the same year at Dieppe. "An Exposition upon the Sixth Psalm of David," addressed to Mrs Bowes, "A Godly Letter of Warning or Admonition to the Faithful in London, Newcastle, and Berwick," "Two Comfortable Epistles to his afflicted Brethren in England," and "A Faithful Admonition to the Professors of God's Truth in England," all belong to the year 1554. After visiting the churches of France and Switzerland, Knox accepted an invitation to become one of the pastors of the English congregation at Frankfort-on-the-Main, and repaired thither in November of the same year. Soon after his settlement dissensions arose in the congregation in regard to the use of the surplice, the omission of the litany, the audible responses, and kneeling at the communion (see the letters and extracts from the "Brief Discourse of the Troubles at Frankfort" given by Dr Laing in vol. iv. of Knox's *Works*). A party in the congregation, clamorous for a strict adherence to the English Book of Prayer, lodged information with the magistrates that Knox, in his "Faithful Admonition," had used treasonable language in speaking of the emperor, the queen of England, and her husband Philip II. Not wishing to increase the troubles, the maligned preacher relinquished his charge on the 26th March 1555, and retired to Geneva. The closing months of that year and the opening ones of the year following form an important period in the public labours and the private life of the Reformer; for he then visited his native country, preached in Edinburgh, in West Lothian, and in Ayrshire, and dispensed the communion privately in several places. Before his visit came to a close he addressed a letter to the queen regent, in the hope that she might be persuaded to extend her protection to the Reformed preachers, or at least listen favourably to their doctrine. This letter, "augmented and explained by the author," and reprinted in 1558, "An Exposition upon Matthew iv., concerning the temptation of Christ in the wilderness," and "A letter of wholesome counsel, addressed to his Brethren in Scotland," belong to the year 1556. In visiting Scotland at that time, however, Knox was influenced by other considerations than those bearing simply on the public weal. For as far back as his Berwick ministry he had become acquainted with the family of Richard Bowes, and formed an attachment for the fifth daughter, Marjory. Dr M'Crie represents the marriage as having taken place in 1553 before Knox left England; and in support of his view it falls to be said that after that date Knox addresses Mrs Bowes as "Dearly Beloved Mother," and that he speaks of Marjory as his "wife," his "dearest spouse." But, considering the strong opposition to the union on the part of Richard Bowes and other relatives, as also the very uncertain and precarious position of the reformer at the time, there is good reason to think, with Dr Laing, that then the parties had only formally pledged themselves to one another "before witnesses," and that the actual marriage took place when Knox visited Scotland in 1555.

At the urgent solicitation of the English congregation at Geneva, consisting largely of those who had withdrawn from Frankfort, Knox left Scotland in the summer of 1556; and in the "*Livre des Anglois à Genève*," on the 13th September of that year, the names of "John Knox, Marjory, his wife, Elizabeth, her mother, James (hané),

his servant, and Patrick, his pupil," are entered as members of the English congregation. In Geneva the Scotch Reformer laboured with voice and pen till 1559. The literary works of that period, in addition to ten *Familiar Epistles*, include *Letters to his Brethren and the Lords professing the truth in Scotland*, three in number, 1557; *An Apology for the Protestants who are holden in prison at Paris*, 1557; *The Appellation from the Sentence pronounced by the bishops and clergy*, 1558; *A letter addressed to the Commonalty of Scotland*, 1558; *An Epistle to the inhabitants in Newcastle and Berwick*, 1558; and *A brief exhortation to England for the speedy embracing of the Gospel*, 1559. Judged by the excitement it created, the most outstanding writing of this period is *The First Blast of the Trumpet against the Monstrous Regiment of Women*; and it cannot be denied that this publication was unseasonable, and might be expected to expose the author to the resentment of two queens during whose reign it was his lot to live. Indeed the sounder of the *First Blast* would seem to have realized that it was "blown out of season," for, whereas his purpose was "thrice to blow the trumpet in the same matter, if God so permit," and on the last occasion to reveal his name, the intention was never carried into effect. The resentment to which his blast against feminine government gave rise in queenly breasts did not soon subside; one immediate effect was that, when Knox resolved to return to Scotland, and applied to the English Government for permission to pass through the sister kingdom, the application was refused. Impatient of delay he sailed from Dieppe direct for Leith, and, landing at that port in safety, reached Edinburgh on 2d May 1559.

From this time to the close of his life the biography of the Reformer becomes inseparably connected with the history of Scotland. Within a few days of his arrival in Scotland, through the representations of the Romanist clergy to the queen-regent, Knox was proclaimed an outlaw and a rebel; but, undeterred by considerations of personal danger, he lost no time in joining the leaders of the Protestant party then assembled in Dundee. From Dundee he went with them to Perth, where his preaching was the antecedent though not the cause of a tumult which resulted in the altar, images, and other ornaments of the church being torn down, and the houses of the grey and black friars being laid in ruins. St Andrews is the next place of importance at which Knox joined the Protestants, at this time called the congregation, the lay leaders of the party, mostly noblemen, being known as the lords of the congregation. Here Knox announced his intention to preach in the cathedral church; and, undismayed by the threats of the archbishop, unmoved by the remonstrances of his friends, he carried his purpose into effect, preaching on four successive days, and with such signal effect that the provost, bailies, and inhabitants agreed to set up the Reformed worship in the town, stripped the church of images and pictures, and pulled down the monasteries. By the end of June Knox was again in Edinburgh, preaching in St Giles's and the abbey church; and on the 7th July he was elected minister of Edinburgh.

When the army of the queen-regent took possession of the capital, and the lords of the congregation agreed to leave it, they took their minister with them from a regard alike to the danger to which he would be exposed if left behind and the service it was in his power to render the Protestant cause. The result abundantly verified the wisdom of the step, for, set free from city labours, Knox travelled over a great part of Scotland, and visited the towns of Kelso, Jedburgh, Dumfries, Ayr, Stirling, Perth, Brechin, Montrose, Dundee, and St Andrews, with marked results in the diffusing of knowledge and the strengthening of the hands of fellow Protestants. By the end of April

1560 we find him once more in Edinburgh, having rendered important service to the Protestant leaders in their negotiations to procure aid from England, and, of necessity rather than from choice, acting the part of a politico-ecclesiast. The most elaborate theological writing of the Scotch Reformer, although written before his final return to Scotland, was published in this year, 1560, at Geneva. It is *An Answer to the Cavillations of an Adversary respecting the doctrine of Predestination*.

The event of greatest political importance in this same year 1560 was the assembling of the Scottish parliament at Edinburgh, on 1st August. A petition having been presented by the Protestants of the country, craving the abolition of Popish doctrine, the restoration of purity of worship and discipline, and the appropriating of ecclesiastical revenues to the support of the ministry, the promotion of education, and the relief of the poor, the ministers and barons were required to lay before parliament a summary of Reformed doctrines. "Within four days" this was done. The confession was read before the whole parliament, and after reasoning and voting was ratified by Act of Parliament, and the Protestant religion formally established. *The Confessions of faith professant and belevit be the Protestants within the Realme of Scotland, &c.*, in the composing of which no small share must have fallen to the minister of Edinburgh, is inserted by him at length in book iii. of his *Historie*. Between the dissolution of parliament and the first meeting of the General Assembly of the Church of Scotland on the 20th December, Knox and three other ministers were engaged in drawing up the plan of ecclesiastical government known as the *Book of Policy, or First Book of Discipline*. This standard document, approved by the General Assembly and subscribed by a majority of the members of privy council, is also incorporated in Knox's *Historie*.

The youthful, widowed, and fair Queen Mary, having arrived in Scotland in August 1561, lost no time in sending for Knox to the palace of Holyrood, in order that she might hold with him the first of those four or five dialogues which historians have rendered with dramatic effect not always consistent with historical accuracy. The charge brought against the Reformer of treating his sovereign with rudeness and disrespect in the course of those interviews has been thoroughly disproved by his biographer giving the details of what passed as furnished by one of the parties in his *Historie*, and is quite discredited by such a judge as Thomas Carlyle.

In the following year Knox found a more congenial sphere for the exercise of his logical and dialectic skill in a disputation with Quintine Kennedy, abbot of Crossragwell, in the neighbourhood of Maybole, Ayrshire. The abbot had set forth a number of articles respecting the mass, purgatory, praying to saints, the use of images, and other points which he declared his intention to open up more fully in his chapel at Kirkoswald. But when Knox, who happened to be in the vicinity, appeared on the Sabbath specified, the abbot deemed it prudent to absent himself, and Knox preached in his stead. This led to correspondence which resulted in arrangements for a disputation taking place. The disputants met at Maybole on the 28th September 1562 and the two following days at 8 A.M., in the house of the provost. Forty persons on each side were admitted as witnesses of the dispute, "with so many mo as the house may goodly hold, be the sight of my lord of Cassilis" (nephew of Kennedy). As usually is the case in such contentions, both sides claimed to be victorious; but, to counteract the one-sided reports circulated by the abbot and his friends, Knox published, in 1563, an account of the dispute taken from the records of the notaries present, to which he added a prologue and short marginal notes.

Queen Mary, having failed to influence the Reformer by her "many salt tears" or her flattery, endeavoured to get him into her power by moving the privy council to pronounce him guilty of treason on the ground that he had written a circular letter to leading Protestants in reference to the trial of two persons indicted for a riot in the Chapel Royal. Knox's trial took place at a special meeting of council in December 1562, at which the queen was present and acted an unseemly part as prosecutor. To the unconcealed chagrin and intense displeasure of his sovereign, Knox was by a majority of the noblemen present absolved from all blame and commended for his judicious defence.

Before he was required to appear a second time at a privy council meeting, Knox, who had been a widower for three years, was married to his second wife Margaret Stewart, daughter of "the good" Lord Ochiltree, and in Ochiltree House, an ancient baronial residence, the room is still pointed out where, in March 1564, the marriage was celebrated. The occasion of his second appearance before the privy council was the preaching of a sermon in St Giles's about a month after the marriage of Queen Mary and Lord Darnley in July 1565. On the day the sermon was preached the young king made an imposing appearance, sitting on a throne prepared for his reception. Enraged by what he regarded as passages having a reference to himself in the discourse of the preacher, Darnley returned to the palace with the determination not to taste food till the offender had been punished. Knox was accordingly called before the council, "from my bed," as he tells us. Informed that he had offended the king, and that he must desist from preaching so long as their majesty remained in Edinburgh, Knox made reply that he had spoken nothing but according to his text (Isa. xvi. 13-21), and, if the church should command him either to speak or abstain, he would obey, so far as the word of God would permit him. In regard to the sermon he deemed it necessary for his own exoneration to write out in full what he had spoken, and publish it with a preface dated at "Edinburgh, the 19th of September 1565." This sermon is the only specimen of Knox's pulpit discourses handed down to us. Dr McCrele is of opinion that the prohibition was of a very temporary nature, but it does not appear that Knox resumed his usual ministrations in Edinburgh, unless at occasional intervals, till after Mary had been deprived of her authority in 1567. During this period of absence from his charge, however, the inhibited preacher was far from idle. In 1566 he drew up the most considerable portion of his *Historie of the Reformation*, having made a commencement in 1559 or 1560, and he wrote at the request of the Assembly various public letters. He also visited churches in the south of Scotland, and made a journey to England, in order to see his two sons, who had been there for education since the death of their mother Margery Bowes.

On the 29th July 1567 the infant James VI. was crowned in the parish church of Stirling, and on that occasion Knox reappeared in public and preached the coronation sermon. He also preached at the opening of parliament in December of the same year, when the Confession of Faith formed and approved by parliament in 1560, with various Acts in favour of the Reformed religion, was solemnly ratified. When James Stuart, earl of Murray and regent of Scotland, was assassinated and died at Linlithgow, 23d January 1568, the event caused anguish and anxiety to the Reformer, who poured out the sorrows of his heart in the sermon and the prayers of the day on which the tidings reached the capital, and who thereafter preached the funeral sermon in the presence of three thousand persons gathered to witness the interment in the south aisle of the collegiate church of St Giles. The strain to which body and mind alike had been subjected for many years back, and the

shock caused by the removal of the nobleman in whom he placed the greatest confidence, affected the Reformer's health, and in the month of October 1570 he had a stroke of apoplexy. Although he so far rallied as to have the use of speech restored to him and to resume preaching, he never entirely recovered from the debility which the stroke produced.

Resolved to take no prominent part in public affairs, and confining himself to preaching in the forenoon of the Lord's day, Knox might have spent what little of life on earth remained for him in the house assigned him by the provost and town council of Edinburgh, had he not become personally obnoxious to Kirkcaldy of Grange. This and the troubles which agitated the country induced Knox, "sore against his will, being compellid be the Brethren of the Kirk and Town," to quit the metropolis and retire to St Andrews. During his stay there of fifteen months the many infirmities of age did not prevent him engaging in his two favourite employments of preaching and writing. How he preached James Melville, then a student, afterwards minister of Anstruther, has described in an often-quoted passage of his "Diary." The latest publication of Knox in his life time was "impreunt at Sanctandris be Robert Lekprent, Anno Do. 1572." It is a tract in the form of an answer to a letter written by James Tyrie, a Scottish Jesuit.

By the end of July the adherents of the queen's party abandoned Edinburgh, and so enabled the banished citizens to return to their homes. One of their first acts was to send for Knox, who, travelling slowly because of weakness, reached the capital (for the last time) on the 23d August 1573. Only two more public appearances were to be made by him. The first of these was when in September tidings came to Edinburgh of the St Bartholomew massacre. Being assisted to reach the pulpit, and summoning up the remainder of his strength, he thundered out the vengeance of heaven against "that cruel murderer and false traitor, the king of France," and desired the French ambassador to tell his master that sentence was pronounced against him in Scotland, that the Divine vengeance would never depart from him nor from his house if repentance did not ensue, but that his name would remain an execration to posterity, and none proceeding from his loins should enjoy his kingdom in peace. The other occasion on which the debilitated Reformer appeared in public was the induction of Lawson, sub-principal of King's College, Aberdeen, as his successor, which took place on the 9th November. After taking a leading and solemn part in the services, he crept down the street leaning upon his staff and the arm of his attendant, and entered his house never to leave it alive.

Interesting details of his last illness and death-bed exercises are furnished in two contemporary narratives—Richard Bannatyne's "Account of Knox's Last Illness and Death" given in his *Journal of the Transactions in Scotland 1570-1573*, and the "Eximii viri Joannis Knoxii Scotice Ecclesie instauratoris vera extremæ vite & obitus Historia" of Thomas Smeton, principal of the University of Glasgow, at the end of his *Responsio ad Hamiltonii Dialogum*, 1579. Both narratives are inserted by Dr Laing in his edition of the *Works*, vol. vi. part ii. Attended by his wife and friends, Knox died on Monday the 24th of November 1572, in the sixty-seventh year of his age. The funeral took place on the Wednesday following, when the body was brought from the house in the Netherbow Port by the newly-appointed regent, the earl of Morton, and other noblemen, and interred in the burying-ground connected with the church of St Giles. "When the body was laid in the grave," says Calderwood, "the earl of Morton uttered these words:—Here lieth a man, who in his life never feared the face of man; who hath

been often threatened with danger and dagger, but yet hath ended his days in peace and honour." If any stone ever marked the precise spot where Knox was buried—said by tradition to be in the Parliament Square, a few feet to the west of the pedestal of Charles II.'s statue—it must have been destroyed in 1633, when the burying-ground was wholly obliterated by buildings. As in the case of his illustrious contemporary and friend Calvin, no tombstone marks the place where he was interred.

Knox's family consisted of five children—two sons and three daughters. His two sons were born to him by his first wife Mary Boyd. Nathaniel and Eleazer Knox were both born in Geneva, entered as students of the university of Cambridge, and became fellows of St John's College. Both died at an early age, and by their deaths the family of the Reformer became extinct in the male line. The three daughters of Knox were Martin, Margaret, and Elizabeth. Martha was married to Alexander Farlie of Brand, in the neighbourhood of Edinburgh, a tradition that she became the first wife of James Fleming, father of Robert Fleming, author of *The Fulfilling of the Scriptures*, having been disapproved by Dr Laing (*Works*, vol. vi., part 2, ix.). Margaret Knox married Zachary Pent, for several years minister of St Catherine's, Edinburgh; and Elizabeth married John Welch, of Welsh, minister successively of Selkirk, Kirkcaldy, and Ayr, and, when transported, of the French Protestant Church. Dr Laing considers it improbable that any lineal descendants of these daughters still exist.

Of Knox as an original painter in known to exist. Several likenesses have been frequently reproduced. 1. A wooden portrait of the Reformer occurs in *Beza's Icones*, published at Geneva in 1580, which has often been reproduced. 2. A French translation of the *Icones*, by Simon Gaultier, appeared in 1681 with a totally different portrait substituted in place of that of Knox, which is now believed to represent William Tyndale, the translator of the Bible. 3. In 1602 Verheiden, a Dutch theologian, published at the Hague his *Protestantium aliquot Theologorum Effigies*, and in that work a head engraved on copper by Hondius is given as that of Knox. There is every reason to suppose that this is merely an engraved copy from Beza's, and not taken from an original painting. 4. The Torphichen portrait of Knox as Calkin Hones. It has on the back of the canvas the inscription, in a handwriting less than a century old—"Rev Mr John Knox." The first sacrament of the Supper given in Scotland after the Reformation was designed by him in this hall. It is in the Torphichen hall, Glasgow, painted at least a century after Knox's death, with Beza's wooden portrait for model. 5. In 1830 the Society for the Diffusion of Useful Knowledge published an engraving of a portrait of Knox which now goes by the name of the Somerville portrait. This painting belonged to the Somerville family, and hung on the walls of their London residence till the portrait became extinct. The tradition in the family is that it was brought into their possession by James, the thirteenth baron, in the latter half of the 16th century, and the supposition of those who regard this as a veritable likeness of the reformer is that Baron Somerville had fallen in with an excellent portrait wrongly by some distinguished artist of Knox's time (presumably Francis Forbus, who painted a likeness of George Buchanan), and had a copy of it painted for his mansion of Drum, near Edinburgh. Engravings of Beza's and Verheiden's portraits will be found in *Knox's Works*, vols. i. and vi.; of the Torphichen portrait in the *Life of Knox*, 1st edition; and of all the five likenesses in *The Portraits of John Knox*, by Thomas Carlyle, whose verdict is in favour of the Somerville portrait as "the only probable likeness anywhere known to exist."

Literature—A *Life of Knox*, collected and edited by David Laing, G. vols. Edinburgh, 1846-47. 31. *Chr. The Life of John Knox*, 1st ed., 1811, 7th ed., 1835. *Laing's John Knox and the Church of England*, London, 1816; 7. *Carlyle's John Knox and the Portraits of John Knox*, published in connection with *The Early Kings of Norway*, London, 1871. The life and labours, character and influence, of Knox are dealt with more generally in the following works:—*Bill Burton's History of Scotland*; *J. A. Frend's History of Scotland*; *George's Lives and Hero's Works*; *Montroll's The Influence of Knox and the Scottish Reformation on England, America, and Europe*; *and The Influence of the Reformation on the Scottish Character*, Edinburgh, 1864. (O G M C.)

KNOXVILLE, chief city of Knox county and of East Tennessee, United States, is situated on the right bank of the Tennessee river, which is navigable up to this point, four miles below the confluence of the Holston and French Broad rivers, and about 165 miles east of Nashville. By recent statistics it is shown to be one of the six healthiest cities in the United States; the elevation is 1000 feet, mean temperature 58° Fahr., average rainfall 54·6 inches. Among its numerous handsome buildings are the United States custom-house and post-office, the university of Tennessee, and the public schools. There is a free library in the city. The university, which includes the State college

of agriculture and the mechanic arts, was founded in 1807, the latter departments being added in 1869. It has a good library, and geological, mineralogical, and zoological collections. In 1881 there were 398 students. Knoxville is a busy industrial and commercial centre. Its manufactures include iron in all its forms, railway and other carriages, paper, furniture, sashes and blinds, tobacco, flour, leather and harness, pottery, &c., and it has a brisk trade in these articles, as well as in boots and shoes, hardware, and dry-goods. Marble and coal of excellent quality are found in vast quantities near the city. Knoxville was settled in 1789, and laid out as a town in 1791, when it was named after General Henry Knox, at that time Washington's minister of war. From 1794 till 1817 it was the capital of Tennessee. During the civil war it was an important position, passing into the possession of the Union forces in 1863. The population of the city in 1880 was 9693, or, including directly connected suburbs, 15,460.

KOBELYAKI, a town of Russia, in the government of Poltava, 40 miles south-west of the government town, with a station on the railway between Kharkoff and Kiyevsk. The town proper is situated on the right bank of the Vorskla, but a suburb of some size, known simply as Zaryetchny or "Beyond the River," lies on the other side. Of the 13,000 inhabitants more than half are occupied exclusively with agriculture, but weaving, introduced by German colonists, is beginning to be a considerable industry in the town. Kobelyaki was founded by the Polish nobleman Nemirovitch, and is mentioned as a town in 1647. In the neighbourhood lies the village of Perevolotchna, where the Swedish forces under Charles XII laid down their arms.

KOBRIN, a town of Russia, in the government of Grodno, 12 miles east of Brest-Litovsk and 4 miles from the Tselv station of the railway between Minsk and Brest-Litovsk. It lies in the midst of a marshy country, to the east of which are extensive forests; although situated on the Mukhavetz river, which enters into the system of canals uniting the Dnieper and Bug, it enjoys but little prosperity. Its 8000 inhabitants are chiefly engaged in agriculture; there is also some trade in grain, salt, timber, and bones. Kobrin was until the 18th century the capital of a principality of the same name.

KOCK, CHARLES PAUL DE (1794-1871), novelist, was born at Passy on the 21st of May 1794, and died at Paris on the 29th of August 1871. He was a posthumous child, his father, who was a banker of Dutch extraction, having been one of the numerous victims of the Terror, and dying on the scaffold with Hebert and Clootz, not as an extreme republican, but as "suspect" of foreign relations. The family was one of some rank in the Netherlands, and an uncle of the novelist attained to the position of minister of the interior in his native country. Paul de Kock, however, remained all his life a citizen of France. He began life as a banker's clerk, which occupation he soon quitted for literature. But his natural taste, or the memory of his father's death, kept him far apart from the republican party, and he was perhaps the most remarkable literary continuator of the *ancien régime* as far as light novels were concerned. His life was almost entirely uneventful, his chief incident being a burglary which was committed at his country house at Roumouville in his later days. For the most part he resided on the Boulevard St Martin, and was one of the most inveterate of Parisians.

Paul de Kock began to write very early, and continued to produce novels almost until the end of his long life. But his period of greatest and most successful activity was the Restoration and the early days of Louis Philippe. The comparative "pataminy" of his style, and the fact of his standing aloof from the whole innovating movement in

literature as in politics, made him relatively less popular in France itself than abroad, where he was considered as the special painter of life in Paris. Major Ponsdenn's remark that he had read nothing of the novel kind for thirty years except Paul de Kook, "who certainly made him laugh," is likely to remain one of the most durable of his testimonials, with as a companion the legendary question of a foreign sovereign to a Frenchman who was paying his respects, "Vous vanez de Paris et vous devez savoir des nouvelles. Comment se porte Paul de Kook?" The disappearance of the *grisette* and of the cheap dissipation which Murger pathetically laments in more than one of his works practically made Paul de Kook obsolete, and his want of style affected him as unfavorably as it did his dramatic analogue Scriba. But to the student of manners his vivid and by all accounts truthful portrayal of low and middle class life in the first half of the 18th century at Paris will never lose its value, and, though he can hardly be said to hold a high place in literature, he is a remarkable follower of Restif de la Bretonne, and may be said to be in a sense the last of the 18th century school of novelists.

It has been said that the works of Paul de Kook are very numerous. In the fullest list that we have seen they amount to about a hundred, some of them being decidedly voluminous. With the exception of a few not very felicitous excursions into the historical romance, they are all stories of middle class Parisian life, of *quingettes* and *cabarets* and equivocal adventures of one sort or another. The most famous of all is *Le Barbier de Paris*, which has been translated into almost every European language. Of equal literary merit, and, considering the style, of singular freedom from objectionable characteristics, is *André le Sauvageur*, a remarkable story, full of narrative power, and one of the happiest examples of the working up of simple and commonplace details into an interesting whole. A certain sameness pervades most of Paul de Kook's work. It is almost untouched by the influences of the romantic movement, and has none of the strong sentiments of the school which derived from the author's contemporary Balzac. But there is a good deal of human nature in it, a good deal of accurate observation, and an almost total absence of the revolting and the preposterous. Paul de Kook was the Charles de Bernard of low life, and greater praise of its kind could hardly be given to any writer.

KODUNGALUR, or **CHANGANNORE**, a town in Cochin state, Southern India, 10° 18' 50" N. lat., 76° 14' 50" E. long., with a population (1876) of 9476.

Though now a place of little importance, its historical interest is considerable. Tradition assigns to it the double honour of having been the first field of St. Thomas's labours (68 A.D.) in India and the seat of Chozomad Perumal's government (843). The visit of St. Thomas is generally considered mythical; but it is certain that the Syrian Church was firmly established here before the 9th century (Burnell), and probably the Jews' settlement was still earlier. The latter, in fact, claim to hold grants dated 378 A.D. The enmity of the Portuguese drove most of the Jews to Cochin. Up to 1814, when the Vypin harbour was formed, the only opening in the Cochin backwater, and outlet for the Periyar, was at Kodungalur, which must then have been the best harbour on the coast. In 1602 the Syrian Christians invoked the protection of the Portuguese. In 1638 the latter built their first fort there, and in 1658 enlarged it. In 1661 the Dutch took the fort, the possession of which for the next forty years was contested between this nation, the Zamorin, and the raja of Kodungallur. In 1776 Tipu (Tippon) seized the stronghold. The Dutch recaptured it two years later, and, having ceded it to Tipu in 1784, sold it to the Travancore raja, and again in 1789 to Tipu, who destroyed and left it in the following year.

KOHAT, a district in the lieutenant-governorship of the Punjab, India, is situated between 33° 47' and 35° 53' N. lat., and between 70° 34' and 73° 17' E. long., and is bounded on the N. by Peshawar, on the E. by the Indus

river, on the S. by Bannu district, and on the W. by the Kunm river and the Waziri hills. It consists chiefly of a bare and intricate mountain region, deeply scored with river valleys and ravines, but enclosing a few scattered patches of cultivated lowland. The eastern or Khatak country especially comprises a perfect labyrinth of ranges, which fall, however, into two principal groups, to the north and south of the Teri Toi river. The Miranzai valley, in the extreme west, appears by comparison a rich and fertile tract. In its small but carefully tilled glades, the plane, palm, fig, and many orchard trees flourish luxuriantly; while a brushwood of wild olive, mimosa, and other thorny bushes clothes the rugged ravines upon the upper slopes. Occasional grassy glades upon their sides form favourite pasture grounds for the Waziri tribes. The Teri Toi, rising on the eastern limit of Upper Miranzai, runs due eastward to the Indus, which it joins 12 miles north of Makhad, dividing the district into two main portions. The drainage from the northern half flows southward into the Teri Toi itself, and northward into the parallel stream of the Kohat Toi. That of the southern tract falls northwards also into the Teri Toi, and southwards towards the Kunm and the Indus. The frontier mountains, continuations of the Safed Koh system, attain in places a considerable elevation, the two principal peaks, Dupa Sir and Maseo Garh, just beyond the British frontier, being 8260 and 7040 feet above the sea respectively. The Waziri hills, on the south, extend like a wedge between the boundaries of Bannu and Kohat, with a general elevation of less than 4000 feet. The salt mines are situated in the low line of hills crossing the valley of the Teri Toi, and extending along both banks of that river. The deposit has a width of a quarter of a mile, with a thickness of 1000 feet; it sometimes forms hills 200 feet in height, almost entirely composed of solid rock-salt, and may probably rank as one of the largest veins of its kind in the world. The most extensive exposure occurs at Bahadur Khel, on the south bank of the Teri Toi. Petroleum springs exude from a rock at Panoba, 23 miles east of Kohat; and sulphur abounds in the northern range.

The census of 1888 extended over an area of 2383 square miles, and disclosed a total population of 145,410 (males, 79,328; females, 66,096). The Mohammedans numbered 136,566, as against 6544 Hindus, 1887 Sikhs, and 478 "others." The Hindus chiefly belong to the trading castes. Among the Mohammedans, 6818 rank as Sayyids; but the Pathans form by far the largest division. Only one town, Kohat, contains a population exceeding 5000 inhabitants. Since the annexation of the Punjab, cultivation has extended from 64,772 acres in 1848 to 163,016 acres in 1878-79. The agricultural staples include wheat and barley for the spring harvest, with rice, millet, Indian corn, and pulses for the autumn crops. Tobacco, mustard, and oil-seeds also cover small areas, and cotton of inferior quality is grown in favourable years. The area under wheat in 1878-79 was returned as 88,400 acres; barley, 17,470; millets, 28,705; Indian corn, 13,050; rice, 4710 acres. Cultivation has now nearly reached its utmost limit. The principal industry of the district is centred in the salt mines. Of these five are now open, from which 294,680 cwts. of salt were quarried in 1870-71. Gun barrels manufactured near Kohat town are a considerable reputation along the north-western frontier. Coloured carpets, woollen carpets, country cloth, and pottery are also turned out at Kohat, Hangan, and Teri. The frontier military road forms the chief channel of communication, practicable throughout for wheeled conveyances and artillery. The district has altogether 246 miles of road, all unmetalled, and in many cases mere tracks, passable at best by camels, and sometimes only by bullocks or ponies. The total imperial revenue raised in the district in 1865-62 amounted to £6894, which in 1872-73 had risen to £19,448, of which the land-tax contributed £8951, and salt £8566. Education remains in a very backward stage. Four Government or aided schools and forty-three indigenous schools had a total roll of only 746 pupils in 1872-73. From its proximity to the hills, the temperature of the district is comparatively cool, except during the summer months.

Kohat, the chief town and cantonment of the above district, situated in 33° 53' N. lat. and 71° 29' 43" E.

long, near the north bank of the Kohat Toi river, and 2 miles from the southern base of the Afridi Hills. The population in 1868, including the cantonment, was 11,271. The town is built on undulating ground, within an amphitheatre of hills, and is surrounded by a slight wall, 12 feet in height. Its principal manufacture is that of gun barrels. The cantonment and civil station lie to the east and north-east of the native city. The cantonment has accommodation for about 3000 troops.

KOLLÉ, JOHANN GEORG (1808-1878), traveller and author, was born at Bremen, April 28, 1808. He studied law at Göttingen, Heidelberg, and Munich, and for six years was a private tutor in Courland. In 1838, after travelling through parts of Russia, he settled at Dresden. The success of four books, which he published in 1841, describing his Russian experiences, decided his choice of literature as a profession. Travels in Europe and America supplied ample material, and book after book appeared. In 1851 he undertook to prepare an historical coast survey of the United States, in the service of Government. In 1855 he returned to Bremen, where in 1863 he was made city librarian. In that post he died, October 28, 1878.

Kohl was a popular author, and his books, both in the original and in English translations, have enjoyed considerable popularity. His style is agreeable and lively, and not without humour; his observation was acute, and not more superficial than was inevitable from the mode in which he amassed his materials. Besides the books on Russia, Kohl published works on Austria-Hungary (1842), England, Scotland, and Ireland (1844), the Alps (1848-51), Denmark and the Northern Duchies (1846-47), north-eastern Germany (1852), the Netherlands (1850), Istria, Montenegro, &c. (1851), the Danube (1854), Canada and New England (1857), the north-west of the United States (1860), Lake Superior ("Kitchi-Dani") (1869). Among his historical, geographical, and miscellaneous writings are the following:—*Der Rhein*, 2 vols., 1851; *Das westliche Elben*, 3 vols., 1850; *Geschichte des Endelungslandes*, 1861; *Die Frau Sühndi zu Bremen*, 1862; *Norddeutsche Skizzen*, 1864; *History of the Discovery of Maine*, 1860; *Die Völker Europas*, 2 vols., 1872; *Kleine Essays*, 1876.

KOLABA, a district of the Bombay Presidency, India, lying between 17° 52' and 18° 50' N. lat., and between 73° 7' and 73° 42' E. long. It is bounded on the N. by Bombay harbour and Thana district, on the E. by Poona and Satara, on the S. by Ratnagiri and Janjira state, and on the W. by the Arabian Sea. Lying between the Sahyadri range and the sea, Kolāba district abounds in hills, some being spurs of considerable regularity and height, running at right angles to the main range, whilst others are isolated peaks or lofty detached ridges. The sea frontage, of about 20 miles, is throughout the greater part of its length fringed by a belt of cocoa-nut and betel-nut palms. Behind this belt lies a stretch of flat country devoted to rice cultivation. In many places along the banks of the salt-water creeks there are extensive tracts of salt marsh land, some of them reclaimed, some still subject to tidal inundation, and others set apart for the manufacture of salt. The district is traversed by a few small streams. Tidal inlets, of which the principal are the Nāgathona on the north, the Roha or Chaul in the west, and the Bānkot creek in the south, run inland for 30 or 40 miles, forming highways for a brisk trade in rice, salt, firewood, and dried fish. Near the coast especially, the district is well supplied with reservoirs. The Sahyadri range has two remarkable peaks—Rāigiri, where Sivaji built his capital, and Mirādongar. There are extensive teak and black wood forests, of which the value is increased by their proximity to Bombay. The Kolāba teak has been pronounced the best grown in the Concan, and inferior only to that of Calicut. In 1875-76 the forest revenue amounted to £3634. Tigers and leopards are found all over the district, and bears on the Sahyadri range, Hyenas and jackals abound. Bison, *sāmbhar*, and cheetah have been shot, but are very rare.

Kolāba district, with the exception of Alibāgh subdivision, formed part of the dominions of the peshwa, annexed by the Bombay Government in 1818. Alibāgh lapsed to the paramount power in 1839.

The population in 1872 was 356,405—Hindus, 330,914; Mohammedans, 17,104; Parsis, 25; Jews, 1940; and Christians, 208. Of the Hindus the most important class are the Bishnams, who own large gardens and palm groves along the coast. Another important class are the Bhāndāras, or toddy-drawers and cocoa-nut cultivators. The Bani-lamel (see vol. xii p. 686) are chiefly found in the sea-board tracts. A considerable number of them enlist in the native army, and are highly esteemed as soldiers. They also monopolize the work of oil-pressing to so great an extent that they are generally known as *oilmen* or *tels*. The total area of Government cultivable land in 1876-77 was returned at 468,846 acres, of which upwards of 98 per cent was taken up for cultivation. Rice forms the staple produce, and is the chief export of the district. The inferior grains are *sachas* (*Elaeagne coratensis*), *scars* (*Panicum miscitatum*), and *hariri* (*Paspalum frumentaceum*); and these form the chief food supply of the people. The estimated value of the exports (rice, salt, timber, vegetables, and fruit) is £438,349, of the imports (grain, ryoco goods, oil, butter, and sugar), £170,615. The local industries are salt manufacture and silk-weaving. The total imperial, local, and municipal revenue in 1876-77 was £106,808, of which £72,463 was contributed by the land tax. There are seventy-one Government or aided schools attended by 3844 pupils. The average annual rainfall is 75 inches. The chief town of the district is Alibāgh.

KOLAR, or COLAR, a district of Mysore state, Southern India, lying between 12° 46' and 13° 28' N. lat., and 78° 5' and 78° 35' E. long. It occupies that portion of the Mysore table-land immediately bordering the Eastern Ghāts. The principal watershed lies in the north-west, around the hill of Nandidrug (4810 feet), from which rivers radiate in all directions, and the whole country is broken by numerous hill ranges. The chief rivers are the Pālar, the South Pinākini, Pennar, the North Pinākini, and the Papagani, which are industriously utilized for irrigation by means of canals and tanks. The rocks of the district are mostly syenite or granite, with a small admixture of mica and felspar. The soil in the valleys consists of a fertile loam, and in the higher levels sand and gravel are found. The hills are covered with scrub, jungle, and brushwood. The only tract where the trees attain any size is in the neighbourhood of Nandidrug, where an area of 7 square miles has been reserved by the forest department.

The population in 1871 was 618,864, spread over an area of 2577 square miles—Hindus numbering 668,652; Mohammedans, 25,038; Jains, 651; and Christians, 618. Two towns contain upwards of 5000 inhabitants, namely, Kōlar, 9924; Chikhalapur, 9882; Sālaghatta, 7009; and Hosur, 6711. The staple agricultural produce are rice, ragi, and *yaar*. Pulses, oil-seeds, vegetables, and tobacco are also grown on limited areas. Cattle breeding has recently been fostered by the British Government, and large cattle fairs are held annually. The manufactures of the district comprise sugar, silk and cotton weaving, and oil-pressing. Iron ore is smelted in considerable quantities. The principal exports are sugar, rice, ragi, ryocoan cloth, betel leaf, opium, and *gah*; the imports are European piece goods and salt. The total revenue of the district in 1873-74 amounted to £119,448, of which £97,470 was derived from the land and paid by 78,547 proprietors of 678 separate estates. The Government aided and inspected schools in 1874 numbered 288, attended by 6547 pupils; in addition there were also 109 unaided schools. The district bears a good reputation for healthiness, the mean annual temperature being 76°, and the average annual rainfall 29.17 inches.

The early history of the district is enshrouded in the usual Hindu legends, chiefly localized at the village of Avani, which is still a popular place of pilgrimage, as containing a *linga* set up by Iama himself. The earliest authentic evidence shows that Kōlar in primitive times formed part of the kingdom of the Pallavas, a dynasty overthrown by the Chōlas, to whom is assigned the foundation of Kōlar town. After the Chōlas came the Balliā kings, who in their turn gave way to the powerful monarch of Vijayanagar, in the early part of the 14th century. About this period arose the Gauda family, whose offspring appear to have submitted meekly to every conqueror until they were swept away by Hyder Ali. The first Mohammedans to invade this tract were the Bālikpur king, whose general was the Marhattā Shāhji, the father of Sivaji the Great. In 1698 Shāhji obtained Kōlar as a fief, which he transmitted to his son Yashoji or Kōaji, the

founder of the Tanjore line. Subsequently Koldu was overrun by the Mughals. In 1791 it was formally ceded by the sultan to Hyier Ali, who was a native of the state, having been born at the little village of Bulkot, and after the fall of Tipu in 1799 it was incorporated in the British state of Mysore. The chief historical interest of modern times centres round the hill fort of Nandur (Nandurghat), which was stormed by the British in 1791, after a bombardment of twenty-one days. Koldu, which with the rest of Mysore had been under British administration since 1835, was restored to its native chief in March 1881.

KÖLCSEY, FERENCZ or FRANCES (1790-1838), a distinguished Hungarian poet, critic, and orator, was born at Szodemer, in Transylvania, on the 8th of August 1790. His parents both died during his childhood, leaving him to the care of a trusted female servant. At an early age Kolcsy was sent to the Calvinistic school at Debreczen, where he acquired a sound knowledge of the Latin and Greek classics, as also of the leading Hungarian and German poets. In his fifteenth year he made the acquaintance of Kazinczy, and zealously adopted his linguistic reforms. In 1809 Kolcsy went to Pest with the intention of following the legal profession, and became a "notary to the royal board." The public career of a lawyer, however, proving distasteful to him, he soon left the city, and, secluding himself at Cséke in Szatmár county, devoted his time to æsthetic study, poetry, criticism, and the defence of the theories of Kazinczy. Kolcsy's early metrical pieces contributed to the *Transylvanian Museum* did not attract much attention, whilst his severe criticisms of Csokonai, Kis, and especially Berzsényi, published in 1817, rendered him very unpopular. From 1821 to 1826 he published many separate poems of great beauty in the *Aurora*, *Hébe*, *Aspasia*, and other magazines of polite literature. Having by these means again risen in the estimation of the literary public, he was induced by Paul Szemere to join him in the production of a new periodical, styled *Élet és Irodalom* ("Life and Literature"), which appeared from 1826 to 1829, in 4 vols., and gained for Kolcsy the highest reputation as a critical writer. About this time his powers as an orator began to be displayed in his capacity of upper notary to the county of Szatmár. From 1832 to 1835 he sat in the Hungarian diet, where his extreme liberal views and his singular eloquence soon rendered him famous as a parliamentary leader. In the meantime he had not been inactive as a literary savant. Elected on the 17th November 1830 a member of the Hungarian Academy of Sciences, he took part in its first grand meeting, in 1832 he delivered his famous oration on Kazinczy, and in 1836 that on his former opponent Daniel Berzsényi. When in 1838 Baron Wesselényi was unjustly thrown into prison upon a charge of treason, Kolcsy eloquently though unsuccessfully conducted his defence; and he died about a week afterwards (24th of August) from internal inflammation. His collected works, in 6 vols., were published at Pest, 1840-48, and his journal of the diet of 1832-36 appeared in 1848. A monument erected to the memory of Kolcsy was unveiled at Szatmár-Námeti on the 25th of September 1864.

See G. Steinsacker, *Ungarische Lyriker, Lektüre und Pest*, 1874; F. Tölgy, *Magyar Költők élete*, 4 vols., Pest, 1871; J. Ferenczy and J. Dalmák, *Magyar Írók*, 2 vols., Pest, 1868-68.

KOLDING, a town in the district of Velle, Denmark, is situated on the east coast of the province of Jutland, on the Koldingfjord, an inlet of the Little Belt. It has some little shipping, but its harbour is not deep. A little to the north-west is the splendid ruin of the royal castle Koldinghus, formerly called Oersborg or Arneborg. It was begun by Duke Abel in 1248; in 1808 it was burned. The large square tower was built by Christian IV. (1688-1648), and was surmounted by colossal statues, of which one is still standing. The name of Kolding occurs in the 10th century; but its earliest known town-rights date from

1331. In 1644 it was the scene of a Danish victory over the Swedish, and in 1849 of a Danish defeat by the Schleswig-Holstein troops. The population in 1870 was 5400.

KOLHÁPÜR, a native state in the Bombay Presidency, India, lying between 15° 58' and 17° 11' N. lat., and between 73° 45' and 74° 24' E. long., it is bounded on the N. by Sátard district, on the E. and S. by the states of Sangli, Miraj, and Kurunehwad, and on the W. and S.W. by Sawantwari state and Ratnagiri district. The area is 3184 square miles. Kolhápür state stretches from the heart of the Sahyadri range eastwards into the plain of the Deccan. Along the spurs of the main chain of the Sahyadri hills lie wild and picturesque hill slopes and valleys, producing little but timber, and till recently covered with rich forests. The centre of the state is crossed by several lines of low hills running at right angles from the main Sahyadri range. In the east the country becomes more open, and presents the unpicturesque uniformity of a well-cultivated and treeless plain, broken only by an occasional river. Among the western hills are the ancient Marhatta strongholds of Pashala, Vishalgiri, Bura, and Ilunga. The rivers, though navigable during the rains by boats of 2 tons burthen, are all fordable during the hot months. Iron ore is found in the Sahyadri range, and smelting was formerly carried on to a considerable extent; but now the Kolhápür mineral cannot compete with that imported from Europe. There are several good stone quarries. The principal agricultural products are rice, millet, sugar-cane, tobacco, cotton, safflower, and vegetables. The population of the state, including feudatories, was 802,691 in 1872, Hindus amounting to 98½ per cent., and Mohammedans to 4 per cent. Pottery, hardware, and coarse cotton and woollen cloth are the principal manufactures. The chief exports are coarse sugar, tobacco, cotton, and grain; piece goods, salt, silk, sulphur, and spices are imported.

The title of Kolhápür traces their descent from Raja Rám, a younger son of Sivaji the Great, the founder of the Marhatta power. The prevalence of piracy caused the British Government to send expeditions against Kolhápür in 1765 and 1792; and in the early years of this century the misgovernment of the chief compelled the British to resort to military operations, and ultimately to appoint an officer to manage the state. In 1829 a treaty was concluded with Sivaji III. The revenue of the state is estimated at £204,000. The military force consists of 1618 men. Exclusive of a few masonry institutions, there are in all 104 schools, attended by 6106 pupils. The climate is on the whole temperate.

KOLHÁPÜR, the capital of the above state, is situated in 16° 43' N. lat. and 74° 18' E. long., 135 miles south by east of Poona. It is a picturesque, flourishing trading town, adorned with many handsome buildings. Population in 1872, 89,631.

KOLIN (Böh., *Nový Kolín*, i.e., New Kolín), a town in the circle of Kautzin, Bohemia, is situated on the Elbe, about 36 miles east of Prague, with which city as also with Berlin it is connected by the Austrian State Railway, here intersected by the north-western line, in 50° 4' N. lat., 16° 14' E. long. Among the many noteworthy buildings in Kolín may be specially mentioned the church of St Bartholomew (Early Gothic style), erected during the latter half of the 14th century, the castle, and the town-hall. The educational and industrial establishments comprise collegiate institutes for both sexes, a commercial school, religious houses, several sugar refineries and oil-mills, a spirit distillery, and an artificial manure factory. Population of commune 9473, of town 9199. Kolín is chiefly famous on account of the battle of Chotzenitz or Kolín, 18th June 1767, when the Prussians under Frederick the Great were defeated by the Austrians under Daun.

KOLOMEJA, or KOLOMYJA, a town and district in the Austrian province of Galicia, lies on the right bank of the Pruth and on the railway from Czernowitz to Lemberg,

about 105 miles south-south-east of the latter, in 48° 31' N. lat., 25° 1' E. long. Koloneka is the seat of the administrative, military, and judicial authorities of the district, and has Roman Catholic churches, synagogues, a lower gymnasium, and manufactures of earthenware. More than a third of the inhabitants are Jews, who carry on the greater part both of the wholesale and retail trade. The Ruthenian or native population of the town and neighbourhood are mostly employed in agricultural pursuits, and in the pasturing of horses, oxen, and sheep. In 1881 the population amounted to 23,100.

KOLOMNA, a district town of Russia, in the government of Ryazan, situated on the railway between Moscow and Ryazan, 67 miles south-east of Moscow, at the confluence of the Moskva river with the Kolomeuka. It is an old town mentioned in annals in 1177, and until the 11th century the capital of the Ryazan principality. It suffered greatly from the invasions of the Tatars, who destroyed it four times, as well as from the wars of the 17th century; but it always recovered, and never has lost its commercial importance. During this century it became a centre of manufactures of silks, cottons, and leather; there are also several smaller manufactures. The merchants of Kolomeuka carry on an active trade in cattle brought from southern provinces, and in grain, cattle, tallow, skins, salt, and timber purchased in the governments of Ryazan and Tula, and sent to Moscow, either by rail, or by boat down the Moskva river. Population 19,000.

KOMORN, or KOMORN (Hungarian, *Rév-Komárom*), a royal free town of Hungary, and capital of the trans-Danubian county of Komárom, lies at the eastern extremity of the island of Csüllőköz or Schilt, and at the confluence of the Wag with the Danube, 48 miles west-north-west from Budapest, with which city it also with Vienna it is directly connected by railway, in 47° 46' N. lat., 18° 7' E. long. Komorn is celebrated chiefly for its fortifications, which, owing to their favourable position and extended line of *étoiles-de-pont*, are believed to be impregnable, and are capable of holding a force of some 30,000 defenders. The town is the seat of the county administration, and of a royal court of law, and has Roman Catholic, Greek Orthodox, Lutheran, and Calvinist churches, a Jewish synagogue, Roman Catholic and Protestant gymnasia, county and town halls, a military hospital, two savings banks, and a shipping agency. The streets are for the most part narrow, irregular, and gloomy. The commercial relations of Komorn with the chief towns on the Danube are facilitated by its important steam-packet station. The inhabitants carry on a brisk trade in grain, timber, wine, flour, and fish. The civil population at the end of 1880 amounted to 13,108, mostly Magyars and Germans by nationality.

The walls of the fortifications of Komorn were commenced from the land side in 1572. They were much strengthened and extended two hundred years later by King Matthias (Corvinus). The new fort was begun by Ferdinand I about 1647, and received additions in 1673 under Leopold I. In 1648, 1694, 1698, and 1699 Komorn was beleaguered by the Turks. It was raised to the dignity of a royal free town in 1761. In 1787, 1798, September 1848, and April 1854 it suffered severely from fire, and in 1788, 1822, and 1851 from earthquakes. The fortifications, having been neglected during the latter half of the 18th century, were enlarged and to a great extent reconstructed between 1805 and 1806. During the revolutionary war of 1848-49 Komorn was a principal point of military operations, and was long unsuccessfully besieged by the Austrians, who on the 11th July 1849 were defeated there by General Görgei, and on the 3d August by General Klapka. On the 27th September the fortress capitulated to the Austrians upon honourable terms, and on the 3d and 4th October was evacuated by the Hungarian troops. The treasure of the Austrian national bank was removed here from Vienna in 1866, when that city was threatened by the Prussians.

KOMOTAU, a town and district of Bohemia, at the foot of the Erzgebirge, and at the junction of the Buschtiehrud, Dux-Bodenbach, and Aussig-Tepitz lines of railway, about

10 miles north-north-west of Saas, in 50° 27' N. lat., 13° 20' E. long. An old but thriving town, Komotau is the seat of the military and judicial authorities of the district, as also of boards of mining and of customs. The industrial establishments comprise hosiery, breweries, distilleries, and vinegar works, a sugar of lead manufactory, and an iron foundry. The amount of beer delivered in 1880 was 535,683 gallons. Lignite is worked in the neighbourhood. At the end of 1880 the population was 10,111.

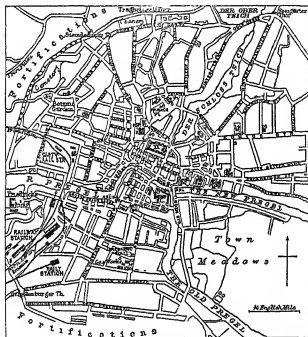
KONGSBERG, a mining town in the district of Buskerud, Norway, is situated on the Laagen, 500 feet above the sea, and about 60 miles south-west of Christiania by rail. With the exception of the church and the town-house, the buildings are mostly of wood. The origin and whole industry of the town are connected with the Government silver-mines in the neighbourhood. Their first discovery was made by a peasant in 1623, since which time they have been worked with varying success. Over a hundred mines have been opened, but of these only three are now of any importance. The annual profit averages about £22,000. During last century Kongsberg was much more important than it now is, and contained more than double its present population. Dr Clarke in his *Travels* (1823) gives a good description of the place, and mentions a mass of native silver, nearly 600 lb in weight, found there, which is preserved in the museum at Copenhagen. Within the town of Kongsberg are situated the smelting-works, the mint, and a Government weaving factory. The population of the town in 1875 was 4811.

KONIGGRATZ (Bohemian, *Královéhradeck*), a fortified town and episcopal seat in Bohemia, at the confluence of the Adler with the upper Elbe, and at the junction of the Reichenberg-Paraditz and North-Western lines of railway, in 50° 10' N. lat., 15° 49' E. long. Wax candles, gloves, shoes, woollen cloths, and musical (wind) instruments are manufactured. The population in 1880 was 6173. The place is chiefly notable from the battle of Königgratz or Sadowa fought in its neighbourhood on 3d July 1866, when the defeat of the Austrians under Benedek decided the German supremacy of Prussia, and led to the acquisition of Venice by Italy and the constitutional independence of Hungary. See Jahns, *Die Schlacht bei Königgratz*, 1876.

KÖNIGINHOF (in Czech, *Dvůr Králové*), chief town of a department in the north-east of Bohemia, is situated on the left bank of the Elbe, about 80 miles north-east of Prague. In the tower of one of the churches Hanka discovered the Königinhof MSS. in 1817 (see vol. xi. p. 440). The Zaby monument in the market-place commemorates the discovery. Cotton-weaving, yarn-spinning, and brewing are the leading industries. In 1421 Königinhof was stormed by the Hussites. On June 23, 1866, it was the scene of a Prussian victory over the Austrians. The population in 1869 was 6222.

KÖNIGSBERG (in Polish *Królewiec*), chief town of a government district in the province of East Prussia, and since 1843 a fortress of the first rank, is situated on the Pregel, 4½ miles from its mouth in the Frische Haff, 25 miles from the sea-coast, and 397 miles north-east of Berlin, in 54° 43' N. lat. and 20° 30' E. long. It consists of three formerly independent parts—the Altstadt (old town) to the west, Lobenicht to the east, and the island Kniphof, together with numerous suburbs, embraced in a circuit of 24 miles. The Pregel, spanned by many bridges, flows through the town in two branches, which unite below the Green Bridge. Its greatest breadth within the town is from 80 to 90 yards. It is frozen from November to March. Although an old town, Königsberg does not retain many marks of antiquity. The Altstadt has long

and narrow streets, but the Kneiphof quarter is roomier. Of the seven market-places only that in the Altstadt retains something of its former appearance. Among the more interesting buildings are the Schloss, a long rectangle begun in 1255 and added to later, with a Gothic tower 277 feet high, and the chapel (built 1592) in which Frederick I placed the Prussian crown on his own head in 1701, and the cathedral, begun in 1323, restored in 1856, a Gothic building with a tower 164 feet high. Behind the Schloss is the parade-ground, with the statue of Frederick William III by Kiss. To the east is the Schlosssteich, a long narrow ornamental lake covering 12 acres, with beautifully laid out tree-shaded banks. The north-west side of the parade-ground is occupied by the new university buildings, completed in 1873, along with the new exchange on the south side of the Pregel, they are the finest architectural feature of the town. The university was founded in 1544 by Albert I, duke of Prussia,



Plan of Königsberg

- | | | |
|-----------------------------------|--------------------------|--------------------------|
| 1 Observatory | 8 Post Office | 16 Library |
| 2 Zoological Museum | 9 Kant's House | 17 Roman Catholic Ch. |
| 3 Polish Church | 10 Statue of Kant | 18 Hospital |
| 4 New City Buildings | 11 Schloss | 19 Bank |
| 5 Theatre | 12 Statue of Frederick I | 20 Old University Build. |
| 6 Statue of Frederick William III | 13 Hofmied Church | 21 Cathedral |
| 7 New Altstadt Church | 14 Academy of Painting | 22 Exchange |
| | 15 Town Museum | |

it possesses a library of 200,000 volumes. Among its famous professors have been Kant (born in Königsberg in 1724), to whom a monument was erected in 1864, Herder, Heibart, Bessel, Voigt, K. E. von Baer, F. Neumann, and others. In the summer session of 1880 it had a teaching staff of 88, in the winter session 1880-81 its students numbered 808. Königsberg has also four gymnasia, two commercial schools of the first rank, an academy of painting with a public picture gallery, and a school of music, besides other educational establishments. The hospitals and benevolent institutions are numerous. The protected position of its harbour has made Königsberg one of the important trading cities of Germany. Ships of more than 1500 tons have to discharge cargo at Pillau, at the entrance to the Haff, connected with Königsberg by rail, and the grain trade with the interior is carried on by barges. The chief imports and exports of Königsberg are grain, spirits, colonial wares (especially tea),

petroleum, coal, iron, herrings, flax, hemp, and wood. The exports by sea for the third quarter of 1881 amounted to 16,508 tons, and the imports from Russia alone to 42,479 tons. The number of ships that entered Königsberg and Pillau in 1879 was 1653 (278,000 tons), the number that cleared was 1656 (299,000 tons). The corresponding figures for 1880 were not so large. The manufactures of Königsberg are not very important. They include iron, machinery, beer, spirits, sail-cloth, cloth, oil, flax, leather, and its specially "matchpane." There is also yarn-spinning, cloth-printing, dyeing, tanning, and tobacco manufacture. The population, in 1858 only 83,000, was 140,896 in 1880.

The Altstadt of Königsberg grew up around the castle built in 1255 by the Teutonic Order, to restrain the neighbouring heathens. Its first site was near the fishing village of Steinbrunn, but after its destruction by the Prussians in 1293 it was rebuilt in its present position. By 1327 all three parts, which were only united in 1724 by Frederick William I, had acquired city rights. In 1340 Königsberg entered the Hanseatic League, and in 1361 it was in direct alliance with England. From 1457 it was the residence of the grand master of the Teutonic Order, and from 1525 till 1813 of the dukes of Prussia. The tide of Königsberg was much limited by the constant shifting and silting up of the channels leading to its harbour, and the great northern wars did it immense harm. By the end of the 17th century it had almost recovered, and during the 19th century the opening of the railway system in East Prussia and Russia gave it commerce a new impetus, making it the principal outlet for the Russian staples—grain, seals, flax, and hemp. It has now regular steam communication with Memel, Stettin, Kiel, Amsterdam, and Hull. The local shipping is unimportant.

KONIGSHUTTE, a town in the circle of Benthien in the government district of Oppeln, Prussia, is situated in the middle of the Upper Silesian coal and iron district, about 55 miles south-west of Oppeln. In 1899 it was incorporated with various neighbouring villages, and raised to the dignity of a town. The largest non-work in Silesia is situated at Königshutte, and includes puddling works, rolling-mills, and zinc-works. Founded in 1797, it was formerly in the hands of Government, but it is now carried on by a company. In 1877 it employed about 3000 hands, and turned out 54,000 tons of raw iron, 41,700 tons bar-iron, &c., 750 tons raw zinc, and 19,600 tons of steel goods for railways, &c. In the neighbourhood of the town there are coal-mines, chalk-quarries, and brick-fields. The population in 1882 was 4495, in 1875 it was 26,040.

KONITZ, or KONRTZ, a town of the German empire, in the Marienweider district of the province of West Prussia, situated near the railway, about 68 miles south-west of Danzig. It was the first fortified post established in Prussia by Bolk, the grand master of the Teutonic Order, and it continued for a long time to be a place of military importance. Wool and iron are the chief objects of the local industry. The inhabitants numbered 8046 in 1875, about 3000 are Roman Catholics and 550 Jews. There is a history of the town by Upenkamp (Konitz, 1873).

KONOTOP, a district town of Russia, in the government of Tchernigoff, 137 miles north-east of Kiev, on the railway from this town to Kursk. Its 10,000 inhabitants live by agriculture, boat building, and trade. Situated in a district which produces a good deal of corn and is also engaged in cattle and sheep breeding, it has a brisk and rapidly increasing trade in agricultural produce. The town was founded in 1635 by the Poles, who built a strong citadel, the ruins of which still exist. In 1648 it was taken by the Cossacks of Khmelnitzky, and in 1659, during Vigovsky's insurrection, Russian troops besieged it.

KOPENICK, or KOPENIK, a town in the circle of Teltow in the government district of Potsdam, Prussia, is situated on an island at the influx of the Dahme into the Spree,

8 miles S.E. of Berlin. Two bridges connect it with the mainland. It has a royal palace, with a ritter-saal and a chapel, and a normal school (in the palace). Silk-weaving, calico-printing, iron rolling, and the manufacture of sugar, shoddy, glass, chemicals, gold-leaf, &c., are the chief industries. There are also steam saw-mills, and some little shipping. Kopenick was the residence of the heathen prince Jaco, and later of the electors of Brandenburg. It was at Kopenick that Frederick the Great was tried by court martial, when crown-prince. The population in 1875 was 7113.

KOPREINITZ, an ancient royal free town of Hungary, in the province of Croatia and Slavonia and county of Korus, is situated about 16 miles north-east of the county town Korus (Kreutz), and on the Zákány-Zágráb line of the Hungarian state railway, in 46° 13' N. lat., 16° 50' E. long. The most interesting building is the old castle or fort, still in a good state of preservation, and now used as barracks. There are also in the town Roman Catholic and Greek Orthodox churches, a Jewish synagogue, a town-hall, and a municipal savings bank, besides the usual Government offices. Both the weekly and occasional fairs are well attended, but the trade is chiefly confined to the agricultural products of the neighbourhood. The communal lands, extending principally over a level plain, yield large quantities of grapes, fruit, beans, timber, and grain, especially maize. Population in 1880, 6049.

KOPRILI, KOPRILIZ, or KÖPRÜLÜ, a town in the vilayet of Piriand, Macedonia, Turkey, is situated on both sides of the Vardar, the ancient Axios. Its Christian inhabitants call it Velea, probably a corruption of Byzantia, described by Polybius as the chief city of Paonia. Owing to the position of the town on sloping hills, the streets are steep; there are, however, numerous well-built houses. A wooden bridge crosses the river at this point. Mulberry trees and maize are grown in the neighbourhood. The population of Koprili, which has given its name to a celebrated family of viziers, is about 15,000.

KORAN. See MOHAMMED.

KORAT, a small territory, tributary to Siam, is situated to the north-east of Bangkok, on the borders of Siam and Cambodia. The approach to it from Bangkok is through an extensive malarious forest, called by the natives, on account of its fatal character, Dong Phray Phai, the forest of the king of fire. The chief mountain is named Khaojai, and from it flows the river Mahok. The productions and exports from Korat comprise stags' and panthers' skins, raw silk, manufactured silk and cotton, peacocks' tails, ivory, elephants' bones, and a small quantity of sugar. The copper-mines of Korat are said to be rich; silk of rather inferior quality is brought from Laos, Ubone, and Bassac. Elephants, buffaloes, and oxen are abundant in the province. Korat is governed by a ruler who has absolute power of life and death. It pays a tribute of gold, silver, and silk to Siam, and has to furnish a large levy of men when required. Sir John Bowring estimates the population of the whole district at 60,000. Korat, the chief town, lies about 170 miles north-east of Bangkok. It is surrounded by a wall, and stands on a stream whose banks are bordered with little plantations of betel and coco-nut trees. Outside the town proper is the Chinese quarter, consisting of sixty or seventy houses surrounded by a strong palisade 9 feet high. The Chinese number about 600, and are the industrious trading element in the population. The native name of Korat is Nakhon Raxa Sema, or frontier town. The population is 5000 or 6000.

KORDOFAN, a province of the Egyptian Sudan, which, though marked off from the surrounding territory by no very definite confines, may be said to lie between 12° and

16° N. lat. and between 29° 30' and 32° 30' E. long. On the east it does not reach the Nile, and on the west it is usually held to be separated from Durrur by a neutral strip of country. It consists for the most part of a rolling steppe in which a hill of 50 feet is a landmark for a day's journey; but towards the west there are a few isolated peaks such as Jebel Abu Saun and Jebel Kordofan, which rise to a height of 150 to 800 feet above the plain, and in the north-west there are two considerable groups, Jebel Katal and Jebel Kaga. The general elevation of the country above sea-level is given as from 1410 to 1840 feet. A granitic sand with abundance of mica and felspar forms the upper stratum throughout the greater part of the area, but an admixture of clay, which is observable in the north, becomes strongly marked in the south, where there are also stretches of black vegetable mould. Beneath there appears to unfold itself an unbroken surface of mica schist. River or stream there is really none, though a few temporary watercourses or *khors* exist in the rainy season, and the only permanent lakes are El Birkoh, El Rahad, and Shikaleh, which are formed by the great Khor Abu Hable in the south. During the rainy season the water collects in myriads of little depressions, but owing partly to rapid evaporation and partly to the porous character of the soil the surface of the country is soon as dry as before. The water which has found its way through the granite sand flows over the surface of the mica schist and settles in the hollows. Wells consequently sunk so as to reach the solid rock obtain a supply of water more or less abundant according to the spot which they happen to strike; and it is the existence of these which renders human life possible in Kordofan. It is estimated that (apart from those in a few areas of depression—Cagmar, Abu Haraze, Bara, and Mulbee—where the sand stratum is very thin and water is reached at the depth of a few feet) there are about 900 of these wells. They are narrow shafts going down from 75 to 150 or 200 feet, and supported "from the bottom to a little above the water-level" by the long roots of the mimosa, wound round so as to form a complete casing. The water is raised by rope and bucket at the cost of enormous labour, and none is available for irrigation. The very cattle are trained to go a long time without drinking. Entire villages migrate after harvest to the neighbourhood of some plentiful well; and in El Obeyd water becomes a regular article of trade soon after the close of the rains. As there is no highland area draining into Kordofan, the underground reservoirs are dependent on the local rainfall, and a large number of the wells are dry during many months. The rainy season lasts from June to September, rain falling every three or four days in brief but violent showers. The wind during that period is from the south or south-west; the air is extremely oppressive; and fevers prevail among the foreign residents. In September the north winds begin to take their turn, and from the middle of October they blow steadily throughout the winter, and produce what Europeans consider a delightful climate. With March begins the dry and sultry summer. The settled population of Kordofan is estimated at 164,740, the nomadic at 114,000. The former, who are scattered over the country in about eight hundred and sixty villages, are of very mingled blood, especially in the neighbourhood of the capital, but the Ghodiat, Gulladat, and Gowanieh appear to be the original stock. Of the nomadic tribes the most noteworthy are the Hasanieh, the Kababieh, and the Bagara. The last-mentioned—who roam about the southern parts of the country—are a dark red-bronze race remarkable for their magnificent physique. The staple crop in Kordofan is the dokhn or *Pennisetia typhoides*. Raion both uncooked and in various culinary conditions, it forms the main food of nine-tenths of the population, and

furnishes the raw material for the sweetish Kordofan beer or merruca. Cattle are largely bred by the Bagana, and camels by the Kababish; and horses, goats, donkeys, and sheep are kept in small numbers. Since the ostrich has been almost hunted out of the country the chief article of importance for trade is the gum yielded by the many mimosa trees, which along with the hujib, the tamarisk, and the talh tend to relieve the monotony of the steppe. Salt and iron ore exist within the province, but they have not become of any practical value.

Of the movements by which the present composite ethnology of Kordofan was attained little record is recoverable. In 1790 Sheikh Naeib of Sennar subjugated the district; and under his rule the inhabitants prospered. But, piqued by his neighbor's success, Ibn Fadhl of Darfur invaded Kordofan with a powerful army numbering no less than 12,000 or 14,000 camels, and completely defeated the Sennar governor Melek el Heshima. The Darfur supremacy continued till 1821 when Mohammed Aly undertook the conquest of Nubia and Sennar. The inflexible Mohammed Aly, son-in-law, subjugated Kordofan, and continued to rule it with some than a rod of iron till he was recalled on account of his cruelties.

See the *Travels of Sultan Taima* (1821), Ruppell (1846), Holnrad (1857), Rueseger (1857), Pallas (1841), Ibrahim (1849), Graf von Schelloden (1850), Petherick, Egypt, the Sudan, and Central Africa, London, 1861, Major H. G. Jones, *General Report on Province of Kordofan*, Cairo, 1877, *Memoir, Notes de la expédition Egypte Province*, Vienna, 1878. The Italian traveller Matteucci and Meusnier traversed Kordofan in 1880, in their great journey across the continent. The geographical nomenclature is still in many cases uncertain.

KOREA, a petty native state in Chintia Nagpur, Bengal, India, situated between 22° 55' 50" and 23° 49' 15" N. lat., and between 81° 58' 15" and 82° 48' 15" E. long., and having an area of 1631 square miles. The state consists of an elevated table-land of coarse sandstone, varying from 2477 to 3370 feet above sea-level. Large forest tracts of *sal* timber exist. Iron is found throughout the state, and a tribe of Kols, called Agariás from their occupation, are largely engaged in iron-smelting. The field crops consist of rice, wheat, barley, Indian corn, *marud*, pulses, oil seeds, cotton, &c., while the jungle produces stick lac and resin. The population in 1872 was returned at 21,127, viz., 11,093 males and 10,034 females (Hindus, 10,807; Mohammedans, 140; "others," 10,180). Of aboriginal tribes, the most numerous and influential are the Ghoris (4644); next in importance are the Cheros (3009). The chiefs family call themselves Chauhan Rajputs, and claim descent from a chief of that clan, who conquered Koré six hundred years ago.

KORITSA, GORITSA, GEORITSA, or GHIORITSA, a town of Albania, in the Turkish vilayet of Janina, situated in a spacious plain 45 miles east of Berat and 30 miles west of Kastoria. It is a place of about 10,000 inhabitants, containing a considerable number of well-built houses scattered among its cottages of unbaked mud. To its position on the route between the Adriatic and the Archipelago it is indebted for a flourishing trade. The metropolitan church is a large edifice richly adorned in the interior with paintings and statues.

KÖRNER, KARL TADDOPO (1791–1813), German patriot and poet, was born at Dresden, September 23, 1791. His father, a prosperous lawyer, made his house in Dresden a centre of literary, musical, and artistic society, and was an intimate friend of Schiller; and his mother, a daughter of the copper-plate engraver Stock of Leipsic, enjoyed Goethe's friendship through life, and in her later years claimed it for her son. Theodor Körner was at first so delicate a child that his parents made the paternal vineyard—the same in which Schiller sat and wrote *Don Carlos*—a few years before his summer schoolroom. They prescribed for lessons, gymnastics, riding, swimming, fencing, and the like, till the delicate boy grew into a young athlete, with a joyous, affectionate disposition which won the hearts of all who knew him. Early at the Kreuzschule in Dresden, but chiefly with private tutors at home, Körner now studied languages, history, and mathematics. He was an adept at

various kinds of fine wood-turning, could sketch, and play the guitar; but his happiest hours were spent over the volumes of Goethe and Schiller—the household gods; and under their influence the boy began to write verses which his parents forbore to praise, but which displayed, even then, much of the facility and grace of his later poems. At the age of seventeen he went to the school of mines in Freiberg, and worked enthusiastically for two years at mathematics, mineralogy, and chemistry. The poems he wrote during this period were collected and published under the title *Knospen*. From Freiberg Körner went to the university of Leipsic, where for some months he studied philosophy, history, and anatomy. He founded there a poetical association, and became a member of the "Macaria" and more than one student club; but he was unfortunately drawn into the hostilities then rife between two parties in the university, and, after fighting several party duels, was at last forced to leave the town to escape the results of a street fray in which he took part. From Leipsic he went to Berlin, and then to Vienna, with letters to his father's old friends, the Prussian ambassador Von Humboldt and Friedrich Schlegel. Two little pieces which he wrote for the stage, *Die Braut* and *Der grüne Domino*, were acted at the Vienna Court Theatre in July 1812 with great success; and, with the consent of his parents, he gave up all his former plans, with the hope of being able to make a living by literature alone. His other works followed with astonishing rapidity. In some fifteen months appeared some dozen dramatic pieces and the librettos of a few operas (*Das Freiermädchen*, *Der verdächtige Posten*, and *Die Bergkneppen*), besides many short poems. One after the other all his plays were received at the Vienna Theatre with applause. *Ermy*, founded on an heroic incident in Hungarian history, was the favourite with the public; but Goethe praised *Die Braut*, *Der grüne Domino*, and *Die Sühne*. In January 1813, at the age of one and twenty, Körner was appointed poet to the court theatre in Vienna. With the preparation of the libretto of an opera, *Die Rückkehr des Ulysses*, for Beethoven, and with the writing, printing, and stage preparation of his plays, the young poet's hands were now full; very busy and very happy he describes himself in his letters. His betrothal to a young Viennese lady, known now only as the "Toni" of his correspondence, was another source of happiness; but this bright career came suddenly to an end. In the early spring of 1813 there was published the *Fatherland's Call to Arms in the Struggle for Liberation*, and Körner was one of the first to answer the summons. He left Vienna in March, and at Breslau joined the Prussian free-corps then forming under the command of Lützow. When the corps was solemnly consecrated in the village church at Rogau a few days later, the service was opened with a chorale, set to Körner's words, "Dem Herrn Allen die Ehre"; and almost immediately afterwards, when Petersdorf was sent on a mission to Dresden, to try to unite the Saxons in the common cause, the young poet was sent with him, and on this occasion published his spirited prose *Address to the People of Saxony*. Here Körner saw his parents and friends for the last time. In April he was made lieutenant by the vote of his comrades; and a little later, having left the infantry, he was made adjutant to Lützow himself. At Kitzow, near Leipsic, during the three weeks' armistice, he was severely wounded through the treachery of the enemy, but after several adventures escaped to Carlsbad, where he remained till he was well enough to resume his former post. Lützow's free-corps was in almost daily action when the young adjutant was welcomed back. His cheerful zeal and self-denying helpfulness had endeared him to all his comrades, and it was his wild war songs, sung by many voices to old national melodies round the camp

fires at night, that helped to spread that fervour in the corps which made it peculiarly terrible to the enemy. The poems written by him at this time are published under the title *Leyer und Schwert*. They include the lines "Abgeschied vom Leben," which were composed during the night when he lay wounded in the wood by Kitzau. The letters written by Körner to his parents at this time are tender and thoughtful—often aflame with patriotic fervour, but with now and then a ring of intense sadness which forebodes the end. This was very near. His last poem, "Das Schwertlied," was scribbled in his pocket-book at dawn on the 26th of August, when the corps was prepared for action; and he was reading it to a friend when the order to attack was given. It is the wildest of all his war-songs, a love-rhapsody to his sword,—the soldier's bride; and it was this poem that suggested the refrain of Mrs Hemans's beautiful verses to his memory. In the engagement that followed, on the high road between Gadebusch and Schverin, Körner, as adjutant, fought at Litzow's side. The French were in great force, but were overcome and fled. Among the hottest in pursuit was Körner, who was mortally wounded, as he rode through a wood, by a shot from one of the fugitive *tirailleurs* who lay hidden there. He was buried with full military honours under an old oak on the road from Lubelow to Dreikrug, by the village of Wäbbelin, where there is now a monument to his memory.

Körner's position in the literature of his country is a peculiar one. He was not quite two and twenty when he died, and his works are necessarily but first-fruits—might all be included in the modest title *Kneipe*—plentiful indeed, and full of promise of flowers to come. His earlier poems were hardly more than graceful and pleasing, and even his popular dramas scarcely entitle him to a high place in the literature of his country. It was with the war that Körner's true inspiration came. Had he lived a lifetime, he could never have equalled the productions of those few impassioned weeks, but the homage which all Germany paid, and still pays, to the young poet's memory is due, not to his lyric genius alone, but to his bright youth also, and heroic death. His works have passed through many editions. That published in one volume, with a preface by Karl Streckfus (Berlin, 1870), includes a sketch of his life, extracts from his letters, a few English translations of his poems, and stanzas to his memory by German and English poets, of which last Follen Hemans is the chief. There is an indifferent English translation of the life of Körner by his father, with selections from his works, by G. F. Richardson, 2 vols., 1827. (P. M.)

KOROTCHKA, a district town, in the government of Kursk, Russia, 100 miles south of Kursk, on the Korotcha river. Its 7000 inhabitants live by gardening, exporting great quantities of dried cherries, by making candles and leather, and by trade; the merchants purchase cattle, grain, and salt in the south, and send them to Moscow. Founded in 1638, Korotcha formerly was a small fort erected against the invasions of Tartars.

KOROTOYAK, a town of Russia, in the government of Voronezh, on the right bank of the Don, 6 miles from the Voronezh railway station, and 47 miles south of Voronezh. It was founded in 1642 by emigrants from interior provinces of Russia, and had a small wooden fort. Owing to the proximity of Ostropojak, which is a trading place of some importance, its trade is insignificant, and its 9000 inhabitants live by agriculture and some trade in grain.

KOSCIUSKO, or **KOSCIUSZKO**, **THADDEUS** (1746-1817), Polish patriot, was descended from an old family of small proprietors in the province of Lithuania, and was born in 1746. From his father he inherited a taste for music, and in the other branches of education he showed such marked aptitude at the cadet school of Warsaw that along with some other youths he was sent at the expense of the state to complete his education at Versailles, Bresl, and Paris. On his return to Poland he was appointed captain of artillery, but on account of the unfortunate result of his attachment to the daughter of a nobleman he in 1777 went

to Paris, whence he sailed with the French fleet to aid the North American States in their war of independence. Under Washington he displayed great firmness and intrepidity in various trying circumstances, and rose to be general of a brigade. In 1786 he returned to his native country, where he lived in retirement until the reorganization of the army in 1789, when he was appointed major-general. In the war with Russia which followed the adoption of the new constitution of 1791 he conducted himself with conspicuous valour and skill, and at Dubienka, with a force of only 4000 men, held an army of 20,000 Russians at bay. All his efforts were, however, rendered fruitless by the pusillanimity of King Stanislaus, who in March 1792 agreed to a humiliating peace, upon which Kosciusko along with several other leading officers resigned his commission. A second partition of Poland was consummated in August 1793, but a spirit of resistance gradually gathered force and culminated in the insurrection of 1794, when Kosciusko was recalled to Cracow and appointed generalissimo and dictator. With an army of 6000 he marched to meet the Russians, who were advancing upon Cracow in greatly superior numbers, and after a strenuous conflict of four hours' duration completely defeated them. On receipt of the intelligence Warsaw rose against the Russian authorities, putting 7000 persons to death; and after instituting a new government Kosciusko went in pursuit of the enemy, who retired towards the Prussian frontiers. But for the interposition of Prussia the emancipation of Poland would have been accomplished. King Frederick William, however, advanced against Warsaw with an army of 40,000 men, to which Kosciusko could oppose only 15,000. He was defeated at Szczekocin, but retreated in good order upon Warsaw, which he defended with stubborn persistence, until the diversion of an insurrection in Great Poland caused them to raise the siege. Meantime an immense force of Russians was advancing against Warsaw in two divisions, the one under Suwaroff and the other under Persen. Kosciusko resolved to attack Persen before his junction with Suwaroff, but, as he had only 4000 men to meet the 14,000 Russians, his small army was in a few moments completely enveloped by superior numbers, and he himself fighting desperately fell pierced with several wounds. A tradition that as he fell he gave utterance to the words "Finis Polonia" found currency several years afterwards, but when it came to his knowledge he indignantly denied it. For two years he remained a prisoner at St Petersburg, but, gaining his liberty after the accession of Paul I., he went to England and then to America. Returning to France in 1798, he took up his residence at Fontainebleau. In 1806 he refused to allow Napoleon, whose professions he rated at their proper value, to use his name to incite a rising in Poland against Russia; and the forged address put forth by Napoleon in his name was never accepted by his countrymen as genuine, although Kosciusko was unable to disavow it until eight years after it was issued. In 1814, when the Russian army entered France on the fall of Napoleon, Kosciusko had a long interview with the emperor Alexander of Russia, who, it is said, promised him to restore to Poland its ancient boundaries. In 1815 he settled in Switzerland, devoting himself chiefly to agricultural pursuits. His death, October 17, 1817, was the result of an accidental fall from his horse. It was a statesman Kosciusko was more ardent than sagacious, he manifested a skill and daring as a soldier which but for the overwhelming nature of his task would have gained him a place among the most renowned generals of his time, while his noble and chivalrous patriotism, untainted by any desire after self-glorification, has secured him the world's universal admiration and esteem.

See the lives by Falkenstein (1897, 2d ed. 1894), Chodzko (1887), and Paszkowski (1879), and also *Pologne et Suisse, légende de Domsako*, by Jules Michelot (1851), reprinted in *La Pologne suarier* by the same author (1868).

KOSLI, a town in Muttra (Mathura) district, North-Western Provinces, India, in 27° 47' N. lat., 77° 28' E. long., with a population in 1877 of 12,770.

KÖSLIN, or **CÖSLIN**, chief town of a circle and government district in the province of Pomerania, Prussia, is situated at the foot of the Gollenberg, 5 miles from the Baltic coast, and about 86 miles north-east of Stettin (105 by rail). It is regularly built, and is the seat of a local court. In the large market-place is the statue of Frederick William I., erected in 1824. The industries include the manufacture of soap, tobacco, iron, paper, bricks and tiles, beer, and other goods. Population in 1875, 14,814.

Köslin was built in 1186 by the Saxons, and made a town in 1266. In 1382 it embraced the Reformation. It was severely tried in the Thirty Years' War, and in the Seven Years' War. In 1790 it was burned. On the Gollenberg stands a monument to the memory of the Pomeranians who fell in the war of 1818-15. The town formerly possessed a mint of its own.

KOSLOFF, or **Kozlov**, a town in the government of Tamboff, Russia, on the railway between Ryazak and Saratoff, 45 miles west of Tamboff, on the Lesnoy Voronezh river. It had its origin in a small monastery, which was founded in the forest in 1627; nine years later, an earthwork was raised close by, for the protection of the Russian frontier against the Tartars. Situated in a very fertile country, on the highway to Astrakhan and at the head of the water communication with the Don, the town soon became a centre for the trade with these countries; as the junction of the railways leading to the Sea of Azoff, to Tsaritsin on the lower Volga, to Saratoff, and to Orel, its importance has recently been still further increased. Large transactions in grain, and also in horses and tallow, are effected in the rich agricultural district of Kosloff, as well as in those of Lipetok and Borisogleb, for the Moscow market, or for western Europe, *viz* Orel; manufactured wares are imported for the supply of the neighbouring districts. There are also in the town and district several tallow melting houses, one manufactory of woollen cloth, and several distilleries. The town is built of wood, and its unpaved streets are dirty. Population, 27,000.

KOSTENDIL, **GHUSTENDIL**, or **DUSTENDIL**, a town in the extreme south of the principality of Bulgaria, Turkey, is situated on the Struma, the ancient Strymon. It is fortified and contains several factories. The surrounding district is fertile, and gold and silver mining is carried on. Population about 8000.

KOSTER, or **COSTER**, **LAURENS** (1370?-1440), the first Dutch printer, whose claims to be considered at least one of the inventors of the art (see **PRINTING**) have been recognized by many investigators. His real name was Laurens Janszoon.—Koster (i.e., sacristan) being merely the title which he bore as an official of the great parish church of Haarlem. We find him mentioned several times between 1417 and 1434 as a member of the great council, as an assessor (*scabini*), and as the city treasurer. He probably perished in the plague that visited Haarlem in 1499-40; his widow is mentioned in the latter year. His descendants through his daughter Lucia can be traced down to 1724.

See Peter Striver, *Beschryvinge der Stad Harlem*, Haarlem, 1828; Scheutema, *Levensschets van Laurens d. Koster*, Haarlem, 1884; Van der Linde, *De Haarlemsche Costerlogende*, Hague, 1870.

KOSTROMA, a central government of Russia in Europe, surrounded by those of Volodga, Vyatska, Nijni-Novgorod, Vladimir, and Yaroslavl, lies mostly on the left bank of the upper Volga, and has an estimated area of 32,700 square miles. Its surface is generally undulating, with hilly tracts

on the right bank of the Volga, and extensive flat and marshy districts in its eastern parts. The rocks belong chiefly to the Permian system, a small tract being occupied by representatives of the Jurassic, and both being deeply covered with Quaternary clays. The soil in the east is for the most part sand or a sandy clay; a few patches are covered with fertile black earth. Immense forests, yielding excellent timber for shipbuilding, and in many cases still untouched, occupy no less than 70 per cent. of the surface of the government (13,330,000 acres in 1870). The export of timber is greatly facilitated by a series of navigable tributaries of the Volga, such as the Kostroma, Unzha, Neya, and Vyksa, and many others of less importance. The climate is severe; frosts of -22° Fahr. are common in January, and the mean temperature of the year is but 3° 1 (summer, 64° 5; winter, -13° 3). The population, which numbered 1,176,000 in 1870, is Russian, with some Meryns,—the indigenous of this part of Russia,—Tcheremisses, and Tartars. Agriculture is in a low state of development; only 4,000,000 acres are under crops, with a return (1,415,000 quarters of corn in 1877) unequal to the wants of the population. Flax is cultivated to some extent, and exported. Stock-breeding has steadily decreased since 1861; in 1870 there were only 394,500 horned cattle (against 420,000 in 1867), and the number has since much decreased. Bee keeping is an important branch of industry in some districts. The chief articles of commerce are timber, fuel, pitch, tar, mushrooms (yearly value upwards of £5000), and various kinds of wooden wares for building and household purposes, which are largely manufactured by the peasantry in villages, and exported to the steppe provinces of the lower Volga and Don. Boat-building for river traffic is also carried on. Some other small industries, such as the manufacture of silver and copper wares, leather wares, &c., are also presented in the villages, but the trade in linen and twinning, formerly the staple, is now declining. There are now several cotton factories, spinning mills, and engineering and chemical works. The government of Kostroma is divided into twelve districts:—Kostroma, Nerekhta, Kineshma, Makarieff, Yurievets, Galitoh, Tokukhloma, Soligalitch, Boul, Kologriv, Velduga, and Varnavin.

KOSTROMA, a town of Russia, capital of the government of the same name, 280 miles north-east of Moscow and 55 miles from Yaroslavl. It is situated on the left bank of the Volga, at the mouth of the navigable Kostroma river, with suburbs on the opposite side of the Volga. It is one of the oldest towns of Russia, having been founded by Yuri Dolgorouky in 1152. Its fort was often the refuge of the great princes of Moscow during war, but the town was plundered more than once by Tartars. The cathedral, built in the 13th century, and situated in the *Kremi*, or former citadel, is a fine monument of old Russian architecture. Kostroma has been renowned since the 16th century for its linen, which was exported to Holland, and the manufacture of linen and linen-yarn is still carried to some extent, flax being purchased in the governments of Kostroma and of Pekoff. There are also in the town and in its province several important cotton-mills, tanneries, saw-mills, an iron-foundry, and a machine factory. Owing to its situation on the Volga, and at the mouth of a navigable river, Kostroma carries on an active trade—importing grain and exporting linen, linen-yarn, leather, and especially timber and wooden wares. Population, 30,000.

KOTAH, a native state in Rajpootana, India, situated between 24° 30' and 25° 51' N. lat., and 74° 40' and 76° 59' E. long. It is entirely surrounded by native territory, being bounded on the N. by Bundi, on the E. by Gwalior and Tonk, on the S. by Jhalawar, and on the W. by Udaipur. The area is 3797 square miles, with an estimated

population of 310,000. Kotah slopes gently northwards from the high table-land of Malwa, and is drained by the Chambal with its tributaries, all flowing in a northerly or north-easterly direction. The Mokandarra range, from 1200 to 1000 feet above sea level, runs from south-east to north-west, forming the southern border of Kotah, and separating it from Jhalawar. The Mokandarra Pass through these hills, in the neighbourhood of the highest peak (1671 feet), has been rendered memorable by the passage of Colonel Munson's army on its disastrous retreat in 1804. The defile is strikingly picturesque, and forms one of the chief outlets between the Deccan and northern India. There are extensive game preserves, chiefly covered with grass. In addition to the usual Indian grains, wheat, cotton, opium, and a little tobacco of good quality are cultivated. The manufactures are very limited. Cotton fabrics are woven, but are being rapidly superseded by the cheap products of Bombay and Manchester. Articles of wooden furniture are also constructed. The chief articles of export are opium and grain, salt, cotton, and woollen cloth are imported.

Kotah is an offshoot from Bānch state, having been bestowed upon a younger son of the Bindri Rājā by the emperor Shah Jahan in return for services rendered in which the latter was in rebellion against his father Jahāngir. The affairs of the state having fallen into confusion, the administration is now superintended by a British political officer. Many of the state nobility hold lands on a semi-feudal tenure. The estimated gross revenue of the state in 1875 was £353,375, of which the land yielded over £170,000. Tributes of £28,472 (including maintenance of a contingent known as the Duoli Irregular Force) is paid to the British Government, and £149 to Jeypore. The climate is very salubrious during the prevalence of the hot winds at the commencement of summer, and is considered unhealthy during the rainy season. Epidemic fevers invariably appear after the close of the rains.

KOTHEB, or KOTZBUS, chief town of a circle in the duchy of Anhalt, Germany, is situated on the Ziethe, at the junction of several railway lines, about 43 miles north-west of Leipzig by rail. It consists of an old and a new town with four suburbs. It has two palaces, one of which in the old town contains various scientific collections and a library of 20,000 volumes. The industries include iron-founding and the manufacture of agricultural and other machinery, malt, beet-root sugar, leather, spirits, &c.; a tolerably active trade is carried on in grain, wool, potatoes, and vegetables. In 1875 the population, including the garrison, was 14,403.

Said to have been an important Wendish city, Kotheb was captured and destroyed by Henry I. in 937. In 1800 it was burned by the margrave of Meissen. In 1847 it was presented by the emperor to General Laidon, from whom it soon passed by purchase to its old possessors. Hahnemann, the founder of homoeopathy, lived and worked in Kotheb, and a homoeopathic establishment still exists in the town. Till 1853 Kotheb was the capital of the duchy of Anhalt-Kotheb.

KOTRI, a town in Karachi (Kurrachee) district, Sind, India, situated on the right bank of the Indus, in 25° 22' N. lat. and 68° 22' E. long. The population in 1873, including the neighbouring hamlets of Khānpur and Mīmā Miltāni, was 7949—namely, 5166 Mohammedans, 2455 Hindus, 304 Christians, and 34 Parsis. Kotri is the northern terminus of the Sind Railway, which communicates with the seaport of Kurrachee (106 miles). The principal buildings, besides the Protestant and Roman Catholic churches, are the civil hospital, court-house, subordinate jail, post-office, Government and other schools, and travellers' bungalow. The Indus Steam Flotilla maintains an extensive establishment, having its offices in the old fort, with workshops for the repair of steamers and barges. There is a large transit traffic in beer, wine, and spirits, metals, railway materials, piece goods, silk, wool, cotton, grain, oil-seeds, indigo, ghee, oil, salt-petre, and sugar. Water from Kotri is forwarded to Kurrachee, especially for the manufacture of ice and for drinking

purposes. In 1878 the Indus Valley State Railway was opened from Kotri to Sukkur, by which the importance of Kotri as a place of transhipment has been greatly diminished.

KOTTBUS, or COTTBUS, chief town of a circle in the government district of Frankfort, Prussia, is situated on the Spree, about 72 miles south-east of Berlin by rail, and at the intersection of several important railway lines. It contains a mediæval castle, and is the seat of a chamber of commerce. The chief industries of the busy little town are wool-spinning and the manufacture of cloth. Cotton-spinning, and the manufacture of tobacco, machinery, beer, brandy, &c., are also carried on, while its trade is active. In 1875 the population, including the garrison, was 22,612. At one time Kottbus formed a private lordship, but in 1403 it passed by the treaty of Guben to Brandenburg.

KOTZBUE, AUGUST FRIEDRICH FERDINAND VON (1761-1819), German dramatist, was born on the 3d of May 1761, at Weimar, where his father was a councillor of legation. Having attended the gymnasium of Weimar, he went in his sixteenth year to the university of Jena, and afterwards studied about a year in Duisburg. In 1780 he completed his legal studies, and was admitted an advocate. Through the influence of Count Görtz, Prussian ambassador at the Russian court, he became secretary at St Petersburg to the governor-general Von Bann, by whom he was recommended to the empress. In 1783 he received the appointment of assessor to the high court of appeal in Revel, where he married a daughter of Lieutenant-general Von Essen. He was ennobled in 1786, and became president of the magistracy of the province of Esthonia. Before leaving Germany he had published some unimportant writings; in Revel he acquired a considerable reputation by his *Leiden der Ortenbergischen Familie* (1785), his *Kleine Gesammelte Schriften* (1787-91), and his two plays, *Menschenhass und Reue* and *Die Indianer in England* (1789). The good impression produced by these works was almost effaced by a cynical book, *Doctor Bahrdt mit der eisernen Stirn*, which appeared with the name of Knigge on the title page. After the death of his first wife Kotzbus retired from the Russian service, and resided for some time in a country house which he had built near Narva. At this time he manifested extraordinary literary activity, publishing within a few years, besides *Die jüngste Kinder meiner Luise* (in 5 volumes), upwards of twenty plays. In 1798 he accepted the office of dramatist to the court theatre of Vienna, resigning it in about two years with a pension of 1000 florins. On his way to St Petersburg, where his sons were being educated, he was arrested in April 1800, and sent to Siberia. Fortunately he had written a comedy which flattered the vanity of Paul I.; and a translation of this play so delighted the emperor that Kotzbus was brought back, received an estate from the crown lands in Livonia, and was made director of the German theatre in St Petersburg. He returned to Germany when the emperor Paul died, and in 1802 was admitted into the Academy of Sciences at Berlin. Here, in association with Merkel, he edited *Der Freimithige*, and began his *Umanach dramatischer Spiele*, which he continued to issue until his death. He also wrote several plays in Berlin, and made some enemies by the bitterness with which he attacked Goethe. Towards the end of 1806 he was again settled in Russia, and in the security of his estate in Esthonia wrote many satirical articles against Napoleon in *Die Biene* and *Die Grille*. As councillor of state he was attached in 1812 to the department for foreign affairs in St Petersburg, and in 1817 he went to Germany as a sort of spy in the service of Russia, with a salary of 15,000 roubles. In his weekly journal (the *Literarisches Wochenblatt*) he scoffed at the pretensions of those Germans

who demanded free institutions, and became an object of such general dislike that he was obliged to leave Weimar for Mannheim. He was especially detested by young enthusiasts for liberty; and one of them, Karl Ludwig Sand, a theological student, formed a deliberate resolution to kill him. On the 23d of March 1819 Sand called at Kotzebue's house in Mannheim, and stabbed him to the heart, crying, "Here, thou betrayer of the Fatherland!" The assassin was executed, and the Government of Germany made his crime an excuse for placing the universities under strict supervision. Besides his plays and the other works already mentioned, Kotzebue wrote a history of the German empire and a book on the ancient history of Prussia, neither of which has solid merit. He was also the author of *Erinnerungen aus Paris* (1804), and *Erinnerungen von einer Reise aus Island nach Rom und Neapel* (1805). He wrote more than one hundred plays, the majority of which are now forgotten. Although destitute of poetic insight, he had remarkable facility in the invention of effective situations; and a respectable place in German literature is secured for some of his comedies by the liveliness with which their characters are portrayed, and by the sprightliness of their dialogue. There is a complete edition of his dramatic works in 28 volumes (1797-1823), another in 44 volumes (1827-29), and a third in 40 volumes (1840-41).

KOTZEBUE, ORRÖ VOX (1787-1848), Russian navigator, son of the subject of last notice, was born at Revel on December 19, 1787. After being educated at the St Petersburg school of cadets, he accompanied Krusenstern on his voyage of 1803-6. After his promotion to Lieutenant, Kotzebue was placed in command of an expedition fitted out at the expense of the imperial chancellor, Count Rumantsov, in the brig *Perrick*. In this vessel, with only twenty-seven men, Kotzebue set out on July 30, 1815, to find a passage across the Arctic Ocean, and explore the less known parts of Océania. Proceeding by Cape Horn, he reached on April 18, 1816, Schouten and Lemaire's Isle of Dogs. After cruising about the Pacific for some time, and discovering various islands and groups,—as the Krusenstern group, and the Kutsoff and Suwaroff Islands in the east of the Caroline archipelago,—Kotzebue made for Kamohatka, and on June 29 reached New Archangel. In the middle of July he proceeded northwards, coasting along the north-west coast of America, discovering and naming Kotzebue Gulf or Sound and Krusenstern Cape. Returning by the coast of Asia, he again sailed to the south, sojourned for three weeks at the Sandwich Islands, and on January 1, 1817, discovered New Year Island. After some further cruising in the Pacific he again proceeded north, but a severe attack of illness compelling him to return to Europe, he reached the Neva on August 3, 1818, bringing home with him a large collection of previously unknown plants and much new ethnological information. In 1823 Kotzebue, now a captain, was entrusted with the command of a new expedition, in two ships of war, the main object of which was to take reinforcements to Kamohatka. There was, however, a staff of scientific men on board, who collected much valuable information and material in geography, ethnography, and natural history. The expedition left Cronstadt on August 23, and, proceeding by Cape Horn, visited the Radak and Society Islands, reaching Petropavlovsk in July 1824. Many positions along the coast were rectified, the Navigator Islands visited, and several discoveries made. The expedition returned by the Marianas, Philippines, New California, and Sandwich Islands, reaching Cronstadt on July 10, 1826. There are English translations of both Kotzebue's narratives:—*A Voyage for the Purposes of Exploring a North-East*

Passage, undertaken in the years 1815-18, 3 vols. (1821); and *A New Voyage Round the World in the years 1823-26* (1830). The narrative of the second voyage is generally considered to be rather highly coloured, while in the first Kotzebue animadverts in strong terms on the conduct of the English missionaries in the Society and Sandwich Islands, who, however, were defended both by Ellis and Mr. Charles Darwin. Three years after his return from his second voyage, Kotzebue retired to his estate in Esthonia, where he died February 15, 1846.

KOUSSO, KOSO, or CUSSO, a drug recently introduced into English medicine as a remedy for tapeworm. It consists of the flowers of *Hagenia abyssinica*, Willd. (*Brayera anthelmintica*, Kunth), a handsome rosaceous tree 60 feet high, growing throughout the table-land of Abyssinia, at an elevation of 3000 to 8000 feet above the sea-level. The drug as imported is in the form of cylindrical rolls, about 18 inches in length and 2 inches in diameter, and comprises the entire inflorescences or panicle kept in form by a band wound transversely round it. The flowers have a light brown hue, or in the case of the female flower a reddish tinge, for which reason the latter is sometimes distinguished as dark kouso. The active principle of kouso is stated by Flückiger to be koso, $C_{31}H_{48}O_{15}$; it is supposed to be a compound ether of isobutyric acid, since it gives off the odour of this substance when its solution in concentrated sulphuric acid is diluted with water. Koso appears to have been first obtained as a definite crystalline substance by Merck, who prepared it in the form of tasteless yellowish rhombic needles or prisms, soluble in chloroform, ether, benzol, and bisulphide of carbon, very soluble in boiling but only sparingly so in cold alcohol. It is not decomposed by boiling dilute acids. The koso of Bedall appears to be an impure substance containing variable quantities of crystalline koso. Kouso yields on distillation a steareopene-like oil having the odour of the drug, also traces of valerician and acetic acids. The medicinal properties of kouso were first investigated in 1822 by Brayer, a French physician of Constantinople, but the drug did not come into use in Europe until 1850, in 1854 it was introduced into the British pharmacopœia. In medicine it is used in the form of an unstrained infusion of 1 to 1½ oz. of the coarsely powdered flowers, which are swallowed with the liquid. Administered in this form it sometimes causes vomiting; hence an extract of the flowers, prepared by percolating them with castor oil to dissolve out the active principle, has been introduced. Kouso is considered to be an effectual vermifuge for both *Tœnia solium* and *Bothriocephalus latus*. In its anthelmintic action it is nearly allied to male fern.

See Brayer, *Travels*, v. p. 78, 1790; Brayer, *Notice sur une nouvelle plante de la famille des Rosacées employée contre le Tœnia*, 1822; *Pharmaceutical Journal*, x. p. 15; *Pharmaceutisches*, 52 ed., p. 266-269; *Bulletin de Thérapeutique*, 1876, p. 556.

KOVNO, a north-western province of European Russia, is bounded on the N.E. and S.E. by the provinces of Courland and Vilna, and on the S. and S.W. by Russian Poland and by Prussia, a narrow strip touching the Baltic near Memel. It has an estimated area of 23,680 square miles. The level uniformity of its surface is broken only by two low ridges which nowhere rise above 800 feet. The geological character is varied, the Silurian, the Devonian, the Jurassic, and the Tertiary systems being all represented; the Devonian is that which occurs most frequently, and all are covered with Quarternary boulder-clays. The soil is either a sandy clay or a more fertile kind of black earth. The government is well watered by the Nieman, the Windau, the Condaud Aa, and the Duna, which have navigable tributaries. In the flat depressions covered with boulder-clays there are many lakes and marshes, whilst

forests, now greatly reduced, still cover about 18 per cent. of the surface of the government. The climate is comparatively mild, the mean temperature at Kovno being 44° Fahr. The population (1,166,040 in 1870) is very varied, consisting of Lithuanians proper and Zhmuds, Jews, Slavs, and Germans; 82 per cent. are Catholics, 13 Jews, 3 Protestants, and 2 belong to the Greek Church. The Poles number only 3000, and the Russians (White, Little, and Great) 182,000. The chief occupation of the inhabitants is agriculture, 60 per cent. of the whole surface being under crops; both grain and potatoes are exported. The yield of corn (2,370,000 quarters prior to 1867) is now about 2,879,000 quarters per annum. Flax is also cultivated, and the linseed is exported. Stock-breeding is not carried on to any considerable extent; but, owing to the number of lakes, the fishing industry has some importance. The manufacturing industries, if distillation be left out of account, are trifling. Trade, especially the transit trade, is brisk, from the situation of the government on the Prussian frontier, the custom houses of Yurburg and Tauragen being among the most important in Russia. Kovno has seven districts:—Kovno, Novoolexandrovsk, Ponevysk, Rossiensy, Shavli, Telski, and Vilkomir. The principal towns are Kovno (82,000 inhabitants), Shavli (15,400), Vilkomir (11,150), Rossiensy (10,700), and Novoolexandrovsk (8200).

The territory which now constitutes the government of Kovno was formerly part of Lithuania. During the 13th, 14th, and 15th centuries the Livonians and Teutonic knights continually ravaged and plundered it, especially the western part which was peopled with Zhmuds. In 1569 it was annexed, along with the rest of the grand principality of Lithuania, to Poland; and it suffered very much from the wars of Russia with Sweden and Poland, and from the invasion of Charles XII. In 1795 the principality of Lithuania was annexed to Russia, and until 1872, when the government of Kovno was constituted, the territory now forming it was a part of the government of Vilna.

KOVNO, the KAUNE of the Lithuanians, capital of the above government, is situated on the railway between St Petersburg and Berlin, 503 miles south-west from the former. It consists of two parts, the new town, built on the right bank of the Niemen, and an old town, situated on the left bank of the Vilis which here joins the Niemen. By its situation at the confluence of two navigable rivers, some few miles above the mouth of the Neryva, and close to a place where the Niemen sharply changes its northern direction into a western one, Kovno, which is supposed to have been built in the 11th century, soon acquired importance both as a fortified place and as a centre for trade. In its early history it often suffered from the attacks of the crusaders, and fell alternately under their dominion and under that of Lithuanians. Its citadel was destroyed in 1400, and from that time it became the centre of an active trade, being visited by German and English merchants. In the 16th, 17th, and 18th centuries it was the chief emporium for trade with Lithuania, and rivalled Königsberg. Henry of Valois said it was the best jewel of the kingdom. But continuous wars destroyed this commerce, and, when Kovno became a Russian town, in 1795, it was already a very poor place, which numbered in 1817 but two hundred houses. Owing to its advantageous situation, it has again acquired commercial importance. It has several remarkable old churches, two of which have been transferred to the Greek confession, and a beautiful old guild-hall now transformed into an imperial palace. Its population (83,060) is most varied; one half are Jews engaged in petty trades and commerce. Salt, salted fish, coal, and various manufactured wares are brought here from Prussia on vessels which return with cargoes of corn, linseed, timber, rags, bones, and wool, purchased in the governments of Vilna, Minsk, Grodno, and Tchernigoff.

KOVROFF, a town in Russia, situated in the government of Vladimir, on the railway between Moscow and Nijni Novgorod, 40 miles east-north-east of the capital of the province, on the right bank of the Klazma river. It has become, of late years, an important manufacturing centre,—cottons, machinery, and railway carriages being the principal items. It also carries on an active trade in the export of wooden wares and in the import of grain, salt, and fish, brought from the Volga provinces for the use of the government of Vladimir. Population 5000.

KOZELESK, a district town of the government of Kaluga in European Russia, situated 43 miles south-west of Kaluga, on the left bank of the river Zhuzdra. The principal building is the cathedral, erected in 1700, and rebuilt by Catherine II. after the fire of 1777. In the first half of the present century sailcloth was largely manufactured in the town; but this industry has declined, and, though there are oil-mills, tanneries, rope-walks, and breweries, many of the working classes have to seek employment elsewhere. Population in 1870, 13,400.

Kozelsk emerges in the middle of the 12th century. In 1288 it was utterly destroyed, and all its inhabitants put to the sword by the Tartar invaders. During the 16th century it formed a bone of contention between the Lithuanian princes and the grand-dukes of Moscow. Ivan the Terrible surrounded it with a wooden palisade. Captured by Dolgoroukoff in 1607, it withstood a heavy siege at the hands of Ismailoff.

KRAFFT, or KRAFT, ADAM (c. 1455–1507), sculptor of the Nuremberg school, was born, probably at Nuremberg, about the middle of the 15th century, and died, some say in the hospital, at Schwabach, about 1507. Of his life few particulars are known beyond the dates of several of his works. He seems to have emerged as sculptor about 1490, the date of the seven reliefs of scenes from the life of Christ, which, like almost every other specimen of his work, are at Nuremberg. The date of his last work, an Entombment, with fifteen life-size figures, in the Holzschuher chapel of the St John's cemetery, is 1507.

Besides these, Kraft's chief works are several monumental reliefs in the various churches of Nuremberg, the alto-relievo Entombment outside St Sebald's church; Christ Bearing the Cross, above the altar of the same church; and various works made for public and private buildings, as the relief over the door of the Waghans, a St George and the Dragon, several Madonnas, and some purely decorative pieces, as coats of arms. His masterpieces are perhaps the magnificent tabernacle, 63 feet high, in the church of St Lawrence, 1498–1500. See Wanders's *Adam Kraft und seine Schule*, 1869.

KRAJOVA, or ORAJOVA, a town in the circle of Dolochi, Roumania, is situated near the Sethyl, a tributary of the Danube, about 110 miles west of Bucharest. There are prosperous salt-works situated in the town; and from its position at the junction of the Carpathian high-roads with the route from Bucharest to Widdin its trade (largely in the hands of Jews) is important. In 1873 its population was 22,764.

Krivoja was the former capital of Little Wallachia. In 1807 it was the scene of a victory of the wretched Maréchal over the Turkish sultan Bajazet; and there, in October 1809, a fight between the Russians and Turcs took place.

KRANTZ, or CRANTZ, ALBERT (c. 1450–1517), German historian, was a native of Hamburg. He studied law, theology, and history at Rostock and Cologne, and after travelling through western and southern Europe was appointed professor, first of philosophy and subsequently of theology, in the university of Rostock, of which he was rector in 1482. In 1492 he returned to Hamburg as theological lecturer, canon, and prebendary in the cathedral. By the senate of Hamburg he was employed on more than one diplomatic mission abroad, and in 1500 he was chosen by the king of Denmark and the duke of Holstein as arbiter in their dispute regarding the province of Ditmarschen. As dean of the cathedral chapter, to which office he was appointed in 1508, Krantz applied himself with zeal to the reform of ecclesiastical abuses, but, though opposed to

various corruptions connected with church discipline, he had little sympathy with the drastic measures of Wickliffe or Huss. A desubtled utterance of his, somewhat desponding in its tone, with reference to Luther and his ninety-five theses has occasionally, but unfairly, been interpreted as a summary condemnation of that Reformer. Krantz died December 7, 1517.

Krantz was the author of a number of historical works which for the period when they were written are characterized by exceptional impartiality and research. The principal of these are *Chronica regnorum aequilonarum Danice, Suecie, et Norvegie*, Strasbourg, 1545; *Vandalica, sive historia de Vandalorum vera origines, &c.*, Cologne, 1519; *Saxonia*, 1520; and *Metropolis sive Historia ecclesie in Saxonia*, 1548. See life by N. Wickens, Hamburg, 1732.

KRASNOYARSK, a town of eastern Siberia, capital of the extensive province of Yeniseisk, which stretches as a long strip from the Chinese frontier formed by the Sayan mountains to the shores of the Arctic Ocean. It is situated on the left bank of Yenisei river, at its confluence with the Katcha, and on the highway from Moscow to Irkutsk, 662 miles west-north-west from the latter. It was founded by Cossacks in 1528, and during the early years of its existence it was more than once besieged by the Tartars and Kirghiz. It became the capital of the province in 1822, and is now the seat of the provincial administration. Its commercial importance depends entirely upon the gold-washings of the Yeniseisk district, supplies for which are sent from Krasnoyarsk. The climate is very cold, but dry, so that in the steppe which surrounds the town there is but little snow, even in mid-winter. The Yenisei river is frozen for one hundred and sixty days at Krasnoyarsk. Population, 13,000.

KREMENTZ, a district town of Russia, in the government of Volhynia, in the high valley of the Ikva, one of the tributaries of the basin of the Pripiat, situated 30 miles east from Radziviloff, the great custom-house on the railway between Kieff and Lwow. It is a poor place, the 11,800 inhabitants of which follow agriculture, raise tobacco, and excavate flint. But the Jews, who are numerous in the town, carry on a brisk trade in grain, which is stored here for export to Galicia and Odessa. The picturesque ruins of an old castle on a crag close by the town, are usually known under the name of the castle of Queen Bona; it was built, however, but in the 8th or 9th century. The hordes of Baty vainly besieged it in 1241 and 1256. From that time Kremenetz was alternately under the dominion of Lithuania and Poland, till 1648, when it was taken by the Zaporozhzi Cossacks. During the years 1806 to 1832 its Polish lycium was the centre of superior instruction for the western provinces of Little Russia; but after the Polish insurrection of 1831 the lycium was transferred to Kieff, and is now the university of that town.

KREMENTCHUG, a Russian town in the government of Poltava, situated 74 miles by rail to the south-west of the government town, on the railway between Kharkoff and Nicolaieff, and on the left bank (here flat and sandy) of the Dnieper. It is supposed to have been founded in 1571; by its situation at the southern terminus of the navigable course of the Dnieper, and on the highway from Moscow to Odessa, it early acquired a great commercial importance, which it still retains; by 1855 it was a wealthy town. In 1785 it became capital of "New Russia." It now has a suburb, Kryukoff, on the right bank of the Dnieper, united with the town by a railway bridge. Nearly all commercial transactions in salt with White Russia are effected at Kremenchuk, the salt being deposited in large storehouses in Kryukoff, and then sent by boat to the north-west. The town is also a centre of the tallow trade with Warsaw; considerable quantities of timber, too, are floated down to this place and thence sent to the neighbouring provinces. Nearly all the trade in the

brandy manufactured in the government of Kharkoff and destined for the governments of Ekaterinoslaff and Taurida is concentrated here, as also is the trade in linseed between the districts situated on the left affluents of the Dnieper and the southern ports. Other articles of commerce are rye, rye-flour, wheat, oats, and arrarsine, which are sent, partly up the Dnieper to Pinsk, partly by land to Odessa and Bessarabia, but principally to Ekaterinoslaff, on light boats floated down during the spring floods. Although thus busily employed, the town does not wear the aspect of a commercial place, the linseed being mostly warehoused in the houses of the Jews who carry on this trade, and the important banking operations being also chiefly in the hands of Jews. The Dnieper is crossed at Kremenchuk by a remarkable tubular bridge 1081 yards long, over which passes the railway from Kharkoff to Balta; there is also a bridge of boats. The manufactures consist of carriages, agricultural machinery, and tobacco. Population, 31,000.

KREMNITZ (Hungarian, *Kőrménitz*), a mining town in the cis-Danubian county of Bars, Hungary, lies in a deep valley, and on the Hungarian state railway, 82 miles north of Budapest, in 48° 42' N. lat., 18° 46' E. long. It is the seat of a board of mining control, and of the management of the mint, and has an office of woods and forests. As noteworthy buildings may be mentioned the castle, several Roman Catholic and the Lutheran churches, a Franciscan monastery (founded 1634), the town-hall, and the mint where the celebrated Kremnitz gold ducaats are struck. The great bulk of the unlabintants find employment in connexion with the gold and silver mines, which, though far less productive than formerly, still yield considerable quantities of ore. By means of a tunnel 9 miles in length, constructed in 1851-52, the water is drained off from the mines into the Garam or Gran. In 1880 the population was 8552, mostly Germans.

According to tradition Kremnitz was founded in the 8th century by Saxons. In 1100 it was raised to the dignity of a royal free town. In the middle of the 12th century the population was much augmented by German colonists, and in 1295 the commune received special privileges at the hands of Charles Robert of Anjou. From 1424 to 1438 the town was frequently at the mercy of the Hussites. After the catastrophe at Mohács (1526) it suffered repeatedly from the Turks, and during the 17th century both from the forces of successive Transylvanian princes and from Ottoman hordes.

KREMSIER (in Czech, *Kromeriz*), chief town of a district in Moravia, Austria, is situated in the fertile region of Hanna on the March, about 25 miles south-west of Olmütz. It is the seat of several local courts, and is the summer residence of the bishop of Olmütz, whose palace, surrounded by a fine park and gardens, and containing a picture gallery, library, and various collections, forms the chief object of interest. Kremzier has both a German and a Slav upper-gymnasium, a higher commercial school, a convent, and a hospital. Its industries include printing, and the manufacture of sugar, malt, and pottery. In 1870 the population was 9918.

In 1181 Kremzier was the seat of a bishopric. It suffered considerably during the Hussite war, and in 1648 it was taken and burned by the Swedes. After the stang of 1848, the Austrian congress met in the palace at Kremzier from November 1848 till March 1849.

KREUTZER, COMRADIN (1782-1849), German musical composer, owes his permanent fame almost exclusively to one opera, *Das Nachtlager von Granada*, which has kept the stage for nearly half a century in spite of the changes of taste. It is written in the style of Weber, and is remarkable especially for its flow of genuine melody and depth of feeling. The same qualities are found in Kreutzer's part songs for men's voices, which at one time were extremely popular in Germany, and are still listened to with pleasure. Amongst these *Der Tag des Herrn* ("The Lord's Day.") may be named as the most excellent. It is

undoo a masterpiece of its kind. Kreutzer was a prolific composer, and wrote a number of operas which have disappeared from the stage and are not likely to be revived. His life also is devoid of interesting features, and may be summed up in few words. He was born November 22, 1782, at Moskirch in Baden, and received his musical training from Albrechtsberger, the famous contrapuntist of Vienna. For the theatre of that city he composed most of his operas, including *Das Nachtlager von Granada*, produced in 1834. For a time (1815-1816) he was chapel-master to the king of Wurtemberg, and later on (1840) became conductor of the opera at Cologne. He died December 14, 1849, at Itz, where he had accompanied his daughter Cecilia Kreutzer, a singer of some renown.

KREUZNACH, or CREUZNACH, chief town of a circle in the government district of Coblenz, Prussia, is situated on the Nahe, a tributary of the Rhine, about 40 miles south-east of Coblenz. It consists of the old town on the right bank of the river, the new town on the left, and the island Badeworth, all of which are connected by a fine stone bridge. There is an iron bridge between the island and the right bank. Kreuznach is the seat of a local court, and it has a gymnasium, a business-school, and a hospital. On the Badeworth is the kurlaus, built in 1872, with baths and gardens, and also the chief spring, the Elisabethquelle, impregnated with iodine and bromine, and prescribed for scrofulous and various other affections. The climate is mild, moderately damp, and on the whole equable. The chief industries of the town are marble-polishing and the manufacture of leather and tobacco, and various knock-knacks in agate. Vines are grown on the neighbouring hills. The population in 1875 was 13,772.

The earliest mention of the springs of Kreuznach occurs in 1478, but it was only in the early half of the 19th century that Dr Prieger (whose marble-tablets adorn the town) brought them into prominence. Now the annual number of visitors is about seven thousand. In the 9th century Kreuznach was known as *Crudinacum*. In 1065 it was presented by Henry IV. to the bishop of Spire, from whom it passed (after becoming a town in the early part of the 13th century) to the counts of Sponheim and the Palatinate. In 1814 it became French. During the 17th century Kreuznach was more than once taken and plundered; and in 1689 the French reduced the strong castle of Katzenberg to the ruin which still surmounts the Schlossberg to the north-west of the town.

KRILOFF, KRILOFF, or KRYLOFF, IVAN ANDREYEVICH (1768-1844), the great national fabulist of Russia, was born February 14, 1768, at Moscow, but his early years were spent at Orenburg and Tver. His father, a distinguished military officer, died in 1779, and young Kriloff was left with no richer patrimony than a chest of old books, to be brought up by the exertions of an heroic mother. In the course of a few years his mother removed to St Petersburg, in the hope of securing a Government pension; and there Kriloff obtained a post in the civil service, but he gave it up immediately after his mother's death in 1788. Already in 1783 he had sold to a bookseller a comedy of his own composition, and by this means had procured for himself the works of Molière, Racine, Boileau; and now, probably under the influence of these writers, he produced *Philomela* and *Cleopatra*, which gave him access to the dramatic circle of Knyazhina. Several attempts he made to start a literary magazine followed each other with little success; but, along with his plays, they served to make the author known to the polite society of the capital. For about four years (1797-1801) Kriloff lived at the country seats of the prince Sergius Galtzina, and when the prince was appointed military governor of Livonia he accompanied him as official secretary. About the years which follow his resignation of this post very doubtful information has been preserved, the common opinion being that he wandered from town to town under the influence of a passion for card-playing. Before long he found his place

as a fabulist, the first collection of his *Fables*, twenty-three in number, appearing in 1809. From 1812 to 1841 he held a congenial appointment in the Imperial Public Library—first as assistant, and then as head of the Russian books department. His death took place November 21, 1844. His statue in the Summer Garden is one of the finest monuments in St Petersburg.

Kriloff's success as a fabulist was as rapid as it has been enduring. Honours were showered upon him while he yet lived: the Academy of Sciences admitted him a member in 1811, and bestowed upon him the same gold medal which was accorded to Karamzin for his *History of the Russian People*; in 1838 a great festival was held under imperial sanction to celebrate the jubilee of his first appearance as an author, and the emperor assigned him a handsome pension. Before his death about 77,000 copies of his *Fables* had found sale in Russia; and his wisdom and humour had become the common possession of the many. Nor is the reason far to seek. He was at once poet and sage. In spite of a superficial indifference to political matters, he observed everything with keen and collected interest. His fables for the most part struck root in some actual event, and they told at once by their grip and by their beauty. Though he began as a translator and imitator, he soon showed himself a master of invention, who found abundant material in the life of his native land. To the Russian ear his verse is of matchless quality; while word and phrase are direct, simple, and eminently idiomatic, colour and cadence vary with the theme. This perfection was the result of sustained elaboration, for, though physically indolent, Kriloff was a hard intellectual worker, and had an infinite faculty of taking pains. Of his carelessness in dress, absence of mind, and general irreverence towards etiquette, the stories told are many.

A collected edition of Kriloff's works appeared at St Petersburg, 1844. Of the numerous editions of his *Fables*, which have been often translated, may be mentioned that illustrated by Trutovsky, 1872. The author's life has been written in Russian by Pletneff, by Lebasoff, and by Grot, *Unter zhem Krutlova*. "Materials" for his life are published in vol. vi. of the *Sbornik* of the literary department of the Academy of Sciences. W. R. S. Balston has given an excellent sketch to his English prose version of the *Fables*, 1868, 2d ed. 1871.

KRISHNAGAR, town and headquarters of Nadiya district, Bengal, India, situated on the left bank of the Jalangi river, 25° 23' N. lat., 88° 32' E. long. The municipal limits comprise an area of 7 square miles and a population in 1873 of 26,750 persons—Hindus, 18,114, Mohammedans, 8076; Christians, 560. Besides the usual Government offices and courts, Krishnagar is also a station of the Church Missionary Society and of a Roman Catholic mission, each body having its own church and schools. The town is a seat of considerable trade, and is noted for its manufacture of coloured clay figures, carried on by a few artists of the *kumbhar* or potter caste.

KROLEWETZ, a district town of Russia, in the government of Tchernigoff, 108 miles east of the government town. Its 14,000 inhabitants live by agriculture and gardening, by linen manufacture, and by trading in agricultural produce and salted fish imported from the province of Ekaterinoslaw, and in manufactured wares. There are two important fairs, one for horses and manufactured wares, and the other for cattle.

KROTOSCHIN (in Polish, *Krotoszyn*), chief town of a circle in the government district of Posen, Prussia, is situated about 32 miles south-west of Posen. It has a local court, three churches, a synagogue, steam saw-mills, and a steam brewery, and carries on trade in grain and seeds. The neighbouring castle of Krotoschin is the chief place of a mediatised principality of the prince of Thurn and Taxis, which was formed in 1819. The population of Krotoschin in 1875 was 8034.

KRÜDENER, BARBARA JULIANA VON WISTINGHOFF, BARONESS VON (1766-1824), authoress of the romance of *Valérie*, but better known by the religious fervour and pious mysticism of her later years, was born of noble and wealthy parents at Riga, November 21, 1766. Her education, which was an elaborate one, was received partly in her father's house and partly in Paris. While still very young she was married to the Baron von Krudener, a Russian diplomatist twenty years her senior, whom she accompanied to Copenhagen and subsequently to Venice; the union did not prove a very happy one, and for some years the couple lived apart. It is understood that *Valérie*, published by Madame Krudener in 1804, is to a considerable extent an autobiography of this period of her life; if this be so, it is impossible to exonerate her of all blame for the domestic misfortunes which befel her. After the death of her husband she resided for some time in Paris, mingling freely with a large and brilliant social circle, but afterwards she retired to her property in Livonia, where her sense of the vanity of earthly things gradually deepened, and religious yearnings were quickened which ultimately found satisfaction in the doctrine and worship of the Moravian community. In 1808 she saw much of Jung Stilling at Carlshaus and of Oberlin in Stenthal; and the religious convictions now formed were held by her with such earnestness that she felt constrained to adopt the vocation of an itinerant preacher. Her obvious sincerity, her culture and refinement, her social standing, enabled her to attract considerable notice throughout Baden, in Strasbourg, and in Switzerland, especially in Geneva; and at Heilbronn in 1815 she could reckon even an emperor (Alexander I. of Russia) among her attentive hearers. Her activity, however, which was hardly favourable to established church order, soon became distasteful to the authorities, and, after being invited to withdraw from more than one German state, she again retired into private life on her estate in 1818. Led by her enthusiasm of humanity to St. Petersburg, she was dismissed by the emperor for having declared her sympathy for the struggling cause of Greece. Ill health now came upon her, and she was advised by her physicians to seek a warmer climate. On the southward journey she died at Karmen-Bazar on December 25, 1824. Her life has been written by Eynard (*Vie de Madame de Krüdener*, 3 vols., Paris, 1849).

KRUMEN, CROOMEN, KRUS, or CROOS, a negro people on the west coast of Africa. The name is properly Kru or Krao, though the corrupt form Crew-men has sometimes been put forward as the original. Ethnographically it ought to be confined to the tribes settled in the neighbourhood of the Sinece in the republic of Liberia, where their chief towns are known as Settra Kru, Little Kru, and Nana Kru; but, as they were the first west African people who ventured to take service on board European vessels, it is now generally applied to about a score of tribes living along 200 miles of coast who in this respect have followed their example. In spite of the fact that the Krus have come into close connexion with Europeans for a long series of years, the information in regard to them is of the scantiest description. They are an independent as well as an enterprising people, and keep themselves very much apart from other tribes. It is said that they have never furnished even a nominal convert to Christianity. They are now mainly engaged as traders or agents; and comparatively few of the Krumen proper are to be found serving as boatmen or sailors. As soon as they have amassed a competency they return to their native country. They keep no slaves themselves, and they are never found in slavery abroad. The men are tall, strong, and well-proportioned, with bluish-black complexion, woolly and abundant hair, and a greater frequency of beard than is

common among negroes. They appear to be dolichocephalic and prognathic. Their women are of a lighter shade than negro women generally, and in several respects come much nearer to a European standard. Tribal or clan marks are worn on the face: the Krumen examined by Schlagintweit, for example, had a blue vertical stroke on the brow; those seen by Wittestein at Monrovia had a black stroke and an arrow directed from the ear to the eye. Dr Bleek classifies the Kru language with the Mandingo family, and in this he is followed by Latham; Dr Koelle, who published a Kru grammar (1854), considers it as distinct.

Further details will be found in Quatrefages and Hamy, *Crasse des Races*, part ix., 1878-79, p. 363, Schlagintweit-Bakuninski, in the *Sitzungsbericht* of the Academy at Munich, 1876, Nicolas, in *Bull. de la Soc. d'Anthrop.*, Paris, 1872.

KRUMMACHER. Three members of this family have attained some popularity as religious writers in Germany and indeed throughout Reformed Protestant Christendom.

1. FRIEDRICH ADOLF KRUMMACHER was born July 13, 1768, at Tecklenburg, Westphalia, studied theology at Lingen and Halle, and became successively rector of the grammar school at Mors, professor of theology at Duisburg, preacher at Crefeld and afterwards at Ketwich, consistorialrath and superintendent in Bernburg, and pastor of the Augustuskirche in Bremen (1824), where he died on 14th April 1845. He was the author of numerous religious works, but is best known by his *Parabeln*, first published in 1805, which have gone through numerous German editions (9th ed., Essen, 1876), and have been translated into English and other European languages.

2. GOTTFRIED DANIEL KRUMMACHER, born at Tecklenburg, April 1, 1774, was pastor successively in Bhl, Wulfrath, and Elberfeld. He was the leader of the "pietists" of Wupperthal, and published several volumes of sermons, including one entitled *Israel's Wanderings*. His death occurred on January 30, 1837.

3. FRIEDRICH WILHELM KRUMMACHER, son of Friedrich Adolf, was born at Mors, January 28, 1796, studied theology at Halle and Jena, and became pastor successively at Ruhrtort (1823) and Gemark, near Barmen (1825). In 1847 he received an appointment to the Dreifaltigkeitskirche in Berlin, and in 1853 he became court preacher at Potsdam. He died December 10, 1868. F. W. Krummacher was an influential promoter of the Evangelical Alliance. His best known works are *Elias der Thierster* (1828-33; 6th ed. 1874), well known to English readers, and *Elixa* (1837), also translated, but much less popular both in England and Germany than its predecessor. He published several volumes of sermons, and an *Autobiography* appeared in 1869.

KRUSENSTERN, ADAM JOHN (1770-1849), Russian navigator, hydrographer, and admiral, was born in Mestonia on November 8, 1770. In 1786 he entered the corps of naval cadets, after leaving which, in 1788, with the grade of midshipman, he served in the war against Sweden. Having been appointed to serve in the English fleet for several years (1793-99), he visited America, India, and China. Having published a paper pointing out the advantages of direct communication between Russia and China by Cape Horn and the Cape of Good Hope, he was appointed by the emperor Alexander to make a voyage to the east coast of Asia to endeavour to carry out the project. Two English ships were bought, Krusenstern commanding the one and Lisiansky the other. Leaving Cronstadt in August 1803, Krusenstern proceeded by Cape Horn and the Sandwich Islands to Kamchatka, and thence to Japan. Returning to Europe by the Cape of Good Hope, after an extended series of explorations, Krusenstern reached Cronstadt in August 1806, his being the first Russian expedition

to circumnavigate the world. The emperor conferred several honours upon him, and he ultimately became admiral. As director of the Russian naval school Kruzenstern did a great deal to improve the education and the position of the cadets, and in other ways the Russian navy was much indebted to his enlightened exertions. He was also a member of the scientific committee of the marine, and his contrivance for counteracting the influence the iron in vessels has on the compass was adopted in the navy. He died at Ravel, August 24, 1846.

Kruzenstern's *Voyage Round the World* in 1803 was published at St Petersburg in 1810-14 in 3 vols., with folio atlas of 104 plates and maps (English edition, 2 vols., 1819, French edition, 2 vols., and atlas of 90 plates, 1820). His narrative contains a good many important discoveries and rectifications, especially in the region of Japan, and the contributions made by the various savants were of much scientific importance. A work of permanent value is Kruzenstern's *Atlas of the Pacific Ocean*, with its accompanying *Récueil des Mémoires Hydrographiques*, 3 vols., St Petersburg, 1824-36. See *Moniteur* by his daughter Madame Bernhardt, translated by Sir John Ross, 1856.

KUBA, or KUDAL-KALA, a town of the Caucasus, in the government of Baku, Russia, 120 miles north-west from Baku, and 25 miles west of the Caspian. Its situation at the foot of the highlands of Caucasus, on a plain watered by the numberless branches into which the Kubinka river and other smaller streams divide from their issue from the mountain valleys, makes the neighbourhood very suitable for gardening, which is the chief occupation of the 11,300 inhabitants of Kuba, mostly Mussulman Shiites. They also make carpets with very bright colours, and some silks, which are exported to Transcaucasia and Russia; whilst Jews, who are numerous, carry on an active trade in rough silk, madder, and silk and woollen goods, exported to Russia and Persia. The town, which formerly was a Persian fort, and still is protected on one side by brick walls, is badly built and dirty; it suffers very much from fever. An unsuccessful attempt was made by the military authorities in 1835 to transport the town to New Kuba, 8 miles distant; the new settlement did not increase, and the settlers returned to Kuba.

KUBAN, a Russian district and government at the north-west extremity of the Caucasus, comprising the entire basin of the river of that name. It is bounded on the N. by the lands of the Don Cossacks and the steppes of Stavropol, E. by the watershed of the river basins of the Caspian and sea of Azoff, S. and S.W. by the Caucasian Alps, and W. by the Black Sea and Straits of Kertch. Its area comprises 27,728 square miles. Ekaterinodar, the chief town (population 30,000), is the residence of the governor, who, being also ataman in chief of the Kuban Cossacks, is invested with military and civil power. Climate varies greatly, the highest temperature reaching 104° Fahr., the lowest seldom falling below 10° Fahr. The country is very healthy, except in the lowlands, where fever prevails. The soil is of extreme fertility, yielding an abundance of wheat, maize, and tobacco. Fruit, such as apples, pears, cherries, is plentiful, and the vine is cultivated with success near Temrouk and Taman. The upper valleys are richly covered with forests abounding in fir, oak, ash, beech, hornbeam, &c.; the lower parts consist of extensive pasture lands and swamps. The animals include the stag, roe-deer, bear, wild boar, wolf, fox, ibex, and otomias, also the bison (which, however, is very rare) in the virgin forests of the Teberda; numerous water-fowl, such as ducks, geese, swans, pelicans, also the pheasant, partridge, bustard, and mountain turkey. The rivers and lakes are plentifully supplied with fish, trout abounding in the mountain streams and the sturgeon at the delta of the river Kuban. The mineral wealth consists of coal, salt, petroleum, and ozokerite. The river Kuban (the ancient Hypanis, see CAUCASUS, vol. v. p. 254) is navigable in flat-bottomed boats over a distance

of 100 miles between Temrouk and Ekaterinodar. The delta comprises several lakes.

It is on the upper banks of the Kuban that the Aze or Osas, and the eugenic coast of *Asia Propria*, are believed to have been located. The history of the original settlements of the various native tribes named below, and their language and worship before the introduction of Mohammedanism, remain a blank page in the legends of the Caucasus. The peninsula of Taman, a land teeming with relics of ancient Greek colonisation, has been occupied successfully by the Cimmerians, Scythians, Khazars, Mongols, and other nations. The Genoese, who had established an extensive trade in the 13th century, were expelled by the Turks in 1484, and in 1784 Russia obtained by treaty the entire peninsula and the territory on the right bank of the Kuban,—the latter being granted by Catherine II. in 1793 to the Cossacks of the Don. Then commenced the bloody struggle with the Circassians which continued for more than half a century. The mountaineers were finally subdued in 1864, and 400,000 of their number expatriated. These, however, who elected to remain have become more prosperous than ever before. The population of Kuban, 892,478, embraces 610,028 Cossacks, 108,946 settlers of Russian origin, 4280 foreigners, and 86,602 natives. Cossack villages are military settlements, the men carrying arms as well as following the plough. They are exempt from the poll-tax (3 to 4 rubles) to which the others are subjected, but military service is compulsory, as is gratuitous labour in the construction and repair of roads, bridges, &c. Not only domestic but even field work is conducted mostly by women, remarkable for physical strength and endurance. Corn growing, the rearing of cattle, and fishing are the most profitable occupations. The native mountaineers, known under the general name of Circassians, but locally distinguished as the Karachai, Abadzekh, Khakoutchi, Shapsigh, have greatly altered their mode of life since the pacification of the Caucasus, still, however, maintaining Mohammedanism, speaking their vernacular, and strictly observing the customs of their ancestors. When during the late Russo-Turkish war insurrections broke out amongst the tribes on the Terek, in Daghestan, and Abkhassan, those tribes remained peaceful and perfectly loyal. Their villages, especially those of the Karachai, are striking examples of human industry, poverty being quite unknown; for the general emancipation in 1867 put an end to intestine strife, the predatory expeditions of former times, and the sale of a number of numerous chiefs on the forced labour of serfs. The native population, as well as the Cossacks, enjoy certain rights of self-government, and are allowed to hold meetings to that end. Exports include wheat, tobacco, leather, wool, petroleum, and live cattle; imports dry goods, grocery, and hardware. Local industry is limited to a few tanneries, petroleum refineries, and spirit distilleries; but Russian and foreign capitalists have of late obtained concessions for exploring the petroleum region stretching between Khadzi and Taman, and the coal-mines of Khamursky in the upper valley of the Kuban.

KUBLAI KHAN (or KAAH, as the supreme ruler descended from Jenghiz was usually distinctively termed in the 13th century) (1216-1294) was the most eminent of the successors of Jenghiz (Chinghis), and the founder of the Mongol dynasty in China. He was the second son of Tuli, youngest of the four sons of Jenghiz by his favourite wife. Jenghiz was succeeded in the khanahship by his third son Okkodaï, or Ogdaï (1229), he by his son Kuyuk (1246), and Kuyuk by Mangku, eldest son of Tuli (1260). Kublai was born in 1216, and, young as he was, took part with his younger brother Hulaku (afterwards conqueror of the caliph and founder of the Mongol dynasty in Persia) in the last campaign of Jenghiz (1226-27). The Mongol poetical chronicler, Sanang Setzen, records a tradition that Jenghiz himself on his deathbed discerned young Kublai's promise and predicted his distinction.

Northern China, Cathay as it was called (vol. v. p. 637), had been partially conquered by Jenghiz himself, and the conquest had been followed up till the Kin or "golden" dynasty of Tartars, reigning at Kai-fung-fu on the Yellow River, were completely subjugated (1234). But China south of the Great Kiang remained many years later subject to the native dynasty of Sung, reigning at the great city of Linngan, or Kinai (*Kwang*—"capital"), now known as Hang-chow-fu. Operations to subdue this region had commenced in 1235, but languished till Mangku's accession. Kublai was then named his brother's lieutenant in Cathay, and operations were resumed. By what seems a vast and risky strategy, of which the motives are not

quite clear, the first campaign of Kublai was directed to the subjugation of the remote western province of Yunnan. After the capture of Tulufo (well known in recent years as the capital of a Mohammedan insurgent Sultan) Kublai returned north, leaving the war in Yunnan to a trusted general. Some years later (1267) the Khan Mangku himself entered on a campaign in west China, and died there, before Ho-chow in Szechuen (1295).

Kublai assumed the succession, but it was disputed by his brother Ariskhanga, and by his cousin Kaidu, and wars with these retarded the prosecution of the southern conquest. Doubtless, however, this was constantly before Kublai as a great task to be accomplished, and its fulfilment was in his mind when he selected as the future capital of his empire the Chinese city that we now know as Peking. Here, in 1264, to the north-east of the old city, which under the name of Yenking had been an occasional residence of the Kin sovereigns, he founded his new capital, a great rectangular plot of 18 miles in circuit. The (so-called) "Tartar city" of modern Peking is the city of Kublai, with about one-third at the north cut off, but Kublai's walls are also on this retrenched portion still traceable.

The new city, officially termed Tai-tu ("great court"), but known among the Mongols and western people as Ksan-baligh ("city of the khan"; see vol. iv. p. 722), was finished in 1267. The next year war against the Sung empire was resumed, but was long retarded by the strenuous defence of the twin cities of Siang-yang and Fan-ching, on opposite sides of the river Han, and commanding two great lines of approach to the basin of the Great Kiang. The siege occupied nearly five years. After this Bayan, Kublai's best lieutenant, a man of high military genius and noble character, took command. It was not, however, till 1276 that the Sung capital surrendered, and Bayan rode into the city (then probably the greatest in the world) as its conqueror. The young emperor, with his mother, was sent prisoner to Ksan-baligh; but two younger princes had been despatched to the south before the fall of the city, and these successively were proclaimed emperor by the adherents of the native throne. An attempt to maintain their cause was made in Fuh-keen, and afterwards in Canton province; but in 1279 these efforts were finally extinguished, and the faithful minister who had inspired them terminated the struggle by jumping with his young lord into the sea.

Even under the degenerate Sung dynasty the conquest of southern China had occupied the Mongols during intermittent campaigns of half a century. But at last Kublai was ruler of all China, and probably the sovereign (at least nominally) of a greater population than had ever acknowledged one man's supremacy. For, though his rule was disputed by the princes of his house in Turkestan, it was acknowledged by those on the Volga, whose rule reached to the frontier of Poland, and by the family of his brother Hulaku, whose dominion extended from the Oxus to the Arabian desert. For the first time in history the name and character of an emperor of China were familiar as far west as the Black Sea, and not unknown in Europe. The Chinese seals which Kublai conferred on his kinsmen reigning at Tabriz are stamped upon their letters to the kings of France, and survive in the archives of Paris. Adventurers from Turkestan, Persia, Armenia, Byzantium, even from Venice, served him as ministers, generals, governors, envoys, astronomers, or physicians; soldiers from all Asia to the Caucasus fought his battles in the south of China. Once in his old age (1287) Kublai was compelled to take the field in person against a serious revolt, raised by Nayan, a prince of his family, who held a vast domain on the borders of Manchuria. Nayan was

taken and executed. The revolt had been stirred up by Kaidu, who survived his imperial rival, and died in 1301. Kublai himself died in 1294, at the age of seventy-eight.

Though a great figure in Asiatic history, and far from deserving a niche in the long gallery of Asiatic tyrants, Kublai misses a record in the short list of the good rulers. His historical locus was a happy one, for, whilst he was the first of his race to raise above the innate barbarism of the Mongols, he retained the force and warlike character of his ancestors, which vanished utterly in the effeminacy of those who came after him. He had great intelligence and keen desire of knowledge, with apparently a good deal of natural benevolence and magnanimity. But his love of splendour, and his fruitless expeditions beyond sea, created enormous demands for money, and he shut his eyes to the character and methods of those whom he employed to raise it. A remarkable narrative of the oppressions of one of these, Ahmed of Fenak, and of the revolt which they provoked, is given by Marco Polo, in substantial accordance with the Chinese annals.

Kublai patronized Chinese literature and culture generally. Of the great astronomical instruments which he caused to be made specimens are still preserved at Peking, which are truly splendid as works of art, and not contemptible as works of science. Though he put hardly any Chinese into the first ranks of his administration, he attached many to his confidence, and was personally popular among them. Had his endeavour to procure European priests for the instruction of his people, of which we know through Marco Polo, prospered, the Roman Catholic Church, which did gain some ground under his successors, might have taken stronger root in China. Failing this momentary effort, Kublai probably saw in the organized force of Tibetan Buddhism the readiest instrument in the civilisation of his countrymen, and that system received his special countenance. An early act of his reign had been to constitute a young lama of intelligence and learning the head of the Lamaist church, and eventually also prince of Tibet, an act which may be regarded as a precursory form of the rule of the "grand lamas" of Lassa. The same ecclesiastic, Mati Dihwaya, was employed by Kublai to devise a special alphabet for use with the Mongol language. It was chiefly based on Tibetan forms of Nagari; some coins and inscriptions in it are extant; but it had no great vogue, and soon perished. Of the splendour of his court and entertainments, of his palaces, summer and winter, of his great hunting expeditions, of his revenues and extraordinary paper currency, of his elaborate system of posts and much else, an account is given in the book of Marco Polo, who passed many years in Kublai's service.

We have alluded to his foreign expeditions, which were almost all disastrous. Nearly all arose out of a hankering for the nominal extension of his empire by claiming submission and tribute. Expeditions against Japan were several times repeated; the last, in 1281, on an immense scale, met with huge discomfiture. Kublai's preparations to avenge it were abandoned owing to the intense discontent which they created. In 1278 he made a claim of submission upon Champa, an ancient state representing what we now call Cochinchina. This eventually led to an attempt to invade the country through Tongking, and to a war with the latter state, in which the Mongols had much the worst of it. War with Burma (or Mien, as the Chinese called it) was provoked in very similar fashion, but the result was more favourable to Kublai's arms. The country was overrun as far as the Irawaddy delta; the ancient capital Pagan, with its magnificent temples, destroyed, and the old royal dynasty overthrown. The last attempt of the kind was against Java, and occurred in the last year of the old khan's reign. The envoy whom he

had commissioned to claim homage was sent back with ignominy. A great armament was equipped in the ports of Fuh-keen to avenge this insult, but after some temporary success the force was compelled to re-embark with a loss of 3000 men. The death of Kublai prevented further action.

Some other expeditions, in which force was not used, gratified the khan's vanity by bringing back professions of homage, with presents, and with the curious reports of foreign countries in which Kublai delighted. Such expeditions extended to the states of southern India, to eastern Africa, and even to Madagascar.

Of Kublai's twelve legitimate sons, Chingkim, the favourite and designated successor, died in 1284-85; and Temur, the son of Chingkim, took his place. No great king arose in the dynasty after Kublai. He had in all nine successors of his house on the throne of Kank-baligh, but the long and imbecile reign of the ninth, Toghon Temur, ended (1368) in disgrace and expulsion, and the native dynasty of Ming reigned in its stead. (H. Y.)

KUCHAN (a contracted form of *Kabushān*), a walled town and also a district of Persia, province Khōrāsān, enclosed north and south by the Hamr-Masjid and Aladagh mountains. The town lies at the north foot of the Shāh Jahān Kuh (11,000 feet), 3300 feet above the sea, in 37° 10' N. lat., 68° 25' E. long., about 80 miles northwest of Meshhed on the route to Shirvān. It is an important place, seat of a district governor, and surrounded by extensive gardens and vineyards yielding excellent fruits and grapes from which a superior wine is made. Population 30,000.

The district forms the western section of the longitudinal valley stretching between the above-mentioned ranges from Meshhed to Shirvān and communicating by the Allah-o-Akbar Pass (4200 feet) northwards with the Dargaz country on the frontier of the new Russian Trans-Caspian Territory. It is very fertile, largely cultivated, and well watered by the upper Atrak river, which has its furthest source in an intermittent torrent just south of the pass. The whole valley is thickly dotted over with villages, while the slopes of the hills afford good pasture to the numerous flocks and herds of the warlike Zafaranlu Kurds, who guarded the frontier against the Akhal Tekke Turkomans until these marauders were reduced by the Russians in the spring of 1881. Of this region little was known until the explorations of Baker, Gill, O'Donovan, and Stewart (1874-81).

KUCH BEHAR, or СОСНА ВЕНАР, a native state in Bengal, India, lying between 26° 57' and 26° 32' N. lat., and 86° 48' and 89° 55' E. long. It is entirely surrounded by British territory, being bounded on the N. by Jalpāgnri, on the E. by Gōdāri, on the S. by Rangpur, and on the W. by Purniah districts. The state forms a level plain of triangular shape, intersected by numerous rivers. The greater portion is fertile and well cultivated, but tracts of jungle are to be seen in the north-east corner, which abuts upon Assam. The soil is uniform in character throughout, consisting of a light friable loam, varying in depth from 6 inches to 3 feet, superimposed upon a deep bed of sand. The whole is detritus, washed down by torrents from the neighbouring Himalayas. The rivers all pass through the state from north to south, to join the main stream of the Brahmaputra. Some half dozen are navigable for small trading boats throughout the year, and are nowhere fordable; and there are about twenty minor streams which become navigable only during the rainy season. The streams have a tendency to cut new channels for themselves after every annual flood, and they communicate with one another by cross-country water-courses. There are no embankments or artificial canals, nor are any mineral products known to exist.

The population in 1872 was 532,605, distributed over an area of 1807 square miles. The Hindus numbered 127,928; the Mohammedans, 48,086. The Koch or Rājāshāh tribe numbered 111,126 adult males, or 63 per cent. of the whole. This is a widely spread tribe, evidently of aboriginal descent, which is found throughout all northern Bengal, from Purniah district to the Assam valley. They are akin to the Indo-Chinese races of the north-east frontier; but they have now become largely Hinduized, especially in their own home, where the appellation "Koch" has come to be used as a term of reproach. Koch Behar town, which contains the palace of the raja, and has 7192 inhabitants, is the only populous place in the state. Even villages, in the ordinary sense of the word, are unknown, each well-to-do family living apart in its own homestead. Rice is grown on three-fourths of the total cultivated area. Jute and tobacco are largely grown for exportation over an increasing area year by year. The only special industries are the weaving of a strong silk from worms fed on the castor-oil plant, and of a coarse jute cloth, used for screens and bedding. The external trade is chiefly in the hands of Māiwāri immigrants from Upper India. The chief exports are jute, tobacco, oil, timber, salt, sugar, and piece goods are imported. The net revenue in 1870-71 amounted to £212,083, of which £25,719 was derived from *landholder* estates in the British territory. The climate is damp and malarious, but not so hot as in other parts of Bengal. The average annual rainfall is 123 inches.

As in the case of many other small native states, the royal family of Koch Behar lays claim to a divine origin in order to conceal an impure aboriginal descent. The greatest monarch of the dynasty was Nar Nāryān, the son of Van Suh, who began to reign about 1650. He conquered the whole of Kāmrūp, built temples in Assam, of which ruins still exist bearing inscriptions with his name, and extended his power southwards over what is now part of the British districts of Rangpur and Purniah. To his reign also is attributed the introduction of the well-known Nāryān currency, the privilege of coining which has not yet been entirely abolished. His son, Lakshmi Nāryān, who succeeded him in Koch Behar, became tributary to the Mughal empire. In 1772 a competitor for the throne, having been driven out of the country by his rivals, applied for assistance to Warren Hastings. A detachment of troops was accordingly marched into the state; the Bhūtias, whose interference had led to this intervention, were expelled, and forced to sue for peace through the mediation of the lama of Tibet. By the treaty made on this occasion, April 1778, the raja acknowledged subjection to the Company, and made over to it one half of his annual revenues. But, though the Bhūtias were driven out, the rivalry of domestic faction continued. In 1838, on the death of the raja, leaving a son and heir only ten months old, a British commissioner was appointed to undertake the direct management of affairs during the minority of the prince, and many important reforms have thus been successfully introduced.

KUEN-LUN, or KOUEN-LUN, the name given to the mountains between western Tibet and the plains of eastern Turkestan; it is derived from the Chinese geographers, and is probably a corruption of some Turkish or Tibetan word; it appears to be unknown locally. The name having been adopted, chiefly on the initiative of Humboldt, before any correct geographical knowledge had been obtained of the region to which it was applied, it has been used with inconvenient want of precision, and this has encouraged erroneous conceptions. Little precise information is yet available on the subject, but there is no reason to doubt that, within the limits to which actual exploration has gone, the mountains designated as Kuen-lun form the northern border of the high lands of Tibet, descending to the central Asian plain, just as those commonly spoken of under the name of Himalaya constitute the broad mountainous slope which descends to the lower levels of India.

Nothing can be said with confidence of the northern border of Tibet east of 83° E. long., but from this point westward, to about the 75th meridian, it consists of a series of mountain ranges on a scale of magnitude quite analogous to that of the higher ranges of the Himalaya, and beyond the last-named meridian merges into the Thian-Shan mountains. A line of demarcation between the summit of the Tibetan plateau and its northern flank can, in the present condition of our knowledge, only be fixed in an arbitrary manner, and it may for convenience be regarded as following the watershed line from which the streams flow northward to the plain of eastern Turkestan. Using the name

Kuen-lun in the sense thus explained, the zone it includes will be seen to abut at its north-western extremity on the series of elevated plateaus known under the name of Pamir, which extend over a distance of nearly 300 miles to a little beyond 39° N. lat. Here the width of the zone is about 100 miles. To the eastward it becomes broader, and on the 79th meridian is nearly 150 miles across. In this region the chief ranges appear to be laid out, generally, in a north-west and south-east direction, like those of western Tibet, with transverse ridges at irregular intervals. The transverse direction would seem to predominate in the outer portion of the zone nearest to the plain of Turkestan, but the geographical details are too little known to permit us to say more on this point. Of the longitudinal ranges two are of conspicuous magnitude, running approximately parallel to one another about 60 or 70 miles apart; the more northern or outer may be spoken of as the main Kuen-lun; the other, which separates the waters of the Indus, which run off to the south-west, from those of the streams which pass down to the plains of Khotan, Yarkand, and Kashgar, constitutes the watershed before referred to, and has been called the Mustagh or Karakorum range from two of the best known passes across it. The latter of these great lines of elevation, from which the Kuen-lun slope of the Tibetan plateau may be said to commence, is of very considerable altitude throughout, its summits rising more than 28,000 feet above sea-level, and few of the passes falling below 18,000 or even 19,000 feet over a length of some 400 miles. Its flanks are covered with enormous glaciers, some of them being continuous for distances of 60 or 70 miles. The main Kuen-lun is not much inferior in magnitude, one of its peaks rising above 25,000 feet, while the points between that elevation and 20,000 feet are numerous. The passes lie between 18,000 feet on the east and 13,000 feet on the west. The valleys between these ranges vary in elevation from about 15,000 feet to 10,000 feet, the drainage in some cases collecting in small lakes, in others forming streams which, after flowing for some distance parallel to the separating ridges, suddenly change their direction and run off to the north-east through deep transverse lines of rupture, in a manner analogous to that observed on the border of the Himalayan mountain slope.¹

The whole of the region is described as remarkable for its general barren character. The mountain sides are naked and the valleys for the most part narrow and steep. There is a complete absence of forest, and trees of any sort are only found at the lower levels bordering on the northern plain, -walnuts, poplars, and willows alone being mentioned, besides a few fruit trees. The vegetation is scanty and botanically poor, brushwood being found along some of the rivers, and pastures in the bottoms of the deep valleys among the higher ranges. Among the shrubs are species common in Tibet, such as tamarisk, juniper, astragalus, willow, rose, barberry, and elematis. The animal life also appears to be mainly that found in the neighbouring parts of Tibet.

Some facts of interest relating to the geological structure of these mountains may be gathered from the fragmentary reports of Dr Stoliczka, the accomplished geologist who so prematurely died from the results of exposure in these inhospitable regions. The summit of the Karakorum Pass is of Triassic age, and cretaceous beds are found in some of the ranges on the north of the Kuen-lun main range, associated with Palaeozoic deposits supposed to be Carboniferous and Silurian. For the greater portion of the year the climate is very rigorous. The extremes of temperature are great, and the rainfall little.

The population is small. The fixed settlements are confined to the outer valleys; for villages or hamlets are found above 8000 feet of altitude, and hardly any over 8000 feet. The upper valleys are occupied by a nomadic population, wholly pastoral in their habits.

The tract may be regarded as appertaining politically to the sovereigns for the time being of the principalities lying in the plain below it. But from the nature of the case any recognised authority hardly extends beyond the permanently inhabited region. (R. S.)

¹ For information as to the geographical details which have been collected reference may be made to the map published in the *Royal Geog. Soc. Journal*, vol. xiv., accompanying Captain Trotter's account of the results of Sir T. D. Forsyth's mission to Kashgar.

KUKA, or KUKAWA, the capital of the kingdom of Bornu in Central Africa, is situated in 12° 55' N. lat. and 13° 25' E. long, $4\frac{1}{2}$ miles from the western shores of Lake Chad or Chad, in the midst of an extensive and for the most part uncultivated plain. The soil of the whole district consists of a layer of sand resting on clay, beneath which are found sand and lime. At a depth of 40 or 50 feet water is reached, usually sweet, but sometimes brackish. From a distance Kuka presents a very dead and monotonous appearance, there being no minarets or lofty buildings of any sort. The walls, built of earth, are about 20 feet in height. There are two distinct towns, separated by more than half a mile. The western town or Billa Futebe is the larger of the two, measuring from west to east about a mile and a half, and rather less from north to south. The plan is rectangular, and there is a gate in each of the four sides. From west to east runs the main thoroughfare known as the Dendal, which widens out to the west into the market place. About the middle of the Dendal stands the sheikh's secondary palace. The eastern town or Billa Gedibe is somewhat longer and narrower than the western. The Dendal continues from its western gate till closed at the east end of the town by the great palace of the sheikh, gradually widening out into a large open square. The larger dwelling-houses of Kuka are of mud or earth, with windowless walls and flat roofs; the poorer houses are mere huts of straw or reeds, varying in shape from that of a bell to that of a sugar-loaf. In almost every courtyard there is at least one large shady tree, whose branches are tenanted by storks, herons, or a variety of lesser birds; and the whole place is vocal with song. Kuka is a wealthy town. It always contains a large number of strangers—merchants, pilgrims, and adventurers—attracted even from Mecca, Medina, Morocco, Egypt, Tunis, Tripoli, by the fame of the sheikh's liberality. The town enjoys the rare advantage of being absolutely free from all taxation of trade or industry. In the Monday market, which is held outside the western gate, there are often more than 10,000 buyers and sellers. It is at once a fair for horses, cattle, camels, and other live stock, a fruit, grain, and vegetable market, a meat market, and a slave market. The currency consists mainly of Maria Theresa dollars and cowries. For the Mohammedans, not only of Bornu but of the neighbouring countries, Kuka serves as a kind of university town. In its streets are to be seen bands of mendicant students, who spend the day in collecting alms from the people, and after supper gather round the fires which they kindle in the public squares, and noisily and mechanically recite the verses of the Koran far into the night. A less cheerful feature of the street life is the unusual number of blind beggars. The population is estimated at 60,000.

Kuka was founded by Sheikh Mohammed al Amin al Kaneini. It received its name from a kuka or monkey bread tree (*Adansonia digitata*), which attracted the attention of the settlers as a rare thing in the district. In 1840 the town was laid waste by Eing Mohammed Sheriff of Wadai; and when it was restored by Sheikh Omar he gave it the present double form. It is probably from this feature of the place that the plural *KuKawa* has become the ordinary designation of the town in Kano and throughout the Sudan; though the local inhabitants generally use the singular *Kuka*. Kuka has been visited by Denham and Clapperton, Beaman, Vogel, Barth, Kuhlke, and Nachtigal.

For further details see Barth, *Travels in Central Africa*, London, 1858; Nachtigal, *Over South Africa*, Leipzig, 1874; Nachtigal, *Sudan and Soudan*, Berlin, 1876, vol. i. p. 281-282. The last is the most elaborate account.

KUKU KHOJO, in Chinese KWEI-HWA-CHENG or GUI-HUA-TOHENG, a city of the Chinese province of Shensi, situated to the north of the Great Wall, in 40° 50' N. lat. and 111° 45' E. long, about 180 miles west of Kalgan. It lies in the valley of a small river which joins the Honag-ho

² The fear lest the town should be submerged by the lake led the sheikh to found (1874) a new residence (Kharwa) on a range of sand hills about two hours north of Kuka.

50 miles to the south. There are two distinct walled towns in Kuku Khoto, at an interval of a mile and a half; the one is the seat of the civil governor and is surrounded by the trading town, and the other is the seat of the military governor, and stands in the open country. In the first or old town more especially there are strong traces of western Asiatic influence, the houses are not in the Chinese style, being built all round with brick or stone and having flat roofs, while a large number of the people are still Mohammedans, and, there is little doubt, descended from western settlers. The town at the same time is a great seat of Buddhism,—the lamasseries containing, it is said, no less than 20,000 persons devoted to a religious life. As the southern terminus of the route across the desert of Gobi from Uliassutai and the Thian Shan, Kuku Khoto has a large trade, exporting flour, millet, and manufactured goods, and importing the raw products of Mongolia. A Catholic mission and a Protestant mission are maintained in the town.

Early notices of Kuku Khoto will be found in Gerbillon (1688–1698), in Du Halde (vol. ii., English edition), and in Ashtley's *Col-Jahou* (vol. iv.). Recent travellers who have visited it are Ellis (*Journal Roy. Geog. Soc.*, 1879) and Potzloff.

KULDJA, this name of two towns in the valley of the Ili in Central Asia, situated about 25 miles apart.

I. **OLD KULDJA**, the present capital of the Kuldja territory, restored to China by Russia in 1881, otherwise known as Tarter Kuldja, Nin Ynan, or Kuron, lies about $\frac{1}{2}$ mile to the north of the river, in $43^{\circ} 58' N$ lat. and $81^{\circ} 26' E$. long. The walled town is nearly square, each side being about a mile in length; and the walls are not only 30 feet high but broad enough on the top to serve as a carriage drive. Two broad streets cut the enclosed area into four nearly equal sections. Since 1870 a Russian suburb has been laid out on a wide scale. The houses of Kuldja are almost all clay-built and flat-roofed, and except in the special Chinese quarter in the eastern end of the town it is only a few public buildings that show the influence of Chinese architecture. Of these the most noteworthy are the Tarantchi and Dungan mosques, both with turned up roofs, and the latter with a pagoda-looking minaret. The population is mainly Mohammedan, and there are only two Buddhist pagodas. A small Chinese Roman Catholic church has maintained its existence through all the vicissitudes of modern times. Paper and vermicelli are manufactured with rude appliances in the town. The outskirts are richly cultivated with wheat, barley, lucerne, and poppies. Schuyler estimated the population, which includes Tarnkhiis, Dungans, Sarta, Chinese, Calmucks, and Russians, at 10,000 in 1873; it has since increased.

II. **NEW KULDJA**, Manchu Kuldja, or Ila, which lies lower down the valley on the same side of the stream, has been a pile of ruins whitened with bleaching bones since the terrible massacre of all its inhabitants by the insurgent Dungans in 1868. It was previously the seat of the Chinese Government for the province, with a large penal establishment and strong garrison; its population was about 70,000.

See Schuyler, *Turkistan*, London, 1876, Dilke in *Proc. Roy. Geog. Soc.*, 1874; Ujvaly in *Tour du Monde*, 1879; E. D. Morgan in *Proc. Roy. Geog. Soc.*, 1881; and Lit, vol. xii. p. 702.

KULLU, a valley and subdivision of Kámrá district, Punjab, India, situated between $31^{\circ} 20'$ and $32^{\circ} 28' N$. lat., and $76^{\circ} 68'$ and $77^{\circ} 50' E$. long. It is bounded on the N. by the central Himalayan range, on the S. by the Sutlej river, on the S.W. by the Dholádar or Outer Himalaya, Bias river, and the states of Suket and Mandi, and on the W. by Bárá Bāghál hills. The Sainj, which joins the Bias at Lārgi, divides the tract into two portions, Kullu Proper and Sioráji. Kullu Proper, north of the

Sainj, together with Inner Sioráji, forms a great basin or depression in the midst of the Himalayan systems, having the narrow gorge of the Bias at Sārgi as the only outlet for its waters. North and east the Bárá Bāghál and Mid-Himalayan ranges rise to a mean elevation of 18,000 feet, while southward the Jalori and Dholádar ridges attain a height of 11,000 feet. The greater portion of Kullu must thus ever remain an utter wilderness. The higher villages stand 9000 feet above the sea; and even the cultivated tracts have probably an average elevation of 5000 feet. The houses consist of four-stoned chalets in little groups, huddled closely together on the ledges or slopes of the valleys, picturesquely built with projecting eaves and carved wooden verandahs. The Bias, which, with its tributaries, drains the entire basin, rises at the crest of the Rohtang Pass, 13,326 feet above the sea, and has an average fall of 125 feet per mile. Its course presents a succession of magnificent scenery, including cataracts, gorges, precipitous cliffs, and mountains clad with forests of deodar, towering above the tiers of pine on the lower rocky ledges. Great mineral wealth exists, but the difficulty of transport and labour will probably always prevent its proper development. Hot springs occur at three localities, much resorted to as places of pilgrimage.

The census of 1872 disclosed a population of 90,813, spread over an area of 1926 square miles—Hindus numbering 90,266, Mohammedans, 100; and Christians, 7. The character of the hillmen resembles that of most other mountaineers in its mixture of simplicity, independence, and superstition. Tibetan polyandry still prevails in Sioráji, but has almost died out elsewhere. The temples are dedicated rather to local deities than to the greater gods of the Hindu pantheon. Out of a total of 799,884 acres, only 35,584 are returned as actually under cultivation. The staple spring crops include wheat, barley, poppy, tobacco, and oil-seeds; the autumn crops are maize, rice, pulses, and millets. Tea cultivation has recently been introduced into the valley. Rice, wheat, opium, tobacco, tea, and honey are exported. Manufactures are almost unknown. The climate is not healthy. Intermittent fevers and bowel complaints are endemic, while epidemics of virulent contagious fever and cholera break out from time to time. Gout and rheumatism also occur. The average annual rainfall ranges from 45 to 60 inches. The mean temperature in August is 78° Fahr., in November 55° .

KULM (in Polish, *Chełmo*), chief town of a circle in the government district of Marienwerder, Prussia, is situated on the high banks of the Vistula, about 24 miles north-west of Thorn. It is regularly built, and contains an old-fashioned town-house, a gymnasium, a high school, and a cadets' institution founded in 1776 by Frederick II. It carries on trade in grain and has some shipping. The population in 1875 was 9628.

Kulm gives name to the oldest baptope in Prussia, although the bishop resides at Pelpin. It was taken about 1220 by Duke Conrad of Masovia. Frederick II. pledged it in 1296 to the Teutonic Order, from whom it passed by the second peace of Thorn in 1496 to Poland; and it was annexed to Prussia in 1773. It joined the Hanseatic League, and used to carry on very extensive manufactures of cloth. The battle of Kulm, won August 30, 1871, over the French by the Prussians and Russians, took place at the village of Kulm in Bohemia, about 8 miles north-east of Teplitz.

KULMBACH, or **CULMBACH**, a town in the administrative district of Upper Franconia, Bavaria, is picturesquely situated on the White Main, and on the Bamberg-Hof line of the Bavarian State Railway, about 11 miles north-west from Bamberg, in $50^{\circ} 6' N$. lat., $11^{\circ} 28' E$. long. The town has several linen manufactories and a large cotton spinners, but is chiefly famed for its many extensive breweries, the latest returns showing an annual production of 4,115,637 gallons of beer, of which 3,719,478 gallons were exported. On an eminence near the town stands the former fortress of Plassenburg, which during the 15th and 16th centuries was the residence of the margraves of Brandenburg-Kulmbach. It was dismantled in 1807, and is now used as a prison. The population in November 1881 was officially estimated at 6000.

KUM, a walled city of Persia, in the province of Imk-Adjemi, in a hilly district at the western edge of the Great Salt Desert, 85 miles south of Teheran on the main route to Isfahan, and at the northern extremity of the lofty Kuru Kuh range, which runs thence for over 600 miles south-east to the Bam highlands. It is a long, straggling, half-ruined place, with empty bazaars, and neglected streets full of holes and pitfalls. Yet it ranks second to Meshed in sanctity, thanks to the famous shrine of Masuma Fatima, sister of the imám Riza, which also contains the remains of ten kings and four hundred and forty-four "saints," and whose gilded copper dome has been completed by the present shah. Like Kerbela, Kum is a favourite place of interment for the faithful, and is yearly visited by thousands of devout Shiáh pilgrims. At one time it is said to have contained 100,000 inhabitants, and its former greatness is still attested by the surrounding ruins, of which Sir Thomas Herbert quaintly remarks that they "may give beliefs to the inhabitants, who say it was once comparable in pride and greatness to mighty Babylon." Even in that traveller's time it was still a flourishing place, with well-built houses "sweet and well-furnished, her streets wide, her bazaar faire and her meoqes of most honourable esteem." But the neighbourhood now presents the aspect of a vast necropolis, while not more than 4000 of its 20,000 houses are occupied. Cotton of good quality and the castor-oil plant are extensively cultivated in the district, which is watered by the Gomsir and a few other intermittent streams draining east to the great desert. Population estimated at 20,000.

KUMÁUN, a district in the North-Western Provinces of India, lying between 28° 55' and 30° 60' N. lat., and 78° 52' and 80° 58' E. long. It consists of two distinct tracts—the sub-Himalayan ranges, and the *bhábhar* or waterless forest, averaging from 10 to 15 miles in breadth, which stretches between the forests and the Tarai. See *HIMALAYA*, vol. xi. p. 824. Of the entire area of the highlands, only 500 square miles are returned as cultivated and 100 square miles as cultivable. The southern or *bhábhar* portion was up to 1850 an almost impenetrable forest, given up to wild animals; but since then the numerous clearings have attracted a large population from the hills, who cultivate the rich soil during the hot and cold seasons, returning to the hills in the rains. The rest of Kumáun is a maze of mountains, some of which are among the loftiest known. In fact, in a tract not more than 140 miles in length and 40 in breadth, there are over thirty peaks rising to elevations exceeding 18,000 feet (see vol. xi. p. 825). The rivers rise chiefly in the southern slope of the Tibetan watershed north of the loftiest peaks, amongst which they make their way down valleys of rapid declivity and extraordinary depth. The principal are the Káli or Gogra, and the Pindar and Káliganga, whose waters join the Alaknanda. The valuable timber of the yet uncleared forest tracts in Kumáun is now under official supervision. The chief trees are the *chir* or three-leaved Himalayan pine, the cypress, fir, alder, *sál* or iron-wood, and *sáindan*. Limestone, sandstone, slate, gneiss, and granite constitute the principal geological formations of the district. Mines of iron, copper, gypsum, lead, asbestos, and coral exist; but they are not thoroughly worked.

The census of 1872 disclosed a population of 488,514, of whom 426,968 were returned as Hindus and 5569 as Mohammedans. The Kumáunis are a tolerably fair, good-looking race, active, cheerful, honest, and industrious. Polyandry is unknown, but polygamy is frequent. The 4606 villages of the district are scattered about the hill-sides, the houses being built of stone laid in mud, and roofed with slates, or with planks or thatch. The only native town is Almora. There are large bazars at the European stations of Nain Tal and Banikhet. The area available for cultivation is small; but wherever possible the hill sides have been trenched. The soil except in some of the valleys is poor and stony, and requires much manure.

On the better kinds of land rice, wheat, and tobacco are grown; on the others wheat, barley, mustard, vetches, &c. Indian corn, millets, pulses, sugar-cane, cotton, oil-seeds, &c. The staple food of the peasantry is *mandua* (*Eleusine coracana*). Potatoes are becoming common. Fruit is very plentiful, and the oranges are of excellent quality. The tea plantations form now an important and valuable feature in the districts, but are almost entirely in the hands of European owners. In 1876-77 the gardens covered an area of 2929 acres, yielding 241,060 lb. of tea. The only other manufacture is the weaving of coarse woollen clothing. The imports from Tibet include boasts of London, salt, coarse cloth, and Chinese silk. The exports to Tibet are grain, cotton goods, broadcloth, quilts, hardware, tobacco, sugar, spices, dyes, tea, and timber. To the plains of India Kumáun sends grain, clarified butter, tea, ginger, turmeric, red pepper, drugs, spices, bark, honey, wax, a little iron and copper, timber, and wild-jungle produce. The roads in the hills are for the most part only bridle-paths, more or less well laid out, but all now well bridged. Except in the *bhábhar* and deep valleys, the climate is mild. The rainfall of the outer Himalayan range, which is first struck by the monsoon, is double that of the central hills, in the average proportion of 80 inches to 40. No winter passes without snow on the higher ridges, and in some years it is universal throughout the mountain tract. Frosts, especially in the valleys, are often severe. Kumáun is occasionally visited by epidemic cholera. Leprosy is most prevalent in the east of the district. Gout and cretinism afflict a small proportion of the inhabitants. The hill fevers at times exhibit the rapid and malignant features of plague. The malarial pestilence, which was formerly confined to Garwal, has of late years extended its ravages to Kumáun.

KUMPTÁ, or **COOMPTÁ**, a town and port in North Kanara district, Bombay, India, 14° 26' N. lat., 74° 27' E. long., with a population in 1872 of 10,932. It is the chief commercial town in the district. The average annual value of its trade, which consists chiefly of cotton, spices, and grain, the first coming from Dharwar district and the rest from the upland country of Kanara, is returned for the five years ending 1873-74 at £451,811 of import and £268,049 of export.

KUNCH, a town in the North-Western Provinces of India, in 28° 59' N. lat. and 79° 12' E. long., with a population in 1872 of 14,443 (11,956 Hindus and 2492 Mohammedans). It has markets for cotton and wheat, for molasses, rice, and tobacco, and for silk. The bazaar ways are narrow, tortuous, unmade, undrained, with poor-looking and often ruinous shops; both trade and population are declining.

KUNGUR, a district town of Russia, in the government of Perm, 58 miles south-south-east of the capital of the government, on the Sylva, a tributary of the Tchuyskaya. Formerly a blockhouse erected to protect the Russian settlements against the Tartars, it has acquired commercial importance by manufacturing of boots, which are exported in great quantities to the mines of the Ural mountains and to the furthest gold-washings of western and eastern Siberia; more than 1500 men are engaged in this trade. There are also several tallow-melting houses, candle, soap, and glue works, tanneries, and a yard where steamers are made for the navigation of the Kama and its tributaries. The leather of Kungur, which is renowned for its quality, is sold in the eastern provinces of Russia, and reaches Orenburg and Irbit, whilst the tallow is sent to St Petersburg. The wharf on the Sylva is one of the most important in the basin of the Kama. Population, 10,800.

KURDISTAN, or *Kürdistan*, is a convenient geographical designation for the lands inhabited by the Kurds, but the name is not used in the country in this general sense, nor indeed would it be technically correct, for in a very small portion only of the region in question is the population exclusively Kurdish.

Geography.—The furthest point to which the Kurds extend north-westward is the junction of the two arms of the Euphrates near Kharpat, in about 39° N. lat. and 39° E. long., while their south-eastern limit may be defined

* With reference to the *s* sound in this group of words it is to be observed that *Kürd* is always to be pronounced like the English *gourd*, not as in *card* and *whisky*.

as the frontier of Laristan, south of Kirmānshāh, in about 34° N. lat. and 47° E. long. The whole of this space, which is roughly calculated to embrace an area of at least 60,000 square miles, is mountainous, being in fact a section of the great chain which, known in antiquity at one extremity as Taurus and at the other as Zagrus, bisects Asia Minor from west to east, and then turning to the south-east buttresses the great Persian plateau in a series of ranges rising step over step above the valley of the Tigris. Kurdistan thus defined may be divided, according to its physical features, into three separate sections. The first section, stretching from Kharpūt to the Persian frontier, has been thus described by Consul Taylor, who resided for many years in the country.

"The general features," he says, "of this tract are high mountains, enclosing fertile valleys and an undulating upland, bounded on the south-west by the Tigris, and intersected at several points by numerous streams having their rise in the northern districts of the Diarbekir pashalik, and emptying themselves into that river. The scenery in the highlands yields to no other portion of Turkey for variety and romantic beauty, while the numerous rivers and streams flow through clustering landscapes and thickly wooded valleys, bathing in their course the bases of castles and towns famous in profane and ecclesiastical history."

To supplement Mr Taylor's general description, it may be enough to say that there are three principal ranges running from west to east through this portion of Kurdistan:—(1) The Dājik and Mezor Daghi (Paryadres and Abas of antiquity, and Mount Simus of Armenian history), a lofty, rugged, and inaccessible range which fills up the entire space between the two arms of the Euphrates, being connected with Anti-Taurus to the westward, and culminating far to the east in the isolated peaks of the greater and lesser Ararat; (2) The Mudikān range, south of the Murdāda, which is a continuation of the true Taurus, and which is prolonged under the names of Nimrūd Daghi, Sipān Daghi, and Alā Daghi, till it reaches the Persian frontier to the north-east of Lake Van (in this range all the headwaters of the Tigris rise, flowing south under the names of Debehleh-sū, Ambār-sū, Betmān-sū, and the rivers of Arzen and Bolhān, and joining the main stream between Diarbekir and Jemreh); and (3) Mount Masius, or Jebel-Tūr, an inferior range, south of the Tigris, which divides Kurdistan from the great Mesopotamian desert.

The second or central division of Kurdistan, which may be regarded as extending north and south from Lake Van to Sulimānīah, is of a more exclusively mountainous character. With the exception indeed of the districts of Amādīeh, Shikēlābād, and Kōi-Sanjāk on the immediate skirts of the Tigris basin, and the open country of Azerbaijan beyond the great range to the south-west of Lake Urmīeh, where the Kurds of the mountains have overflowed into Persia, there is hardly a square mile of level land anywhere to be found. The ranges of this division, which preserve a general direction of north-north-west and south-south-east, are throughout much broken up by transverse ridges, and seem to be tossed about in inextricable disorder, a few peaks, such as the Jebel-Jūdī above Amādīeh (which almost certainly represents the Ararat of the Bible) and the Gawār (or Jawār) Daghi near Julamerik in the Hakkāri country, rising to a stupendous height, and thus dominating the surrounding mountains, while several large rivers, and especially the Khabūr and the Upper and Lower Zāh, running in narrow and precipitous beds, burst at right angles through the gorges of the chain, and descend upon the Tigris valley in a series of cataraacts amid scenery of the wildest and most impressive grandeur. The actual elevation of the hills in this part of Kurdistan is not less than 10,000 feet above the level of the sea, while some of the highest peaks reach probably to an altitude of 14,000 or even 15,000 feet.

In the third or southern division of Kurdistan, which includes the Turkish pashalic of Sulimānīah and the Persian provinces of Ardān and Kirmānshāh, the mountain chain diminishes both in height and breadth. The average height of the hills is here only about 5000 or 6000 feet, and the loftiest ranges, that of the Bend-i-Nūh, or Noah's Hill, which forms the southern barrier of the gates of Zagrus,¹ and upon which, according to the tradition of Babylonia, as opposed to the tradition of Assyria, the ark is supposed to have rested, does not exceed an elevation of 8000 feet. The pass also which traverses the range at this point, and conducts from the lowlands of Holvān to the upper plain of Kirrūd, is only 10 miles in length. At the foot of the great range on the western side are the fertile plains of Shahzūr, Zohāb, and Ghilān, where rice is extensively cultivated, while on the Persian side, though rocky ridges run out to the eastward both in Ardān and Kirmānshāh, the general character of the country is open, and cereals are everywhere produced in extraordinary abundance.

Population.—There are no means of calculating the total Kurd population with even approximate accuracy, for neither in Turkey nor in Persia has a Government census ever been attempted, and the revenue tables which regulate taxation and conscription, and ought therefore to guide inquiry, are wilfully distorted for political purposes to such an extent as to be quite unreliable. From the materials, however, which have been recently collected by the British consular officers employed in Asia Minor, with a view of testing the relative strength of the Mohammedan and Christian populations, it seems pretty clear that the Turkish Kurds exceed one million and a half in number, while the estimates of travellers who have resided in Persian Kurdistan give about 750,000 souls for the aggregate of the tribesmen and sedentary Kurds dwelling along the mountains from Ararat to Kirmānshāh, together with the scattered colonies of the interior. The following rough table, then, has been compiled from the above sources.

Turkey.

Pashalic of Erzeroum, including sanjaks of Erzingān, Beberd, and Bayazid, with Deyrām mountains	850,000
Pashalic of Diarbekir, with sanjaks of Malatya and Marāsin and dependent tribes	820,000
Pashalic of Beḥs, with sanjaks of Mūsh and Sa'ert, and districts of Mudikān, Sāsūn, Shīrwān, and Northern Bolhān	130,000
Pashalic of Van, with sanjak of Hakkāri and nomad tribes of the Arab and Persian frontier	170,000
Pashalic of Kharpūt, with part of Deyrām	180,000
Pashalic of Mosul, including sanjaks of Southern Bolhān, Amādīeh, Rowandiz, and Kōi-Sanjāk, with tribes of Bilbas, Balik, &c.	250,000
Pashalic of Sulimānīah, with dependencies to Baghdad frontier	150,000
Total of Turkish Kurds	1,600,000

Persia.

Kurds of Agartījān, including Mikmā of Sēp-Bolāk, Bilbas of Lahlān, Zerrān of Ushnā, Shokāka, Hyllānīl, Jēlāl, and frontier tribes from Amrat to Sardisāt	250,000
Kurdistan Proper or Sima-Ardān	120,000
Provinces of Kirmānshāh, including tribes of Gardān, Kalbūr, Zangeneh, &c.	280,000
Kurds of Kermānshāh, of Hajmūd and Kābūd, and scattered communities in Irak	150,000
Total of Persian Kurds	750,000

¹ It is this range, and not the Jebel-Jūdī, as is generally supposed, that represents the Xīfār of the ancient inscriptions, where the ark is said to have rested in the Chaldean account of the flood; and the same tradition is to be traced in the belief which universally prevailed in Babylonia almost to modern times, that the waters of the great deluge penetrated no farther to the eastward than the "peak of Holvān." See Sebeok's *Bericht*, p. 28.

Attempts have been made to classify this Kurdish population as sedentary and nomad, and in connexion with the classification to distinguish between tribal and non-tribal communities, but all such divisions are arbitrary and fallacious, and ought not to be admitted in a statistical account of the nation. No doubt the original Kurdish organization was tribal, and the prevailing habits of the tribes have always been nomadic and pastoral; but such habits are never liable to be modified by local circumstances, and at the present day it is quite incorrect to suppose that the tribal Kurds are universally pastoral and migratory, while the non-tribal Kurds are sedentary and agricultural. In reality the distinction between living in villages as cultivators and living in tents as shepherds mainly depends on the localities where the tribes happen to be established. The Deyramliis, for instance, who inhabit the ranges of Dujik and Mezoor between the two arms of the Euphrates, and who number, according to Consul Taylor's estimate, above 200,000 souls, reside almost exclusively in villages, owing to the severity of their northern climate, while they follow agricultural and pastoral pursuits indifferently. But, on the other hand, the tribes to the south who have easy access to the Mesopotamian plains, prefer a nomadic life, sheltering their flocks and herds in the warm pastures beyond the Tigris during the winter, and driving them up in the summer to feed on the rich herbage of the mountain sides; and the same rule may be held to apply generally throughout Kurdistan, the tribesmen, whose natural instincts lead them to migrate between summer and winter quarters, becoming sedentary only when obstacles, either political or geographical, are placed in the way of their movements. With regard also to the distinction that is sometimes drawn between tribal and non-tribal Kurds, the hypothesis being that the latter, who live in villages and cultivate the soil, are the descendants of the aboriginal peasantry, while the former, who live in tents and support themselves with their flocks, are conquering invaders, the explanation will certainly not hold good. There is in reality no ethnic distinction between the two classes. Tribal Kurds who settle in villages very soon lose their distinctive name, and mix with the peasantry of the neighbourhood, while it constantly happens that a chief of village extraction, either by his individual character or through Government support, founds a new tribe and takes his place among the aristocracy of the nation. It may be added that in respect to the relative importance of the two classes the sedentary Kurds greatly outnumber the nomads, but that they are not so wealthy, nor so independent, nor do they stand nearly so high in popular estimation.

Character.—The Kurds generally bear a very indifferent reputation, a worse reputation, perhaps, than they really deserve. Being aliens to the Turks in language and to the Persians in religion, they are everywhere treated with mistrust, and live as it were in a state of chronic warfare with the powers that be. Such a condition is not of course favourable to the development of the better qualities of human nature. The Kurds are thus wild and lawless; they are much given to brigandage; they oppress and frequently maltreat the Christian populations with whom they are brought in contact,—these populations being the Armenians in Diarbekir, Erzeroum, and Van, the Jacobites and Syrians in the Jebel-Tôr, and the Nestorians and Chaldeans in the Hakkâri country,—but they are not as a general rule either fanatical or cruel. In the Hakkâri country, indeed, they live under ordinary circumstances in perfect amity with the Nestorians, from whom in outward appearance they are hardly distinguishable. It must be added, too, that they are naturally brave and hospitable, and in common with many other Asiatic races possess certain rude but strict feelings of honour. Perhaps the

most distinguishing characteristic of the Kurdish chief is pride of ancestry. This feeling is in many cases exaggerated, for in reality the present tribal organization does not date from any great antiquity. In the list indeed of eighteen principal tribes of the nation which was drawn up by the Arabian historian Mas'oudi, in the 10th century, only two or three names are to be recognized at the present day. A 14th century list, however, translated by Quatremère,¹ presents a great number of identical names, and there seems no reason to doubt that certain families both in Bohtân and Hakkâri, which are extant at the present day, can really trace their descent from the Ommeyyad caliphs, while the Babân chief of Sulimânîah, representing the old Sohrans, and the Ardalan chief of Siun,² who also represents an elder branch of the Gûrâns, each claim an ancestry of at least five hundred years. There was up to a recent period no more picturesque or interesting scene to be witnessed in the East than the court of one of these great Kurdish chiefs, where, like another Saladin, the bey ruled in patriarchal state, surrounded by an hereditary nobility, regarded by his clansmen with reverence and affection, and attended by a bodyguard of young Kurdish warriors, clad in chain armour, with flouting silks scarfs, and bearing javellin, lance, and sword as in the time of the crusades.

Language and Religion.—The present Kurdish language which is called Kormânjî—a title difficult to explain—is an old Persian patois, intermixed to the north with Chaldean words and to the south with a certain Turanian element which may not improbably have come down from Babylonian times. Several peculiar dialects are spoken in secluded districts in the mountains, but the only varieties which, from their extensive use, require to be specified are the Zaza and the Gûrân. The Zaza is spoken throughout the western portion of the Deyram country, and is said to be unintelligible to the Kermânjî-speaking Kurds. It is largely intermingled with Armenian, and may contain some trace of the old Cappadocian, but is no doubt of the same Aryan stock as the standard Kurdish. The Gûrân dialect again, which is spoken throughout Ardalan and Kirmânshâhân,³ chiefly differs from the northern Kurdish in being

¹ See *Notices et Extraits des MSS.*, vol. xiii. p. 306. Of the tribes enumerated in this work of the 14th century who still retain a leading place among the Kurds, the following names may be quoted:—*Gurdmeh* of Dertang, modern Gûrân; *Zengneh*, in Hamadan hills, now in Kirmânshâhân; *Jiamans* of Keruk and Arbil, now in the Deyram mountains, having originally come from Khôrâsân according to tradition; *Sohreh* of Bîkashâd and Tel-Baffân, modern Bohrin, from whom descend the Babân of Sulimânîah; *Zerars* of Kirmânshâhân, modern Zeras of Ushin; (connoisseur pillam of Kel-i-shin and Sîdek noted by author); *Julamerteh*, modern Julamerik, said to be descended from the caliph Mervân-ibn-Hakam; *Hakkârieteh*, Bektâshî inhabiting *Zams* of Arab geography; *Bekheteh*, modern Bektâsh. The *Zozans*, to whom Saladin belonged, are probably modern Rawndî, as they held the fortress of Arbil. Some twenty other names are mentioned, but the orthography is so doubtful that it is useless to try to identify them.

² The *Sharf-nâmeh*, a history of the Kurds dating from the 16th century, tells us that "towards the close of the reign of the Janghids, a man named Babo Ardân, a descendant of the governors of Diarbekir, and related to the famous Ahmed-ibn-Marwân, after remaining for some time among the Gûrân, gained possession of the country of Shahrîr," and the Ardalan family history, with the gradual extension of their power over Persian Kurdistan, is then traced down to the Safavian period.

³ The Gûrân are mentioned in the *Masûk-ul-âkhar* as the dominant tribe in southern Kurdistan in the 14th century, occupying very much the same seats as at present, from the Hamadan frontier to Shahrîr. Their name probably signifies merely "the mountaineers," being derived from *gur* or *gôr*, "a mountain," which is also found in *Sagrus*, i.e., *se-gôr*, "beyond the mountain," or *Zushk-t-âk*, as the name is translated in Persian. They are a fine, active, and hardy race, individually brave, and make excellent soldiers, though in appearance very inferior to the tribal Kurds of the northern districts. These latter indeed delight in gay colours, while the Gûrân dress in the most homely costume, wearing coarse blue cotton vests, with felt caps and

entirely free from any Semitic intermixture. It is thus somewhat nearer to the Persian than the Kermānī dialect, but is essentially the same language. It is a mistake to suppose that there is no Kurdish literature. Many of the popular Persian poets have been translated into Kurdish, and there are also books relating to the religious mysteries of the *Ali-Ollāhīs* in the hands of the *Dayramīs* to the north and of the *Garāns* of *Kirmānshāhān* to the south. European scholars too have been assiduous of late years in investigating the various Kurdish dialects. The New Testament in Kurdish was printed at Constantinople in 1867. The Rev Samuel Rhea published a grammar and vocabulary of the *Hakkārī* dialect in 1872. Lerch, Brugsch, Chodzko, Borsini, Blau, and many others have discussed different branches of the subject in the scientific magazines of the Continent, and quite recently (1879) there has appeared under the auspices of the Imperial Academy of St Petersburg a French-Kurdish dictionary compiled originally by Mous Jaba, many years Russian consul at Erzerum, but completed by Ferdinand Justi by the help of a rich assortment of Kurdish tales and ballads, collected by Messrs Socin and Pryno in Assyria. Justi's preface to the dictionary gives a good account of the present state of Kurdish studies in Europe and Asia.

The religion of the Kurds also furnishes a very curious subject of inquiry. The great body of the nation, in Persia as well as in Turkey, are Sunnis of the *Shāfi'ī* sect, but in the recesses of the *Dayram* to the north and of *Zagros* to the south, there are large half-pagan communities, who are called indifferently *Ali-Ollāhī* and *Kizil-bāsh*, and who hold tenets of some obscurity, but of considerable interest. Outwardly professing to be *Shāfi'īs* or "followers of *Ali*," they observe secret ceremonies and hold esoteric doctrines which have probably descended to them from very early ages, and of which the essential condition is that there must always be upon the earth a visible manifestation of the Deity. While paying reverence to the supposed incarnations of ancient days, to Moses, David, Christ, *Ali* and his tutor *Salman-el-Farsi*, and several of the *Shāfi'ī* imams and saints, they have thus usually some recent local celebrity at whose shrines they worship and make vows; and there is, moreover, in every community of *Ali-Ollāhīs* some living personage, not necessarily ascetic, to whom, as representing the Godhead, the superstitious tribesmen pay almost idolatrous honours. Among the *Garāns* of the south the shrine of *Baba Yaddigir*, in a gorge of the hills above the old city of *Holwān*, is thus regarded with a supreme veneration, while in the family of a certain *Syūd* who resides in the neighbourhood the attributes of divinity are supposed to be hereditary. Similar institutions are also found in other parts of the mountains, which may be compared with the tenets of the *Druses* and *Anacīs* in Syria and the *Isma'īlīs* in Persia.

Climate, Productions, Fauna, &c.—In a country like Kurdistan, which extends over five or six degrees of latitude, and ranges in altitude from 1500 to 15,000 feet above the sea, there is of course every variety of climate and produce. In the northern part of this region the hills are covered with pine forest, while the valleys abound with walnuts, sycamores, and planes, and all sorts of fruit trees, and in summer the hillsides and uplands are covered with a luxuriant herbage. The winters are here very rigorous, and the tribes, as far as they can, migrate at that season to the plains. In central Kurdistan the pine forests cease and give way to dwarf oak and elms, the mastix, holly, &c.,

coats. The *Garāns* here for a long period abandoned nomadic habits, and are now almost universally congregated in villages and occupied with the cultivation of the soil, so that in a great part of Kurdistan the name *Gurū* has become synonymous with an agricultural peasantry, as opposed to the migratory shepherds.

while further to the south large trees almost disappear, and a rough scrub takes their place. A succinct and graphic description of Turkish Kurdistan is given by Consul Taylor in his notes of travel published in the *Geographical Journal* for 1865.

"The moister Turkish provinces of Kurdistan," he says, "watered by an infinity of noble streams, with a salubrious climate and rich soil, yields to no other province in the empire for the variety and richness of its vegetable and animal produce, while its numerous mountain chains abound in mineral wealth. Among its natural vegetable productions, galls, gum-tragacanth, madfir-roots, and the pistachio-oil, from which the natives extract a fine oil used in making soap, are the most important,—the annual value of the export of the former alone being upwards of £285,000. Oleaginous seeds and olive oil are produced in large quantities, and the quality of the former is so superior that it finds its way to many of the northern governments. Sheep's wool was exported in 1866 to the value of £70,000; and mohair, the produce of the *Angora* goats, that thrive so wonderfully in the neighbourhood of *Jezireh*, was eagerly sought after and bought up by native traders from *Kauserli* and *Constantinople* in the same period to the amount of £220,000.

"The manufacture of native cotton cloths, shawls made from mohair, and short woollen cloaks is actively pursued, and the shawls, for texture and variety of colour and pattern, shows the extraordinary natural intelligence of the Kurdish workman. *Diarbekir* is famous itself for its silk muso-goods, similar to those of *Aloppo* and other parts of Syria, but, from its greater cheapness and durability, more in request among the poorer classes of the mountains between *Diarbekir* and the *Black Sea*. Sheep are exported in large quantities from the mountains and desert to *Aloppo*, *Damascus*, and *Beirut*, and camels, purchased from the Arabs, to *Kauserli* and other parts of *Asia Minor*. The uplands and hills abound in several species of polecat, martins, foxes, and wolves, whose furs add considerably in value to the sum total of the export list. A beautiful species of spotted lynx may be included among the former, although it is far more scarce than those enumerated. A rough estimate of the whole annual value of the animal and vegetable produce of the *pashas*, whether consumed at home or exported (exclusive of food), will amount to more than £700,000 sterling.

This account is generally applicable to central and southern Kurdistan as well as to the *pashaliks* of *Diarbekir* and *Erzerum*, but it requires to be supplemented in some particulars. The rice and corn which are grown by the Kurds of the *Tigris* basin and the Persian plains form a very important staple of export, while the hill forests supply charcoal, wild silk, menta, and gum-mastic, in addition to the produce noticed in Consul Taylor's list, to a very large extent; and it may be further noted that along the whole range of mountains from *Jezireh* to *Susa* there is an outer ridge of low gypseous hills, which abounds throughout its whole extent with petroleum and naphtha springs. Mineral oils are not at present much appreciated by either Turks or Persians, but in the future of Kurdistan this important source of wealth cannot be left out of account.

With regard to the fauna of Kurdistan a few words must suffice. Neither lions nor tigers are ever found in the mountains, though the former frequent the banks of the *Tigris* and the latter are common in the *Caspian* forests. The wild animals of Kurdistan are the leopard and lynx, the wild cat, bear, hyena, wild boar, wolf, jackal, and fox, the *mard* (or red deer), the roe and hog deer (and fallow deer and antelope on the skirts of the hills), the wild goat (or ibex), the wild sheep (or mouflon), together with badgers, hares, many varieties of the polecat or martin, and the ordinary smaller animals. Of game birds the most remarkable are the *Kakk-i-Darr* (or large partridge, first brought to the notice of naturalists by Consul Brundt), the grey and red-legged partridge, the *Zhuo*, quail, woodcock, and snipe, three varieties of bustard, the grey crane, and wild geese and ducks in abundance.

It has not been found possible to compute the amount of revenue which is raised from the Kurds. Consul Trotter remarks on this subject:—

"The Turkish Kurds are found in almost every possible stage, from that of thorough subjection to the Government (as in many of

the Diarbekir and Erzerum villages, where they pay all the regular taxes and are exempt from the conscription) up to the semi-independent Kurds of Bohdân, of Madîkîn, and of the Deyram, who never pay taxes except at the rare intervals that the Government is able to occupy their country with a military force, and who have never hitherto, except on very rare occasions, supplied soldiers to the army either regular or irregular.

And, if this uncertain liability to taxation is true of the Kurds of Erzerum and Diarbekir, it applies equally to the districts of Hakkârî and Rowandiz, and to the great tribes such as the Herkî, Hartîshî, and Hyderkânî, who migrate between Persia and Turkey. In Sulimanih, on the other hand, as well as in the Persian provinces of Azerbâijân, Ardêlân, and Kirmânshâhân, the revenue derived from the Kurdish population is fixed, and may be estimated at £1 per house instead of the £1, 6s. which is the usual Osmani rate.

Antiquities.—Kurdistan abounds in antiquities of the most varied and interesting character. There is in the first place a series of rock-cut sun-disk inscriptions, extending from Malatya on the west to Miyandîb (Persia) on the east, from the banks of the Aras on the north to Rowandiz on the south, which record the glories of a Turanian dynasty, who ruled the country of Nairî during the 8th and 7th centuries B.C., contemporaneously with the lower Assyrian empire. Intermingled with these are a few genuine Assyrian inscriptions of an earlier date, and in one instance, at Yan, a later tablet of Xerxes brings the record down to the period of Grecian history. The most ancient monuments of this class, however, are to be found at Holwîn and in the neighbourhood, where the sculptures and inscriptions belong probably to the Guti and Gûti tribes, and date from the early Babylonian period. Excavations at this spot or in the mounds along the course of the Diyâlîk, which is the great river of southern Kurdistan, or more especially at Yassîn Tepeh, the site of the ancient city of Shahrîzôr, would probably lead to the discovery of relics cognate with those which have been found in the palaces of Nineveh and Babylon. Information has also been recently received that a cemetery full of inscribed sepulchral urns has been laid bare by a landslide in the mountains between Sulimanih and Kirmânshâhân, and the description is calculated to arouse the liveliest interest, though until the spot has been visited by some European scholar no definite opinion can be given as to the character and antiquity of the remains.

In the northern Kurdish districts which represent the Armenene, Intilene, Antaeus, Zabdicene, and Morone of the ancients, there are also many interesting remains of Roman cities, well worth examining. Arzen, Miyandîkân (ancient Martyropolis), and Sêlauron have already been reported on by Consul Taylor, but there is still abundant room for research, and attention should be especially directed to the ruins of Danîrûr near Darn, which Schœnau the great Orientalist has recently identified with the Armenian capital of Tigranocerta, a city that has long been the despair of comparative geographers. Of the Macedonian and Parthian periods there are remains both sculptured and inscribed at several points in Kurdistan; at Bîstûn, in a cave at Amadih, at the Mithraic temple of Kurestî, on the rocks at Sir Pîlî-Zohab near the ruins of Halwan, and probably in some other localities, such as the Bîlûk country between Lahjân and Koi-Sunjak, which have never been visited by Europeans; but the most interesting site in all Kurdistan, perhaps in all western Asia, is the ruined fire temple of Pîr Kîlî on the southern frontier of Sulimanih, a spot that has been hurriedly visited by two or three European travellers, but never thoroughly examined. Among the debris of this temple, which are scattered over a bare hillside, are to be found above one hundred slabs, inscribed with Parthian and Pehlevî characters, the fragments of a wall which formerly supported the eastern face of the edifice, and bore a bilingual legend of great length, dating from the Sassanian period. Yet more than half of the inscribed slabs have as yet been copied, time and labour being required to clear out the other slabs which lie embedded in the earth on the slope of the hill down which they have rolled, and the locality, moreover, being one that cannot be easily examined or even visited, owing to the exposed position of the brigand tribes of the border, and it is to be earnestly hoped that, when an opportunity does offer, every fragment of inscriptions may be recovered, so that it may be possible to reconstruct the entire legend, which, independent of its historical interest, is of special importance as the longest and latest specimen of the legendary Pehlevî writing. There are also remarkable Sassanian remains in other parts of Kurdistan,—at Sêlma to the north, and at Kirmânshâhân and Kermî-Shîrîn on the Turkish frontier to the south; and it is probable that an active search among the hills would discover many similar objects of interest. It may indeed be asserted that there is no region of the East at the present day which deserves a more careful scrutiny and promises a richer harvest to the antiquarian explorer

than the lands inhabited by the Kurds from Erzerum to Kirmânshâhân. Dr Schultze in former times and Consul Taylor more recently have done much to illustrate northern Kurdistan between Van and Diarbekir, but the inner mountains of Bohdân, Hakkârî, Rowandiz, and the Bîlûk country are still almost a "terra incognita," and require careful examination.

History.—With regard to the origin of the Kurds, it was formerly considered sufficient to describe them as the descendants of the Carduchi, who opposed the retreat of the Ten Thousand through the mountains, but modern research ascends far beyond the period of the Greeks. We now find that at the dawn of history the mountains overhauling Assyria were held by a people named Gûti; a title which signified "a warrior," and which was rendered in Assyrian by the synonym *Gardu* or *Kardu*, the precise term quoted by Strabo to explain the name of the Cardaces (*Kárdakes*). These Gûti were a Turanian tribe of such power as to be placed in the early cuneiform records on an equality with the other nations of western Asia, that is, with the Syrians and Hittites, the Sussians, Elamians, and Accadians of Babylonia; and during the whole period of the Assyrian empire they seem to have preserved a more or less independent political position. After the fall of Nineveh they coalesced with the Medes and, in common with all the nations inhabiting the high plateaus of Asia Minor, Armenia, and Persia, became gradually Aryanized, owing to the immigration at this period of history of tribes in overwhelming numbers which, from whatever quarter they may have sprung, belonged certainly to the Aryan family.

The Gûti or Kûrîrî were reduced to subjection by Cyrus before he descended upon Babylon, and furnished a contingent of fighting men to his successors, being thus mentioned under the names of Saspîrians and Alarodians in the muster roll of the army of Xerxes which was preserved by Herodotus.

In later times they passed successively under the sway of the Macedonians, the Parthians, and Sassanians, being especially friendly, if we may judge from tradition as well as from the remains still existing in the country, by the Aramean monarchs, who were probably of a cognate race. Gôtarres indeed, whose name may perhaps be translated "chief of the Gûti," was traditionally believed to be the founder of the Gûrînî, the principal tribe of southern Kurdistan; and his name and title are still preserved in a Greek inscription at Bîstûn near the Kurdish capital of Kirmânshâhân. Under the caliphs of Baghdad the Kurds were always giving trouble in one quarter or another. In 224 A.D., and again in 228, there were formidable insurrections in northern Kurdistan; and a third time, in 809, the Bôidî emirs, Asad and Dôst, were obliged to lead the forces of the caliphate against the southern Kurds, capturing the famous fortress of Sermâj, of which the ruins are to be seen at the present day near Bîstûn, and reducing the province of Shahrîzôr with its capital city now marked by the great mound of Yassîn Tepeh. The most flourishing period of Kurdish power was probably during the 12th century of ours, when the great Saladin, who belonged to the Herwandî branch of the Hadhâbî tribe, founded the Ayubîte dynasty of Syria, and Kurdish chieftains were established, not only to the east and west of the Kurdistan mountains, but as far as Khuzistân upon one side and Egypt and Yemen on the other. During the Mongol and Tartar domination of western Asia the Kurds in the mountains remained for the most part passive, yielding a reluctant obedience to the provincial governors of the plains, and for the last three or four centuries they have been divided in the allegiance between the Turkish and Persian crowns.

After Sultan Solîm in 1514 had defeated the army of Shâh Ismâel, the founder of the Safawîan dynasty, he employed one of his generals, Sultan Hussain Bag of Amadih, to recover Shahrîzôr and its dependencies from Persia; and from that time to the present day the political status has not been materially disturbed. The power of the independent Kurdish chieftains from north to south, which was agreed upon in 1047 A.H., between Sultan Murâd IV and Shâh Isfah, after the recovery of Baghdad by the former sovereign, is substantially the same line that was adopted by the Russian and British commissioners who were employed in 1840-42 to mediate between the two Asiatic powers and delimit their respective territories. But in the meantime changes of some moment have occurred in the interior organization of Kurdistan. Both in Turkey and in Persia the independent power of the Kurds has been much curtailed. In Turkey the pashas of Kharpût, Erzerum, and Diarbekir have been invested with larger powers of control, while in Persia the Kurdish sultan has been further strengthened by the establishment of Turkish

1 "The Kalkîrî tribe are traditionally descended from Gûdârî-bû-Gû, whose son Roham was sent by Bahman Kîdîn to destroy Jerusalem and bring the Jews into captivity. This Roham is the individual usually called Bokhî-i-Nasr (Nehemiaschazar), and he ultimately succeeded to the throne. The neighbouring country has ever since remained in the hands of his descendants, who are called Gûrînî (*Shahr-Namêh*, Persian MS.). The same popular tradition still exists in the country, and KÛRÎ-BÛ-GÛ is respectively named. But the rock at Bîstûn, showing that Gûdârî-bû-Gû was really an 'historic' personage. See *Journ. Roy. Geog. Soc.*, vol. ix. p. 114."

governors at Bayand, Van, Bitlis, Amadieli, and Sulimasieli, in succession to the old hereditary Kurdish chieftains. With the tortuous policy, it is true, which is characteristic of the Osmanli race, the Porte has not infrequently in late years encouraged the development of native strength in various parts of Kurdistan for a time and for certain special purposes, but when the position of the local magnates has anywhere become one of political danger, the central Government has stopped in and without difficulty has reasserted its supreme authority.

In 1884, for instance, the famous Rehid Mohammed Pasha almost everywhere the Kurds, who have everywhere broken loose from Siras to Iwanizis, and adopted severe measures of repression, which are still remembered and dreaded. In 1883 again, Behler Khân Beg, who from his paternal government of Hêlân had extended his sway over the whole mountain range, and had sworn to exterminate the Nestorian Christians, was crushed immediately that the Porte put forth its strength against him; but the most notable instance of sudden Kurdish aggrandizement and collapse has occurred during the year 1881. Sheikh Obaidullah, chief of the small tribe of Ormur, who resided in a village of the mountains south of Lake Van, had acquired great local influence, owing to the amity of his family, but more especially from his own ascetic habits and his personal character. He seems to have really embodied the idea at one time of extending an independent Kurdish kingdom, concentrating under his own individual authority all the scattered remnants of his race both in Persia and in Turkey. At any rate, having collected a very considerable force of Kurds in the summer of 1880, he suddenly burst in upon the plains of Persia and ravaged Azerbaijan to the south of Lake Urmia, sweeping the country up to the walls of Maragha on one side of the lake and of Urmia on the other. Having been joined by the Zermas, the Mikris, the Bitliss, and all the tribes of the Persian frontier, it is considered certain that he might have marched on and pillaged Tebriz had he taken full advantage of the panic which followed on the first invasion; but, he having faltered, and thus given time for the arrival of Persian reinforcements, the movement, which was at one time most serious, collapsed, and he retired to the mountains. Now the Turkish Government had unquestionably in the first instance encouraged Sheikh Obaidullah's increasing power and ambitions, not with a view to hostility to Persia, but in the hope that the establishment of a fanatical and great independent Kurdish principality about Lake Van would paralyze any movement of the Armenian nation towards the recovery of its liberty. The Porte indeed in all probability still cherishes the idea of thus controlling the action of its Christian subjects, though it has been compelled by the pressure of the European powers, and under the threat of reprisals from Persia, to arrest Sheikh Obaidullah and keep him under surveillance at Constantinople, while measures have been taken to prevent any immediate renewal of disturbances on the frontier.

The policy of the Persian Government towards its Kurdish subjects has been not very dissimilar to the Turkish programme. Aware of the military efficiency of the tribes, the Persian crown as long ago as the time of Nadir Shah transferred a large colony of Shadili and Zeffernidi Kurds to the Khorsân frontier, where, enjoying the rich lands of Bijand and Kuchan, and strengthened by a line of fortresses, they have ever since been engaged in unceasing conflict with the Turkomans of the Attock, and from whence they afforded invaluable assistance, both in carriage and supplies, to the Russian columns in their late advance into the country of the Akhalik. Persia has also raised several regiments of regular infantry from the Kurdish Shukake of the north, as well as from the Gurdas and Kalkhis of the south, while the shah has also placed Persian governors over the Kurdish districts south of Lake Urmia, and has appointed princes of the blood to administer the more distant and warlike Kurdish provinces of Ardabil and Kirmanshah. At present perhaps the only consummation among whom a spirit of Kurdish nationality may be said to flourish free from the taint, be it for good or be it for bad, of foreign influence, are the Deyramlis of the upper Euphrates and the Hakkiris of central Kurdistan. (H. O. R.)

KURGAN, a district town of western Siberia, in the government of Tobolsk, 363 miles south-south-west of the capital of the province, on the left bank of the Tobol river. It has its name from a lofty tumulus (*Kurgan*), close by which a wooden fort was erected in the 17th century. It is situated in a wide steppe, covered with numerous lakes, the inhabitants of which are active in agriculture, cattle-breeding, and cattle grazing, cattle being purchased in the Kirghiz steppes. It is now the chief centre of the region for trade in cattle, tallow, skins, and salt. Population, 6800.

KURILE ISLANDS, a chain of islands to the north-east of Asia, extending for about 795 miles from the

southern extremity of the peninsula of Kamchatka to the northern extremity of Yezo, and forming the boundary between the Sea of Okhotsk and the outer ocean. Till 1875 the Little or Northern Kuriles belonged to Russia, and the Great or Southern Kuriles to Japan, but by the treaty of that date they were all recognized as Japanese. The principal islands, beginning at the north, are Shumshu (236 square miles), Paramushir (1138), Onokoto (244), Kharimikoto, Si Musir (161), Matua, Urup (665), Iturup (2656), and Kunashir. Like the peninsula of Kamchatka, the whole chain is of volcanic origin, and several of the islands—Yokarna, Musir, Itakoka, Matua, Iturup—are still centres of volcanic activity. Mr Milne, who cruised among the islands in 1878, counted fifty-two well-defined volcanic peaks, and at least seventeen are known to give off steam. The peak of the island of Alaid, estimated to have an altitude of at least 12,000 feet, had two great eruptions in 1770 and 1793. None of the other eminences exceed 5000 feet in height. As the slopes are for the most part exceedingly regular, the production of the volcanoes must be assigned to a comparatively recent period; and the absence of stratification seems to indicate a continuity of action. The forces at work must have been enormous if, as appears probable, the chain was built up from the bed of the sea. To the east of the islands the "Challenger" expedition found a depth of 27,930 feet. The flora of the Kuriles is poor, especially towards the north, in the southern islands it is similar to that of Yezo. In Kunashir, Urup, and Iturup there are well-wooded portions. Sea-otters, wolves, and foxes are among the wild animals hunted for their skins. Many of the islands are altogether uninhabited, and none have more than the scantiest population. In 1868-70 Knipping estimated the total at from 200 to 300 persons, and since the treaty of 1875 a large number have removed to Saghalien and other parts of Russian territory. Ethnographically the people of the Kuriles are in the main identical with the Amos of Yezo, those of the northern islands showing the influence of intercourse with Kamchatka. They are quiet, timorous, and well-behaved, do not practise polygamy, and carefully avoid intermarriage between blood relations. The poorer people burn their dead, the wealthier embalm them. Once a year in autumn they hold a great feast. Of a supreme deity they have some indistinct idea, but they sacrifice to the sun, the moon, and the sea, and worship the bear.

The Kurile Islands were discovered in 1854 by the Dutch navigator De Vree. The Russians first learned about them from Japanese traders who visited Kamchatka in 1711, in the following year two Cosacki, Anzuphoroff and Komarevskii, crossed over to Shumshu, and in 1766-67 a voyage was made among the islands to collect a fur tax. In 1766 a factory of the Russian American Company was established on Urup. Captain Golovin was taken prisoner by the Japanese on Kunashir in 1811.

See Knutson-Gambel, *Kurische Inseln*, 1764; the *Voyage of Krusenstern and Laptev*, and *Allen's paper in Geol. Mag.*, 1865.

KURRAOCHERE, or **KARAOCHI**, a district in Sind, India, lying between 23° 34' and 26° 07' N. lat., and between 66° 41' 30" and 68° 49' E. long., bounded on the N by Shikarpur, on the E. by the Indus river and Hyderabad district, on the S. by the sea, and on the W. by Baluchistan. The area is 14,091 square miles; and the population in 1872 was 426,732. The district consists of an immense tract of land stretching from the mouth of the Indus to the Baluchi boundary. It differs in general appearance from the rest of Sind, having a rugged, mountainous tract along its western border. The country gradually slopes away to the south-east, till in the extreme south the Indus delta presents a broad expanse of low, flat, and unpicturesque alluvium. Besides the Indus and its mouths, the only river in the district is the Habb, forming the boundary between Sind and Baluchistan. The Manchhar Lake in Sakhan subdivision forms the only considerable

sheet of water in Sind. The hot springs at Pir Mangho are 6 or 7 miles north of Kurrahee town.

In 1872 the population was 426,728 (males 242,516, and females 184,209)—the Hindus numbering 78,304, and the Mohammedans 346,538. Eight towns had a population exceeding 2000—Kurrahee, 56,763; Kotri, 7949; Schwän, 4296; Butak, 4703; Dada, 3357; Tatta, 7951; Mirpur Isaro, 2840; and Kati-Bandar, 2199.

In Kurrahee subdivision cultivation exists only on a few isolated spots, and depends upon wells, springs, or natural rainfall. Here the chief crops are *jowar*, *bajra*, barley, and sugar-cane. In Jerruck and Shih-Bandar, where numerous canals carry the waters of the Indus through the alluvial flats, rice forms the staple crop, but wheat, sugar-cane, millets, cotton, and tobacco are also grown. In the barren hills of Kohistan, agriculture is practically unknown; and the normal population devotes itself almost entirely to grazing cattle in the southern plains. The district trade is centred in Kurrahee town, the staple exports consisting of cotton, wool, and grain. Extensive salt deposits of the purest description occur on the Suguda creek, a branch of the Indus. Sea fisheries form an important industry. The pearl oyster is found at several places along the coast, but the pearls are of inferior size and quality. The Indus valley line of the Sind, Punjab, and Delhi Railway runs from Kurrahee to Kotri within the district a distance of 106 miles. The administration is conducted by a collector-magistrate, assisted by several deputies. The total imperial revenue in 1875-74 amounted to £218,079, exclusive of £23,232 derived from the canals. Education in 1875-74 was afforded by forty-nine schools, attended by 3167 pupils. Kurrahee town and neighbourhood, being open to the sea-breezes, are said to possess the healthiest climate in Sind. Fevers prevail at the setting in of the cold season, and in the hot weather external inflammations, ulcers, and skin diseases are very troublesome. Cholera occasionally appears in an epidemic form. The rainfall is slight and fluctuating, the average hardly exceeding 5 inches per annum.

KURRAHEE, or KARACHI, the chief town of Sind, India, and a large seaport, situated at the extreme northern end of the Indus delta, in 24° 51' N. lat. and 67° 4' E. long. The city is almost entirely a creation of British rule, its extensive commerce, splendid harbour works, and numerous flourishing institutions having all sprung up since the introduction of settled institutions; and the architecture of the town is essentially modern and Anglo-Indian. Before 1735 no town whatever appears to have existed on its site; but about that time some little trade began to centre upon the convenient harbour, and the siting up of Shih-Bandar, the ancient port of Sind, shortly afterwards drew much of its former trade and population to the rising village. Under the Kalhorah princes, the khān of Khelat obtained a grant of the town, but in 1795 it was captured by the Talpur Mirs, who built the fort at Manora, at the entrance to the harbour. They also made considerable efforts to increase the trade of the port, and at the time of the British acquisition of the province the town and suburbs contained a population of 14,000.

The census of 1872 returned the inhabitants of Kurrahee, including the cantonment, at 56,763, viz., Mohammedans, 29,156; Hindus, 28,404; Christians, 3897; and "others," 796. The municipal revenue of the town in 1874 amounted to £22,336, and the expenditure to £20,142. Trade has immensely developed of late years. In 1843-44 the total value of the trade was returned at £123,160, that of the exports being only £1010. In 1873-74 the value of the trade amounted to £3,507,684, viz., imports £1,461,768 and exports £2,025,919. Up to 1851 only one English sailing ship had entered Kurrahee harbour, steamers and large vessels having to anchor outside and discharge by lighters. In 1853 the construction of the Napier Mole or causeway, 3 miles long, connecting the town with Kinnaird Island, and the subsequent extensive harbour improvements carried out between 1869 and 1872, at a cost of £460,000, have enabled vessels of any tonnage to enter the harbour. In 1847-48 the number of vessels which entered the harbour was 891, all native craft, of a total burthen of 80,509 tons. In 1873-74 the vessels visiting the harbour numbered 918, of a total burthen of 161,224 tons.

KURSK, a government of European Russia continuous with those of Tohernigoff, Orel, Voronezh, Poltava, and Kharkoff, and estimated to have an area of 17,417 square miles. The surface is irregular and even hilly, but the highest point (near the town of Tim) does not exceed 1013 feet of absolute elevation. Cretaceous and Eocene rocks

prevail, and chalk, iron-stones, mill-stones, potter's clay, and tripoli are among the economic minerals. The rich black earth of the government makes it one of the best agricultural districts of the country. No fewer than four hundred streams are counted within its borders, but none of them are of any service as waterways. To the Dnieper system belong the Seim, the Vorskl, the Tsai, and the Tuskor; to the Don the Northern Donets and its tributaries. Besides oats, which form the staple crop, wheat, rye, potatoes, and buckwheat are largely grown. Beeswax is sent in considerable quantities to Moscow. Horses, cattle, and sheep breeding is on the decline. The manufacturing industries—wool dressing, distillation, tanning, linen weaving—are gaining ground. Wool-spinning and the making of woollen sashes are so generally carried on by the peasant women as to be matter of commercial importance.

The government is divided into fifteen districts—Kursk, Belygorod, Graivoron, Dmitrieff, Korotcha, Igoff, Novuli Oskol, Oboyan, Putivl, Baisk, Starui Oskol, Sudzha, Tim, Phatezh, Sitchehgrui. The places with more than 5000 inhabitants are Kursk, Borisovka (30,000), Sndzha (with suburbs, 18,000), Belygorod (15,097), Miropole (10,754), Kholka, Mikhailovka (10,000), Baisk (9445), Starui Oskol (7091), Putivl (7046), Oboyan (6322), Korotcha, and Phatezh. The population of the government was 1,954,807 in 1870, chiefly Great Russians, but considerably modified by the Little Russian element. About 17 miles from the chief town, in a thickly-peopled district, is the site of the Korennaya fair, formerly the greatest of those in South Russia, and still with an annual trade valued at £900,000. It takes its name from an image of the virgin found at the root (*koren*) of a tree, and yearly carried in solemn procession from Kursk to the spot of its discovery. The Kursk district contains more than sixty old town sites; and barrows (*kurgans*) are extremely abundant. Of the latter many have been destroyed to furnish manure for the soil, but not a few have been examined by such investigators as Professor Zamokvassoff (see the publications of the Statistical Committee of Kursk).

KURSK, the chief town of the above government, is situated 333 miles south of Moscow, at the confluence of the Kur with the Tuskor, and forms the meeting place of the railways from Moscow, Kieff, and Kharkoff. The inhabitants number more than 30,000, or including the suburbs 45,000. Orchards and nursery gardens are among their chief means of subsistence, and gardeners from Kursk are numerous in the neighbouring governments. The leather works are the most extensive of the industrial establishments. Though many of the public buildings of the town are constructed on a large scale, it is enough to mention the cathedral of the Resurrection, dating from 1759, the cathedral of St Sergius (1792), and the Bogoroditski monastery.

Kursk was already in existence in 1632. The defence of the town from an invasion of the Poles was celebrated in *The Triumph of Igor*, an epic which forms one of the most valuable relics of early Russian literature. Down to the close of the 18th century the citadel, defended by the two rivers and a ditch, was a place of considerable strength; the remains are now comparatively few. The rank of government town was bestowed on Kursk in 1779.

KUSTENDJE, or KOSTENTJA, a seaport of Roumania on the coast of the Black Sea, 140 miles east of Bucharest, the terminus of the railway from Thernavoda on the Danube, and the principal outlet for the produce of the Dobruja. The harbour is well defended from the north winds, but those from the south, south-east, and south-west prove sometimes highly dangerous. Of the exports (valued at £217,828 in 1880) the chief are cereals, wool, skins, and cattle. Since the incorporation of the Dobruja with Roumania in 1878 Kustendje gives its name to a province.

KASTENJO is the Constantinian which was founded in honour of Constantine, sister of Constantine the Great. It lies at the seaward end of the Great Wall of Tynan, and has recently been surrounded by fortifications of its own. In spite of damage done by railway contractors (see Henry C. Barclay, *Between the Danube and the Black Sea*, 1876) there are considerable remains of ancient masonry—walls, pillars, &c. A number of inscriptions have been found in the town and its vicinity which show that Tynan, the place of Orid's banishment, must have been only a little way off.

In regard to the Kastensjo inscriptions in general, see Allard, *La Bulgarie Orientale*, Paris, 1868; Jespersius in *Ann. dell. Inst. arch. ital.*, 1865; *Cyprus Inscriptions*, vol. xii. in., and a paper on Weickum's collection in *Sitzungsbericht* of the Munich Academy, 1875.

KUSTRIN, or GOSTRIN, a town and fortress of the first rank in the circle of Königsberg-in-der-Neumark, in the government district of Frankfurt, Prussia, is situated at the confluence of the Oder and Warthe, about 51 miles north-east of Berlin by rail. It consists of the town proper within the strong fortifications, a suburb on the left bank of the Oder, and one on the right bank of the Warthe. There are bridges over both rivers. Kustrin carries on several minor manufactures, and there is some shipping in the rivers. The population in 1875 (including the garrison) was 11,297.

About 1250 a town was erected on the site of Kustrin, where a fishing village originally stood. From 1535 till 1571 it was the residence of the margrave of Brandenburg-Kustrin, who died without heirs. Kustrin was the prison of Frederick the Great when crown-prince, and the scene of the execution of his friend Katte.

KUTAIH, KUTAYA, or KUTAHIA, the chief town of a sandjak in the vilayet of Khudavendiklar, Asia Minor, is situated on the Pursak, an affluent of the Sakaria, the ancient Sangarus. The town lies at an important point of the great road across Asia Minor from Constantinople to Aleppo. It has a busy trade, and a population variously estimated at from 40,000 to 80,000. Kutaiha has been identified with Coteuam.

KUTAIS, a town of the Caucasus, Russia, capital of the province of same name, 60 miles east from Poti, and 4 miles from the Rion station of the railway between Poti and Tiflis. It is one of the oldest towns of the Caucasus; Procopius mentions it under the name of Kotatision. Persians, Mongolians, Turks, and Russians have again and again destroyed the town and its fortress. In 1810 it became Russian. It is situated now on both banks of the Rion river, which is spanned by an iron bridge. Its most remarkable building is the ruined cathedral, erected in the 11th century by the Bagratides, which is the most important representative of Georgian architecture. The fort Umherion, mentioned by Procopius, is now but a heap of ruins. During recent years Kutais has acquired some importance, and its population is rapidly increasing; it is now 12,000. The inhabitants make hats and silks, and trade in agricultural produce and wine. On the right bank of the Rion is a Government model-garden, with a model-farm for promoting the improvement of gardening, for which the warm and moist district of Iberia is well adapted.

KUTTENBERG (in Czech, *Kutná Hora*), chief town of an official district in central Bohemia, Austria, is situated on a small stream in a fertile region, about 180 miles north-west of Vienna by rail. It consists of the town and four suburbs, and among its buildings rich in historical and architectural interest are the Gothic five-naved church of St Barbara, begun in 1368 and not yet finished, several other churches, the Walscher Hof, formerly a royal residence and mint, the seminary, formerly a bishop's seat, and the Gothic town-house. The manufactures include starch, rape-seed oil, beer, sugar, brandy, and liquors; and there are various mills, and calico printing and wool-spinning establishments. The mines in the neighbourhood,

discovered in 1237, used formerly to yield silver; now they give only copper and lead. The population in 1870 was 13,747.

KUTY, a municipal town in the Austrian province of Galicia, lies 20 miles south-east of Kolomea, and on the left bank of the Czernemosz, which here forms the boundary between Galicia and Bukovina, in 48° 18' N. lat., 26° 10' E. long. The trade, especially in prepared leather, is chiefly with Hungary and the northern or Moldavian portion of Roumania. The neighbourhood of Kuty is picturesque and mountainous, and has productive salt springs. Population 8679, mostly of Armenian, Ruthenian, Polish, and Jewish extraction. Kuty formerly belonged to the old province of Rutenia, in the kingdom of Poland.

KUZNETSK, a district town of Russia, in the government of Samara, situated on the railway between Samara and Penza, 158 miles west of the former. In the 18th century it was but a village peopled by smiths (whence its name), and it is through this trade that it has acquired its importance. The majority of its 15,000 inhabitants are engaged in the manufacture of agricultural implements, exported to a large amount, whilst others are employed in tanneries,—the black sheep skins of Kuznetzk being widely renowned in Russia,—and in the manufacture of leather and wooden wares, which last are largely exported to the southern steppe provinces and to the Caucasus.

KYOKU-HPYÜ, a district in British Burmah, lying between 18° 55' and 19° 22' N. lat., and 98° 25' and 94° E. long. It consists of, first, a strip of mainland along the Bay of Bengal, extending from the An Pass, across the main range, to the Ma-i river, and, secondly, the large islands of Ramri and Man-ong, with many others to the south, lying off the coast of Sandoway. The mainland in the north and east is highly mountainous and forest-clad, and the lower portion is cut up into numerous islands by a network of tidal creeks. Between the mainland and Ramri lie a group of islands separated by deep, narrow, salt-water inlets, forming the north-eastern shore of Kyokuhpyü harbour, which extends for nearly 30 miles along Ramri in a south-easterly direction, and has an average breadth of 3 miles. The principal mountains are the Arakan Yomas, which send out spurs and sub-spurs almost to the sea-coast. The An Pass, an important trade route, rises to a height of 4664 feet above sea-level. The Dha-let and the An are navigable by large boats 25 and 45 miles respectively. Above these distances they are mere mountain torrents. Large forests of valuable timber cover an area of about 650 square miles. Kyokuhpyü contains numerous "mud volcanoes," from which marsh gas is frequently discharged, with occasional issues of flame. The largest of these is situated in the centre of Cheduba Island. Earth-oil wells exist in several places in the district. The oil when brought to the surface has the appearance of a whitish-blue water, which gives out brilliant straw-coloured rays, and emits a strong pungent odour. Limestone, iron, and coal are also found.

In 1872 the population was 144,177 (males 73,056 and females 71,121):—Buddhists, 129,702; Mohammedans, 3920; Hindus, 185; Christians, 47; "others," 10,323. The largest town is Ramri, with a population in 1877 of 4028. Kyokuhpyü, the headquarters, situated on Ramri Island, has 2620. Out of a total area of 4309 square miles, no less than 3740 are returned as absolutely uncultivable, and in 1873-77 only 165 square miles were under tillage. The principal crops are rice, sugar-cane, *dhan*, and tobacco. The manufactures consist of silk and cotton cloth, indigo, salt, pottery, coarse sugar, and sesamum oil. The total imperial and provincial revenue in 1876-77 was £43,454, besides a local revenue derived from port and municipal funds, &c.

L represents probably the same sound in all alphabets. That sound used to be called a "liquid," in which class *m*, *n*, and *r* were included. This arrangement was unsatisfactory so far as *m* and *n* are concerned, for they have nothing common in their formation with the others. But *r* and *l* are very closely akin. They are both dentals—or more accurately front palatals—produced by raising the point of the tongue to the front part of the palate, immediately behind the gums. They differ in this: for *r* a small aperture is left over the tip of the tongue by which the air escapes; but for *l* the tongue reaches the top of the palate, but does not rest (as for *r*) against the sides of the mouth, and the voice escapes laterally by these side-apertures. The slightness of the difference in the positions of the mouth for these two sounds explains their exchangeableness. Perhaps the most remarkable variation of the *l* sound is that which is heard in Welsh and denoted by *ll*, in such words as *Llanberis*, *Llangollen*, &c. An Englishman commonly sounds this as *thl*, which is certainly not right. But the best authorities on phonetics are not agreed as to the precise nature of the sound. Mr Ellis thinks that it is produced by laying the left side of the tongue against the whole of the palate, and then forcibly ejecting the breath along the right side. But he admits that the sound thus produced differs very little from a voiceless or surd *l* (the common *l* is sonant), which stands therefore to *ll* in the same relation as *f* does to *v*, or *wh* (really *hw*) to *w*. A simpler modification of the *l* sound is that heard in the Italian "gli" or in the Spanish "llano"; it is formed by raising the middle part of the tongue to the roof of the mouth, not the point against the front part of the palate, as for the ordinary *l*.

The peculiar nature of the *l* sound renders it apt to fall out before consonants with which it is inconsistent; this is especially seen in French plurals, such as "chevaux" from "cheval." It is also common, but sporadic, in English; e.g., in "walk," "talk," "palm," "alma," "half," "would," &c. As is frequently the case with such vanishing sounds, it has sometimes intruded through false analogy in words with which it has nothing to do, e.g., in "could" (Old English "coulde"), and rather strangely in some words of Latin origin, e.g., participle, principle. The form of the letter *L* has varied slightly, but has always consisted of two straight lines at an angle. In Greek the form was generally Δ; and this has been preserved in the Cyrillic and Russian alphabets. But in the western Greek alphabet the form was generally Λ; and this appears in old Roman inscriptions, passing by degrees into the right angle with which we are familiar.

LA BADIE, LABADISTS. Jean de la Badie, a noted Pietist leader in the 17th century, was the son of Jean Charles de la Badie, governor of Guyenne; he was born in the town of Bourg not far from Bordeaux, on the 13th of February 1610, and died in Altona, on the 19th of February 1674. He was sent along with two brothers to the Jesuit school at Bordeaux, where his talents attracted the attention of his teachers, and they secured him for their order against the wishes of his parents. In 1636 he began to study philosophy and theology, and in due time made his profession. From a study of the Bible, of Augustine, Bernard, and the mystics, he was led to hold somewhat extreme views about the efficacy of prayer and the direct influence of the Holy Spirit upon believers, and adopted Augustinian views about grace, free will, and predestination, which brought him into collision with his order. The

result was that he resigned and was separated from the Jesuits on the plea of ill health. He then became a preacher to the people, and was encouraged by his bishop to devote himself to this work. The study of Calvin's *Institutes*, however, taught him that he had more in common with the Reformed than with the Roman Catholic Church, and after various adventures he joined the Reformed Church of France at Montauban in 1650. His fame had preceded him, and his accession to the ranks of the Protestants was deemed a great triumph; no such man since Calvin himself, it was said, had left the Rome Catholic Church. He was called to the pastorate of the church at Orange on the Rhone, and at once became noted for the severity of the discipline he exercised. He set his face zealously against dancing, card-playing, and worldly entertainments. The unsettled state of the country, recently annexed to France, compelled him to leave Orange. He accepted a call to the French church in London, but did not stay there long; and after various wanderings he at length settled at Middelburg, where he was called to be pastor to the French-speaking congregation. His peculiar opinions were by this time (1660) well known, and his congregation and himself at once found themselves in conflict with the ecclesiastical authorities. Various "classes" and synods met and discussed the "seditions" and new and erroneous doctrine which De la Badie had preached in various of our churches before he had been inducted at Middelburg, and the result was the establishment of a separate church by De la Badie and his followers. He had gathered round him some enthusiastic disciples, Peter Yvon at Montauban, Peter Dulligier Francis Menuret, and more important than any Ann Maria v. Seiltman, whose book *Eucleria* is perhaps the best exposition of the tenets of her master. At Middelburg, at the head of his separatist congregation, De la Badie developed his views for a reformation of the Reformed Churches:—the church is a communion of holy people who have been born again from sin; baptism is the sign and seal of this regeneration, and is to be administered only to believers; the Holy Spirit guides the regenerate into all truth, and the church possesses throughout all times those gifts of prophecy which it had in the ancient days; the community at Jerusalem is the continual type of every Christian congregation, therefore there should be a communion of goods, the disciples should live together, as together, dance together; marriage is a holy ordinance between two believers, and the children of the regenerate are born without original sin; marriage with an unregenerate person is not binding. The life and separatism of the community brought them into frequent collision with their neighbours and with the magistrates of Middelburg, and in 1670 they accepted the invitation of the princess Elizabeth abbess of Herford in Westphalia, to take up their abode within her territories, and settled down in Herford to the number of about fifty. Not finding the rest they expected, however, they migrated to Altona in 1672, where they were dispersed on the death of the leaders. Small communities also existed in the Rhineland, and a missionary settlement was established in New York.

See H. van Berkum, *De Lebedien en de Labadisten*, Sneek, 1851; Goebel, *Geach. d. Christl. Lebens in der rheinisch-westphälische Kirche*, Oplenta, 1852; Happe, *Geschichte des Pietismus*, Leyden, 1879; Ritcheil, *Geschichte des Pietismus*, vol. 1., Bonn, 1880; and especially Peter Yvon, *Abriégé abrégé de la vie et de la conduite et des écrits authentiques de Jean de la Badie*, and Anna Maria v. Seiltman, *Eucleria*, Altona, 1678, 1679.

LABARUM, the sacred military standard of the early Christian Roman emperors, was first adopted by Constantine the Great after his miraculous vision in 312, although, according to Gibbon, he did not exhibit it to the army till 323. The name seems to have been known before, and the banner itself was simply a Christianized form of the Roman cavalry standard. Eusebius (*Life of Const.*, l. 31) describes the first labarum minutely as consisting of a long gilded spear, crossed at the top by a bar from which hung a square purple cloth, richly jewelled. At the upper extremity of the spear was fixed a golden wreath encircling the sacred monogram, formed of the first two letters of the name of Christ. In later banners the monogram was sometimes embroidered on the cloth. A special guard of fifty soldiers was appointed to protect the sacred standard. The derivation of the word labarum is disputed; modern scholarship inclines to recognize its etymon in the Basque *labarra*, signifying standard. An illustration of a labarum is given under the heading **FLAG** (vol. ix p. 278, fig. 6, A).

LABEO, **MARCUS ANTIQSTIUS** (cir. 60 a.c.—18 a.d.), was the son of Paucius Antistius Laebo, a jurist of minor note, who caused himself to be slain after the defeat of his party at Philippi. A member of the plebeian nobility, and in easy circumstances, the younger Laebo entered early upon public life, and soon rose to the pretorship; but his undisguised antipathy to the new régime, and the somewhat brusque manner in which in the senate he occasionally gave expression to his republican sympathies—what Tacitus (*Ann.* iii. 75) calls his *incorrupta libertas*—proved an obstacle to his advancement, and his rival, Ateius Capito, who had unreservedly given in his adhesion to the ruling powers, was unfairly promoted by Augustus to the consulate, when, in ordinary course, the appointment should have fallen to Laebo; the result was that, smarting under the wrong that was done him, he declined to accept the office when it was offered to him in a subsequent year (Tac., *Ann.* iii. 75; Pompon., in fr. 47, *Dig.* l. 2). From this time he seems to have abandoned politics, and devoted his whole time to jurisprudence, with which his name is much more prominently connected. His training in the science had been derived principally from Trebatius Testa, although he had also diligently attended the public audiences of most of the more eminent lawyers of the later years of the republic. To a profound knowledge of the law as he had received it from them he added a wide general culture, devoting his attention specially to dialectics, philology (*grammatica*), and antiquities, as valuable aids in the exposition, expansion, and application of legal doctrine (Gell., xiii. 10). Capito, in a letter preserved by Gellius (xiii. 13), says of him "nihil haberet nisi quod iustum sanctique esse in Romanis antiquitatibus legisset;" and this has sometimes been thought irreconcilable with the statement of Pomponius (fr. 47, *Dig.* l. 2) that in law he was an innovator. But the observations of Capito refer to what he calls Laebo's absurd craze for freedom—his horror of anything out of the old current of constitutional practice (which had led him, as Capito relates, into the ridiculous extreme of indignantly resenting, as unauthorized, the courtesy of a tribune who had ordered an officer simply to summon him to answer to a complaint, instead of apprehending him). In his jurisprudential teaching and advising there was none of this dogged disposition to deviate from the paths of his predecessors. It was the characteristic of his rival Capito to stand as much as possible within the old lines,—“in his, quæ ei traditæ fuerant, perseverabat” (Pomp., in fr. 47, *Dig.* l. 3); that of Laebo was, with the aid of his dialectic, philology, and antiquities, to dissect a received doctrine so as to reach its innermost *ratio*, and from this to start afresh, and give

the doctrine a more accurate expression and a variety of new developments. His success in this new method is attested by the position he took among his contemporaries, and the reputation in law he was held by his successors. Down to the time of Hadrian he was probably the name of greatest authority; and the fact that several of his works were abridged and annotated by later hands testifies to the estimation in which they were held by practitioners. While Capito is hardly ever referred to, the dicta of Laebo are of constant recurrence in the writings of the classical jurists, such as Celsus, Ulpian, and Paul; and no inconsiderable number of them were thought worthy of preservation in Justinian's *Digest*. Laebo gets the credit of being the founder of the Proculian sect or school, while Capito is spoken of as the founder of the rival Sabinian one (Pomponius in fr. 47, *Dig.* l. 2). It is doubtful whether this statement is quite accurate. Laebo certainly taught in some way or other; for it is recorded of him that he devoted six months of the year to giving professional advice and instructing his pupils in Rome, while the other six he spent in literary work at his country seat. But the lecturing *stiones* of which Gellius speaks (xiii. 13) had not by that time been established, and it is probable that the real founders of the two schools were Proculus and Sabinus, followers respectively of the methods of Laebo and Capito. Such conjunctions (in reference to peculiar doctrines of the schools), as “Proculus et Pegasus,” “Sabinus et Casius,” are very frequent; but the name of Laebo or Capito in conjunction with another is of the rarest occurrence. There is not a single case in the texts in which the latter is credited with the introduction of a doctrine of the Sabinians, and only one or two in which Laebo is spoken of as the author of a doctrine of the other school.

Laebo's most important literary work was the *Libri Posteriorum*, so called because published only after his death. So far as can be judged, they contained a systematic exposition of the common law in at least forty books, after the order of the commentaries of Q. Mucius Scaevola. They seem to have been epitomized by Javolenus, who was a leader of the Sabinian school; and numerous excerpts from them, some from the original, others from the epitome, are preserved in Justinian's *Digest*. His *Libri ad Edictum*, frequently referred to by Ulpian and Paul, as well as by earlier writers, embraced a commentary, not only on the edicts of the urban and peregrine pretors, but also on that of the curule ediles. His *Probabilia* (*probabilia*) *Lib. VIII.*, a collection of definitions and axiomatic legal propositions, seem to have been one of his most characteristic productions; they were abridged and annotated by Paul, and occasionally criticized by him with some severity. Amongst the writings of Laebo which we know only by report were *Commentarii de jure pontificio*, *Commentarii ad XII. Tabulas*, *Libri Epistolatum*, and *Libri Responsorum*. See Van Eek, “De vis, moribus, et studio M. Ant. Laebo,” *Franker*, 1892, in Oelschlegel's *Thes. Nov.*, vol. i.; Masquius, *De Sectis Sabinianorum et Proculianorum*, 1728; Dirksen, “Ueber die Schulen des Röm. Juristen,” in his *Beiträge zur Kunde des Röm. Rechts*, 1825; Perucius, *M. Antistius Laebo—Das Röm. Privatrecht im ersten Jahrhunderte der Kaiserzeit*, 1st and 2d vols., 1873 and 1878.

LABERIUS, **DECI MUS** (105–43 b.c.), a Roman knight and a prolific writer of *mimi*, or farces, was born about 105 a.c. Of his life we know little; but from the scattered notices of him in the old writers we can gather that he was a man of caustic wit, who wrote his pieces for his own pleasure, and enjoyed some consideration among his contemporaries. In 45 a.c. Julius Caesar, promising him 500,000 sesterces, ordered him to appear in one of his own *mimi* in a public contest with the actor Publilius Syrus. Laberius pronounced a dignified prologue on the degradation thus thrust on his sixty years, and in the course of his acting directed several sharp allusions against the dictator. Caesar awarded the victory to Syrus, but restored Laberius to his equestrian rank, which he had forfeited by appearing as a *mimus*. Laberius died at Puteoli in January 43 a.c. He was the

chief of those who introduced the *munus* into Latin literature towards the close of the republican period. He seems to have been a man of learning and culture, but his pieces did not escape the coarseness inherent to the class of literature to which they belonged; and Anlus Gellius (xvi. 7, 1) accuses him of extravagance in the coinage of new words. The titles of forty-four of his *munus* have been preserved; and what fragments remain have been collected by Ribbeck in his *Concorum Latinorum Reliquia*, 1855, 2d ed. 1873.

LABIENUS, Titus, Julius Cæsar's propinator in Gaul, first attracted his leader's favour in a civil capacity. In 63 B.C. he appeared at Cæsar's instigation as the prosecutor of Rabirius for perduellio; and in the same year, being tribune of the plebs, he carried a plebiscitum that indirectly secured for Cæsar the dignity of pontifex maximus. The military talent of Labienus was respectable, though not brilliant; but of all the officers trained under Cæsar in his Gallic campaigns he was the most trusted. His chief exploits in Gaul were the defeat of the Treviri under Indutiomarus in 54 B.C., his expedition against Lutetia (Paris) in 53 B.C., and his victory over Camulogenus and the Ædi in the same year. In 50 B.C. he was left in command of Gallia Cisalpina, while Cæsar returned to the north; but, on the outbreak next year of the civil war between Cæsar and Pompey, Labienus was one of the first to desert Cæsar. His motive is perhaps to be looked for, not so much in a deliberate calculation of chances, as in an overweening sense of his own importance, not adequately recognized by Cæsar. He was rapturously welcomed on the Pompeian side; but he brought no great strength with him. The veterans remained true to Cæsar, and even the town of Cingulum, on which Labienus had lavished much of his wealth, opened its gates to the future dictator. The ill fortune of Labienus under Pompey was as marked as his success had been under Cæsar's auspices. From the defeat at Pharsalia to which he had contributed by affecting to despise his late comrades, he fled to Africa. There, indeed, he was able by mere force of numbers to inflict a slight check upon Cæsar at Ruspina in 45 B.C.; but when the defeat at Thapsus ruined the Pompeian party in Africa, Labienus withdrew to join the younger Pompey in Spain. At Munda, on March 17, 45 B.C., he again met Cæsar, and in the ensuing defeat of his party fell sword in hand.

See the authorities referred to under CÆSAR; and Baron Carné de Vaux, *Expédition de Labienus contre Lucius*, Paris, 1876.

LABOUR AND LABOUR LAWS. With some exceptions in the case of labour imposed as a punishment for crime or as a test or condition of aid to the poor under the poor laws, the labour here to be spoken of is labour by freemen,—that is to say, labour by persons having the primary right to choose whether they will labour or not, and to choose the terms on which they will consent to labour, if labour be their choice. Further, although voluntary labour of men is undertaken from various motives,—for their own profit, for self-preservation, for love, from public or private duty apart from the prospect of immediate gain,—the labour now treated of relates especially to that rendered to others for pecuniary reward, for money or money's worth,—in other words, for *wages*. This class of persons consists of all those who serve their employers by hand labour, whether rude or skilled, in any branch of productive industry or manufacture, including agriculture, mining, and the like, as well as the processes by which skilled artisans elaborate raw material to its final destination and use. Purely domestic services and the service of shopmen and clerks, as well as the work of contractors for the service of others, who do not work with their own hands, is excluded from specific notice here. The labourers falling within the class thus popularly de-

scribed comprise upwards of a moiety of the present adult male population of the British Isles.

Although this article deals with free labour, the present position of the free labourer cannot be rightly understood without a glance at past history, and some attention to the distinction between voluntary and forced labour.

In every age and country, until times comparatively recent, compulsory personal servitude appears to have been the lot of a large, perhaps the greater, portion of mankind.¹ The slave was a man who had been captured in war or procured by purchase, or who had surrendered himself to the dominion of another as the alternative of starvation or in discharge of a debt, and it was his hands that tilled the soil, dug the mine, wove the cloth, and built the walls in ancient Greece and Italy. It has been asserted that in the early state of Rome the proportion of slaves, who were valued as property, was more considerable than that of hired servants, who could be computed only as an expense. It was thought more for the interest of the merchant or manufacturer to purchase than to hire his workmen, and in the country slaves were employed as the cheapest and most laborious instruments of agriculture. On the other hand, it has been inferred from our scanty materials that, as the Roman empire extended, the agricultural labourer and the citizen in Spain, Gaul, and Britain, in Syria and Egypt, maintained himself, as in the present day, by his own labour and that of his household, without the aid of any slave; but this is probably too favourable a picture. In the decline of the Roman empire, Roman captives were taken home by the northern conquerors. The useful craftsmen—smiths, carpenters, workmen in the metals, shoemakers, tailors, dyers, and others—employed their skill for the use or profit of their masters; while those who were destitute of art but capable of labour were condemned, without regard to their former rank, to tend the cattle and cultivate the lands of the victors. This, however, was only turning the tables on the Romans, for capture in war forms one of the principal sources of supply of slaves wherever slavery exists.

The Germans, in their primitive settlements, were accustomed to the notion of slavery, incurred, not only by captivity, but by crimes, by debt, and the wager of personal liberty in gaming. In the glimpses we get of the conditions of labour elsewhere the same essential features are discernible. In the changes of time and of geographical area of observation the harsher word slave may disappear; yet the thing not only survived the introduction of Christianity but was long regarded as not inconsistent with it, and was recognized as a national institution in civilized Europe. Whether under the name of slavery or of serfdom, or without either name, north, south, east, and west, an absolute right, apart from contract, to earnings and to the person of the labourer was accepted, if not openly vindicated. In looking at the present day at the vestiges of man's former and most permanent handiwork, it is instructive to regard them with an eye to the distinctions between periods of forced and voluntary labour. The pyramids of Egypt and the wall of China are monuments of slave labour; and the same is the case with the classic remains at Athens and Rome, so far at least as relates to the labour involved in the quarrying and hewing of stone, and the making of bricks and placing them in position. As regards Britain, our knowledge is too slight, to allow of positive assertion; but it seems legitimate to conclude that the labour was forced. British and Roman cam-

¹ "The simple wish to use the bodily powers of another person as a means of ministering to one's own ease or pleasure is doubtless the foundation of slavery, and as old as human nature" (Maine).

and earthworks for military purposes probably exhibit the result of organized military labour combined with the forced labour of the inhabitants of the district. In this aspect the fortresses and defences destined for use consequent on the campaigns of a Cæsar or a Napoleon, of an Alexander or a Clive, do not materially differ. The remains still to be seen of Agricola's works on the line between the Firths of Clyde and Forth, as well as of the Roman walls and roads throughout England, and the later but ruler gigantic earth work of the Mercuria king between England and Wales, may be regarded as fruits of slave labour. The stupendous aqueducts of Roman brickwork in various parts of southern Europe are naturally compared with the viaducts of the present age. The comparison may well extend to the accompanying conditions of labour.

Passing over the general effect of serfdom throughout northern Europe, and of the gradual manumission of tillers, as only a minute part of a very large subject, and directing our attention to the conditions of ordinary daily labour in the earliest period of the history of the British islands, we find it necessary to classify labour in relation to its particular application.

At the present day the most obvious natural distinction to be observed in this connexion is that between the labour of the husbandman on the one hand and the labour of the mechanic and artisan on the other, a distinction to some extent parallel with a division into rural and urban labour. In an attempted division of labour in this country recorded in writing, which, although not in its present form earlier than the 16th century, and distorted by a fanciful notion of adapting everything to trade, probably gives us a knowledge of a very primitive people, the following divisions of labour are found:—(1) domestic art, with its three primary branches—husbandry or cultivation of land, pastoral cares, and weaving, and (2) mechanical arts—smith craft, carpentry, and stone-masonry (*Ancient Laws, &c., of Wales, 1841*).

The social status of these various labourers is a very difficult question. It seems clear that the heads of departments of labour, although working for the lord or chief, were free. The authority just cited expressly says that smiths, stone-masons, and carpenters had equal privileges, and every one following those trades was entitled, besides his maintenance and firing, to a fixed measure of land for cultivation, independently of what he might have by birthright. It is clear that there must have been subdivisions, as in the present day, between craftsmen and labourers engaged in the same trade, as between a mason and his labourer, between a ploughman and the driver of the team, and between the shepherd responsible for the flock and the cowherd who merely drove cattle to and from the pasture; a freeman might perform one branch of duty and an absolute slave or serf another on the same land, and for the same chief or head. It cannot be denied that slavery in the strictest sense was an institution among the Saxons in England, and that in the earliest English laws such slaves are found, but the true slave class was a small one, and it has been doubted whether the labour of an ordinary serf was practically more severe, or the remuneration in one form or another much less, than that of an agricultural labourer in some parts of England at this day. On the other hand, a fully qualified freeman might be a simple husbandman.

Of the main conditions of labour at an early period in English towns we have no details. With the gradual development of urban populations around the castle of the lord, it is improbable that in any great number of cases the inhabitants long continued in the condition of personal servitude. The city populations of this island had not the habit and use of slavery. Serfs and oppressed labourers

from adjacent estates may have been glad to take refuge from taskmasters more than ordinarily severe, but there is no doubt that freemen gradually united with them under the lord's protection, that strongmen engaged in trade sojourned among them, and that a race of artisans gradually grew up in which original class feelings were greatly modified. From these and other causes the distinctions between agricultural labourers and mechanics and artisans grew and became permanent.

Proceeding to notice the legislation of England on the subject of labour, we observe, in passing, that the provisions of Magna Charta were not in the interests of labour. The stipulations against the forced building of new bridges and embankments, and for removing all weirs in rivers, were not by way of protest against involuntary labour, but in relief of a higher class. Direct legislation on labour dates as far back as the twenty-third year of the reign of Edward I., when the first Statute of Labourers was passed. The population had been much reduced by pestilence, and the demand for labour naturally led working classes to insist on higher wages, and there were "some rather willing to beg in idleness than by labour to get their living." The statute reciting these facts, and the "lusts especially of ploughmen and such labourers," enacted that "every man and woman of our realm of England, of what condition he be, free or bond, able in body, and within the age of threescore years, not living in merchandise, nor exercising any craft, not having of his own wherewith to live, nor land about whose tillage he might employ himself, nor serving any other," should be bound to serve if he is in convenient service, his estate considered, at the wages accustomed to be given in the twentieth year of that reign, or five or six years before. If he refused, he was to be committed to jail, till he found surety to enter into the service. No persons were to pay more than the old wages, upon pain of forfeiting double what they paid. If the lords of the towns or manors presumed to infringe the law, they were to be sued for treble the sum paid or promised by them or their servants. Artificers and workmen were put under the same restrictions, upon pain of imprisonment for taking more. This statute is remarkable as the first in which any notice occurs of the free labourer for hire, for the necessity of a statute to force him to work at fixed wages recognizes his otherwise free state.

A statute passed two years later (25 Edward III.), reciting that the earlier ordinance was disobeyed, contained minute regulations as to wages. If labourers or artificers left their work and went into another county, process was to be issued to the sheriff to arrest and bring them back. In 1360 (34 Edward III.) the former Statute of Labourers was confirmed, except that labourers were not to be punished by fine and ransom. Instead thereof, the lords of towns (*seigneurs des villes*) might take and imprison them for fifteen days if they would not do as required by law, and then send them to the next jail, "there to abide without bail till they will do so according to the statute." The statute enacted that "all alliances and covenants of masons and carpenters, and congregations, chapters, ordinances, and oaths betwixt them made, or to be made, shall from henceforth be void and wholly annulled, so that every mason and carpenter, of what condition soever he be, shall be compelled by his master to whom he serveth to do every work that to him pertaineth to do, either of free stone or of rough stone, and also every carpenter in his degree. But it shall be lawful to every lord or other to bargain and covenant for their works in gross with such labourers and artificers when it pleaseth them, so that they perform such works well and lawfully, according to the bargain and covenant with them thereof made." A workman absenting himself from his service,

and going to another town or county, was to be proceeded against under the previous statute, to outlawry, to be followed by imprisonment till he did as required by law, and made satisfaction to the party; nevertheless he was to be burnt in the forehead with the letter F, "in token of the falsity," if the party aggrieved so required, and if the justices should so advise. Eight years later, in the same reign (1368, 42 Edward III.), the statute and ordinance concerning labourers was confirmed, and commissions directed to justices to hear and determine matters concerning it.

Indubitable records still exist, proving that before the passing of those statutes, and down to the 15th century, workmen of various descriptions were pressed by writs addressed to sheriffs to work for their king at wages, regardless of their will as to the terms and place of work. Diggers and hewers of stones, masons, and carpenters, as well as ordinary labourers, were so impressed, and by services thus obtained the buildings at Windsor for the Knights of the Round Table, on the institution of the order of the Garter, were erected. In this case the sheriffs were commanded to take security from the workmen not to depart from Windsor without the permission of William of Wykeham, the king's surveyor. Notwithstanding these precautions, many workmen, so impressed, secretly left, in order to work for other persons at higher wages, and writs were directed to the sheriffs of London, commanding them to make proclamation prohibiting any person from employing or retaining any of the workmen on pain of forfeiting all their goods, and, as regards the workmen, commanding their arrest and imprisonment.¹

An Act was passed in the reign of Richard II. (1368, 12 Richard II.) by which no servant or labourer, whether man or woman, could depart out of the hundred to serve elsewhere, unless bearing a letter patent under the king's seal, expressing the cause of going and the time of return. Wages were fixed in a way that shows the classification of agricultural labour. The "baillif for husbandry" stands first. This "master hne," the carter, and the shepherd are on an equality; the ploughman follows; after him the oxherd and cowherd, then the swineherd, the dairy-maid and other women receiving equal wages, and every other labourer and servant according to his degree, no servant or artificers is to take more than the servants and labourers above named after their estate. The givers and takers forfeited the excess, or double or treble if attainted before; "and, if the taker so attainted have nothing wherof to pay the said excess, he shall have forty days imprisonment." This was followed by a remarkable clause: "also it is ordained and assented that he or she which neth to labour at the plough and cart, or other labour or service of husbandry, till they be of the age of twelve years, shall from thenceforth abide at the said labour, without being put to any trade or handicraft; and, if any covenant or bond of apprenticeship be from henceforth made to the contrary, the same shall be holden for none." By a statute of the following year (13 Richard II.), the justices were to settle and proclaim between Easter and Michaelmas what should be the wages of day labourers.

Early in the 15th century we have a glimpse of something beyond this continued legislation interfering with freedom of labour, in a reservation in favour of children being sent to school. An Act of 7 Henry IV., putting a property qualification on apprenticeship and requiring children to be put to such labour as their fathers or mothers are of, or as their estates require, on penalty of one year's imprisonment, fine, and ransom, and of one hundred shillings for receiving such apprentices, has this sentence: "But any person may send their children to school to learn literature." Labourers and artificers are to be sworn to observe the statutes in force or be put in the stocks, and a penalty is imposed on towns neglecting to have stocks. In 1414, by a statute (2 Henry V.) reneating that the servants and labourers of the shires of the realm flee from county to county because they would not conform to the law, and because the law was not put in force in every county, the former Acts were confirmed and directed to be put in force and proclaimed by the sheriff. Justices of the peace were empowered to send writs to the sheriffs for fugitive labourers in like manner as the justices have power to send to every sheriff for the felons or thieves before they are indicted, and to examine all kinds of labourers, servants, and their masters as well as artificers, and to punish them upon confession in accordance with the statutes.

Early in the following reign (2 Henry VI., 1423) further power was given to justices to compel by process an appearance before them of masters as well as servants for examination as to the execution of the statute of Henry V., and to give offenders a month's imprisonment. Four years later (1427) the conclusion was drawn that the statutes of Richard II were faulty,—that of 12 Richard II. because it was too hard upon the masters, that of 13 Richard II. because no penalty was attached to its breach; and, besides remedying the defects, it was enacted (6 Henry VI. c. 3) that justices should fix and make proclamation of wages. Two years earlier (1425) legislation had been directed against meetings of masons. This statute 3 Henry VI. c. 1 recites that, "by the annual congregations and confederations made by masons in their general chapters assembled, the good courses and effect of the Statutes of Labourers are publicly violated and broken, in subversion of the law, and grievous damage of all the commonalty"; and such chapters and congregations were forbidden. It was made felony to cause them to be assembled and held, and masons attending them were to be punished by imprisonment and fine. In 1444 (23 Henry VI.) a scale of wages in agriculture and trade was fixed (including freemasons and "rough" masons, master carpenters and mesne carpenters, and master tilers and slaters), and a servant in husbandry was required before departing to give half a year's warning or else to serve his master the year following. Persons refusing to serve or labour were to be committed to jail, there to remain until they found sufficient surety to serve, and masters were entitled to a fixed fine on such.

A statute towards the close of the 15th century (1495, 11 Henry VII.) referring to previous statutes, especially to the 23 Henry VI., and complaining of their inadequacy or imperfect execution, proceeds to fix the wages of artificers and labourers with great minuteness. This Act contained a remarkable clause against unlawful conspiracy by workmen engaged in building; if such artificers or labourers "make or cause to be made any assembly to assault, harm, or hurt any person assigned to control and oversee them in their working, that he or they so offending have imprisonment for a year without letting to bail or mainprize, and further to make fine at the king's will." It is not surprising that even with so very limited

¹ These proceedings were no doubt founded on notions of the royal prerogative, of which the imprisonment of seamen affords a more recent illustration. This forcing men to work for the king at low wages may be contrasted with proceedings within the present reign. Workmen employed in building the Queen's Palace at Westminster (the House of Parliament) struck for wages in the winter of 1841, and, having nothing to do, availed themselves of vacant seats in the Court of Queen's Bench, where her Majesty was constructively present. Here they were seen from day to day enjoying the comfortable temperature, undisturbed by any fear of writs or other compulsory process to force them to return to their work.

knowledge of principles a short time sufficed to show how ineffectual minute legislation was to control wages. The statute was repealed in the following year, "for divers and many reasonable considerations and causes, the king's highness moving, and for the common wealth of the poor artificers, as freemasons, carpenters, and other persons necessary and convenient for the reparations and buildings, and other labourers and servants of husbandry." But what is surprising is that (although the first legislation of the 16th century was in favour of masters') we find in 1514 a statute regulating wages and hours of work and even the summer day sleep of artificers and labourers, and in fact a re-enactment of the law of 1495.² The London workmen could not endure this restriction as to wages, and in the following year were allowed to take the previous rate when working within the city or its liberties; the king's works were, however, excepted.

At this point it is necessary to refer to the provisions made against vagrancy in the 16th century, those being closely connected with compulsory labour. The great social revolution caused by the suppression of the monasteries, and by the consequent withdrawal of the support which those institutions afforded to the indigent, and too often to the idle, had led to the dispersion over the face of the country of a multitude of beggars, many of whom were able to work but preferred idleness, often adding theft and robbery to mendicancy. Under these circumstances harsh and cruel statutes were passed in the reigns of Henry VIII., Edward VI., and Elizabeth.

In 1530 (32 Henry VIII.) any person, being whole and mighty in body and able to labour, found begging or being vagrant, and giving no satisfactory account how he lawfully obtained his living, might be arrested by a constable, and a justice might, in his discretion, cause every such idle person to be taken to the nearest town and there tied to the end of a cart naked, and to be beaten with whips throughout the town "till his body be bloody by reason of such whipping." He was then required to take an oath to return to his home "and put himself to labour as a true man ought to do." The whipping was to be repeated as often as he made default; but five years later the punishment for "rufflers, sturdy vagabonds, and valiant beggars" persisting in not working after a whipping was increased to having the upper part of the gristle of his right ear clean cut off. If still persistent he was to be tried, and executed as a felon.

On the accession of Edward VI. a law was passed by which a serving man wanting a master, or loitering or wandering, and not applying himself to honest labour, might on conviction be marked with the letter V, and adjudged to be the slave for two years of the person buying him, giving him only bread and water or small drink, and such refuse of meat as the master should think fit, and causing him to work by beating, chaining, or otherwise. If he ran away he might not only be punished by his master in the same way, but the justices, on conviction, were to have him marked on the forehead or ball of the cheek with an hot iron with the letter S, and adjudge him to be the master's slave for life. If he again ran away the offence became felony, and he was to suffer the pains of death "as other felons ought to do." Any child of a vagabond, above the age of five and under fourteen, might be adjudged the servant or apprentice of any person willing to take it until the age of twenty-four if a male and twenty if a female; if it ran

away slavery followed for life. The master might put a ring of iron about the neck, arm, or leg of his slave to prevent his running away, with a penalty on any person helping him to take it off, and if the slave resisted correction he was to be executed as a felon. The slave might be sold or devised by will as after other goods and chattels. This statute was repealed three years after, but it remains on the rolls of parliament, and nothing can obliterate the fact and the consequent disgrace attaching for all time to the parliament that could pass such a law, and to the country that could endure it for a day. This reintroduction of slavery in England by name, and in its worst form, is memorable, and serves to mark the alteration of opinion and feeling that has since taken place, much more than any contrast between freedom of labour and wages in the sense of the political economist.

Early in the reign of Elizabeth (5 Elizabeth, 1562) the statute commonly called "the Statute of Labourers" repealed all former statutes relating to labourers in husbandry and artificers or labourers engaged in particular trades, and consolidated and amended many former provisions. Its chief object was to provide a new rate of wages, and, in addition, to regulate in many respects the terms of employment as between the employer and the employed. This Act admits that the wages laid down by former statutes are in divers places too small in view of the general rise of prices, but approves of the principle and aims of previous legislation, the substance of which it seeks to digest into a single statute. The statute draws a main distinction between artificers and labourers in husbandry. The former may not be hired for a less term than a year, and any unemployed person brought up in a craft or who had practised it for more than three years was bound, on pain of imprisonment, to accept service if required "by any person using the art or mystery wherein he has been exercised," unless he had a farm in tillage, an estate worth 40 shillings a year, or goods to the yearly value of £10. Similar provision was made in respect of service in husbandry. Every person between the ages of twelve and sixty was in like manner bound to serve in husbandry unless possessed of property of specified amount, or employed as a fisherman or mariner, or in mining, or in any of the arts or sciences previously mentioned, or unless born a gentleman, or unless a member of a university or school. Minute regulations were made with reference to the rights and obligations both of master and servant. No person retained in husbandry or trade was to go out of the county or shire where he last served, to serve in any other, without a testimonial. No person leaving his service could be taken into another without showing such testimonial to the authorities of the place in which he was about to serve. If he broke this regulation he was to be imprisoned till he could procure a testimonial, and unless he did so within twenty-one days he was to be whipped. Every person retaining a servant without the latter showing such testimonial forfeited £6. Besides empowering justices in session to make a rate of wages, the statute fixed with great minuteness the hours of labour. In the time of harvest, justices or constables or other head officers might require artificers and persons meet for labour to serve by the day in mowing, reaping, shearing, getting, or turning of corn, grain, or hay, according to the skill and quality of the person, and upon refusal might put him in the stocks for two days and a night. Even single women between the ages of twelve and forty might be compelled to serve in such employment as the justices might direct, under pain of imprisonment. Amended provision was made towards the close of the reign for justices yearly fixing the rate of wages.

It will be seen by the preceding summary how great

¹ In 1512 (4 Hen. VIII.) the penalties for giving of wages contrary to the statute 12 Rich. II. were repealed so far and only so far as relates to the masters.

² Miners and workers for tin, lead, iron, or silver, colliers for sea coal, and glass makers were excepted.

were the restraints still placed by the legislature on the free action of labour. After this mass of unwholesome legislation it is instructive to notice the state of the labouring classes in England in the 16th century, as recorded by Harrison. After dividing English people into four sorts—gentlemen, citizens or burghesses, yeomen, and artificers and labourers—and describing the first three classes, he says—

"The fourth and last sort of people in England are day labourers, poor husbandmen, and some retailers (which have no five hundred, copyholders, and all artificers, as tailors, shoemakers, carpenters, brickmakers, masons, &c. As for slaves and bondmen, we have none; may, such is the privilege of our country, by the especial grace of God and bounty of our princes, that, if any come hither from other realms, so soon as they set foot on land they become so free of condition as their masters. . . . This fourth and last sort of people have neither voice nor authority in the commonwealth, but are to be ruled, and not to rule others; yet they are not altogether neglected, for in cities and corporate towns, for default of yeomen, they are fain to make up their requests of such manner of people, and in villages they are commonly made churchwardens, sidemen, ale conners, now and then constables, and many times enjoy the name of headboroughs. Unto this sort also may our great swarms of idle servagings be referred, of whom there runneth a proverb, *Young serving-men, old beggars*, because service is none heritage. . . . This, furthermore, among other things I have to say of our husbandmen and artificers, that they were never so excellent in their trades as at this present. But, as the workmanship of the latter sort was never more fine and curious to the eye, so was it never less strong and substantial for continuance and benefit of the buyers. Neither is there anything that hurteth the common sort of our artificers more than haste, and a barbarous or slavish desire to turn the penny, and by ridding their work to make speedily utterance of their wares, which enforceeth them to bungle up and despatch many things they care not how so they be out of their hands, whereby the buyer is often very defrauded, and findeth to his cost that lusto maketh waste, according to the proverb *Oh, how many traders and handicrafts are now in England whereof the commonwealth hath no need!* How many useful commodities have we which are perfected with great cost, &c., and yet may with far more ease and less cost be provided from other countries if we could use the means! I will not speak of iron, glass, and such like, which spoil much wood, and yet are brought from other countries better cheap than we can make them here at home. I could exemplify also in many others."

Notwithstanding compulsory legislation, and the forcing of labour for the sovereign already noticed, it is evident that the condition of the labourer, even when employed on royal property, was undergoing amelioration. In a remarkable but apparently unpublished letter of Humphrey Mitchell, surveyor of the queen's works at Windsor (and for some time member of parliament for that borough), to Lord Burghley, written in 1575, he says—"At my first entry into this charge I could scarce get workmen by commission; since, with monthly 'payes,' impressing through the mayor those contumacious in work, rewarding the diligent, and thrusting out the evil where I perceive them loitering, I have brought them into such an obedience and a desire to work here that where I have one I can have twenty to serve her Majesty; and when at the first entry into the works, they had their breakfast at eight of the clock in the morning, and drinking at three in the afternoon, I have taken that idle custom from them, and have only allowed them two hours at noon, and, as necessity serveth, sometimes but one, with their contentation; and for that also I would have them they must know their duty, I bring them to the lecture at the college [Windsor] twice every week, losing no hour's work thereby, for those days they rest at twalve. I suffer not a swearer nor filchy talker in the works to my knowledge, by all which means I think her Majesty hath her work done as diligently as any other private man hath."

Light is thrown on the arrangement of hours by a clause in the above-mentioned Statute of Labourers of the fifth year of the Queen's reign. It enacted that—

"All artificers and labourers being hired for wages by the day or week shall, betwixt the midlet of the months of March and Septem-

ber, be and continue at their work at or before five of the clock in the morning, and continue at work and not depart until betwixt seven and eight o'clock at night (except it be in the time of breakfast, dinner, or drinking), the which time at the most shall not exceed above two hours and a half in a day, that is to say, at every drinking one half hour, for his dinner one hour, and for his sleep when he is allowed to sleep, the which is from the midlet of May to the midlet of August, half an hour at the most, and at every breakfast one half hour; and all the said artificers and labourers betwixt the midlet of September and the midlet of March shall be and continue at their work from the spring of the day in the morning until the night of the same day, except it be in times then appointed for breakfast and dinner, upon pain to lose and forfeit one penny for every hour's absence, to be deducted and defaulked out of his wages that shall so offend."

In the first parliament after the accession of James an attempt made towards the close of the previous reign to enforce the rating of wages and the payment of the rated amounts was renewed. The Act recites, in the same terms as were used only two years before, that the Act of 1562 "hath not, according to the true meaning thereof, been duly put in execution," and, in order to remove a doubt as to the application of the principles of assessing wages, expressly extends it "to rate wages of any labourers, weavers, spinners, or workmen whatsoever, either working by the day, week, month, year, or taking any work at any person or persons' hand whatsoever, to be done in great or otherwise." The giving or receiving more or less than the proclaimed price was expressly declared to be an offence.

In Scotland we find complaints in the 16th century by masters of salt-pans of the great rise in wages, and early in the 17th century (1617) justices were directed to fix at quarter sessions the ordinary rate of hire and wages of workmen, labourers, and servants, and to imprison those who refused to serve for the appointed hire. At the same time, "that servants may be the more willing to obey the ordinance," power was given to the justices to compel payment of wages. This law was re-enacted in 1661. Some years previously (1606) any one hiring a soldier or sailor without a sufficient testimonial from his last master was compelled to deliver him up demanded; and colliers and salters were empowered to apprehend vagabonds and sturdy beggars and force them to labour. In 1621, in consequence of "the great straits and necessities that the poor labourers of the ground" were driven to by the "fraud and malice" of servants who either refused to be hired without the promise of great wages, or else hired themselves from Martinmas to Whitsunday, then "enating them losses" on purpose to make their gain and advantage by extraordinary works, such as casting and winning peats or turfs, building fold dykes, and shearing in the harvest, hired servants were forbidden to leave unless upon proof to a justice of the peace that they were hired to another. If it was found that a servant was not so hired, his master was empowered to detain him at the previous rate of wages. Power was given to apprehend a servant "who broke loose," and to deliver him to a constable or justice, and a power to all persons to apprehend loose and masterless men and women found within their own bounds; and the justices and constables were empowered to compel them to serve for competent hire and wages. Twenty years later servants in manufactures were compelled to work at reasonable rates, and not to hire without their previous master's consent. Houses of correction were erected for disobedient servants, and in 1672 masters of correction houses were empowered to receive such servants and to force them to work, and to correct them according to their demerits. These later laws of Scotland were accompanied by others directed against vagrancy.

Passing over legislation which either affected only particular trades (although denoting the growth of manufacturing industry), or related rather to the poor laws than

directly to the subject of this article, and arriving at the middle of the 18th century, we find the legislature no longer employed in compelling labourers or artisans to enter into involuntary service, but regulating the summary jurisdiction of justices in the matter of disputes between employers and employed, in relation to contracts and agreements, express or implied, presumed to have been entered into voluntarily on both sides.

The statute 20 Geo. II. c. 19 (passed in 1746) provided that all complaints, differences, and disputes arising between masters and servants in husbandry hired for one year or longer (extended by a subsequent statute of the same reign to those hired for less than a year), or arising between masters and artificers, handicraftsmen, and miners (applied in 1829 to labourers of every sort), were to be determined by one or more justices, who, upon complaint of the servant, might determine any dispute as to wages and order payment of any sum found to be due, not exceeding £10 in case of a servant in husbandry, and £5 in case of artificers and other labourers, and, in the event of non-payment, might levy the same by distress on the goods of the master. In case of complaint by the master, the authority of the justice was still larger. He had power to entertain a complaint of "any misdemeanour, misbehaviour, or ill behaviour of the servant in his or her service or employment," and to hear, examine, and determine the same. If the decision was adverse to the servant, the justice might either abate some part of the wages due to such servant, or discharge him from the service, or he might punish the offender by committing him to the house of correction, "there to be corrected," which term was held to mean correction by whipping and holding to hard labour for a reasonable time, not exceeding a month.

A statute of 1823 (4 Geo. IV. c. 54), the next general statute on this subject, took a somewhat wider scope, dealing with breaches of contract on the part of the servant in not entering into the agreed service at all, as well as in quitting it before the term agreed on had expired, and subjecting these breaches as well as any misdemeanour or misconduct while in the service to the jurisdiction of the justices, who might adjudge the offender to be imprisoned in the house of correction for a term not exceeding three months (but without any power to order corporal punishment), abating a proportional part of his wages in the future, or adjudging him to lose the whole or part of his wages already earned, or he might dismiss him from the service.

This stood the statute law until 1867. In consequence of considerable dissatisfaction on the part of workmen with the adjudication of justices, a select committee of the House of Commons was appointed in the previous year to inquire into the state of the law as regards contracts of service between master and servant, and as to the expediency of amending it. That committee reported—

1. That the law as it then existed was objectionable.
2. That all cases arising under the law of master and servant should be publicly tried in England and Ireland before two or more magistrates, or before a stipendiary magistrate, and in Scotland before two or more magistrates, or the sheriff.
3. That procedure should be by summons in England and Ireland, and warrant to cite in Scotland, and, failing appearance of defendant in answer to summons or citation, the court should have power to grant warrant to apprehend.
4. That punishment should be by fine, and failing payment by distress or imprisonment.
5. That the court should have power when such a course is deemed advisable to order the defendant to fulfil the contract, and also, if necessary, to compel him to find security that he will do so.
6. That in aggravated cases of breach of contract, causing injury to person or property, the magistrate or sheriff should have the power of awarding punishment by imprisonment instead of fine.

7. That the arrest of wages in Scotland in payment of fines should be abolished.

The Master and Servant Act 1867, sometimes called Lord Elio's Act, was framed upon the report of the committee, and embodied most of the recommendations. As regards simple breaches of contract, the position of servants was considerably improved. Imprisonment, which, under the former Acts, the magistrate was authorized to impose in the first instance as a punishment for a breach of the contract, was taken away, except as auxiliary to the jurisdiction, as the consequence of disobedience to the order of the court, and wherever imprisonment might, under the former Acts, have been accompanied by hard labour, the power to order hard labour was taken away. Lord Elio's Act did not, however, remove the dissatisfaction felt on the part of workmen, and the events of a few years rendered it desirable to reconsider the whole law, with reference not only to breaches of contract but to other special legislation of a criminal kind, and to the general law of conspiracy affecting the relation of employer and employed.

Commissioners reported in 1875 recommending, so far as relates to the scope of this article, that the proceedings should be altogether divested of a penal character and assume that of a civil proceeding for specific performance or recovery of damages, and that, to effect the main object, Lord Elio's Act should be amended or a new Act framed in clearer language. Within a few months of the presentation of the report, Mr Cross, then secretary of state, introduced two bills, the one an "Employers and Workmen Bill," and the other a "Conspiracy and Protection of Property Bill," and these bills, after undergoing considerable discussion and alteration in their different stages, were passed and came into operation on the 1st September 1875. This article only deals with the former Act. While carrying out the recommendation of the commissioners regarding Lord Elio's Act, and placing all provisions of a penal character in a separate Act ("Conspiracy and Protection of Property"), the legislature thought fit to go further and take away the right of enforcing performance of contracts of labour (although that is a very important branch of civil procedure in relation to various matters of contract), and make it a mere question of recovery of damages, unless both parties agree that security for performance of the contract shall be given instead of damages. Adjudication can be by courts of summary jurisdiction.¹

Neither this Act nor its predecessor takes away the right of parties to sue in the ordinary civil tribunals of the country; but the Act puts county courts (in Scotland the ordinary sheriff court of the county, in Ireland the civil bill court) practically on the same footing with courts of summary jurisdiction,—the jurisdiction of magistrates being simply because the county courts in most places do not sit sufficiently often for the practical adjudication of these differences. The title of the Act, "to enlarge the powers of county courts in respect of disputes between employers and workmen, and to give other courts a limited civil jurisdiction in respect of such disputes," indicates its general scope, which is borne out by its provisions. It

¹ In England such courts are a police or stipendiary magistrate, or, where there is no such magistrate, two or more justices sitting at some place appointed for holding petty sessions, or, in the city of London, the lord mayor or an alderman sitting at the Mansion House or Guildhall. In Scotland the court of summary jurisdiction is the small debt court of the sheriff of the county. In Ireland the court is constituted of one or more of the divisional justices of the police district of Dublin metropolis, and elsewhere in Ireland of two or more justices of the peace in petty sessions, sitting at a place appointed for holding petty sessions. These courts are, for the purposes of the Act, civil courts.

extends to "any dispute between an employer and a workman arising out of or incidental to their relation as such." The expression "workman" does not include a domestic or menial servant, but means any person who, being a labourer, servant in husbandry, journeyman, artificer, handicraftsman, miner, or otherwise engaged in manual labour, whether under the age of twenty-one years or above that age, has entered into or works under a contract with an employer, whether the contract be made before or after the passing of the Act, be express or implied, oral or in writing, and be a contract of service or a contract personally to execute any work or labour. Payment of damages and debts under the Act, as in other cases of judgment debts, is enforceable by imprisonment for a term not exceeding six weeks, only on proof of ability and neglect to pay, whether the proceedings be in the county court or in the court of summary jurisdiction.

Two circumstances show the rapid strides made in a few years in the position of labour in relation to legislation. Lord Elibro's Act in 1867 received the title of "The Master and Servant Act." In eight years that title is silently dropped, and "Employers and Workmen" substituted. In 1867 the prime minister spoke in high terms of eulogy of Lord Elibro's Act as securing valuable rights for workmen. In 1875 the same prime minister, speaking a few weeks after the passing of the Act of that year, remarked that for the first time in the history of the country the employer and employed sat under equal laws.

Although the general tendency of colonial legislation is to follow that of the parent country, where it can be applied, that is not the case in some important British colonies in relation to the enforcement of labour contracts.

In New South Wales, servants, including artificers, journeymen, and handicraftsmen, and all agricultural labourers, as well as domestic servants, are dealt with under a colonial Act of 1867. For not fulfilling a contract, or refusing to go to the place of service, or refusing to perform work, to the extent of the advance without upon conviction may impose a fine not exceeding £10. In default of distress, imprisonment, not exceeding fourteen days, or forfeiture of wages then due may follow. Obtaining advances of money after entering into a contract and refusing to go to the place of service, or refusing to perform work, to the extent of the advance without reasonable cause, is punishable by direct imprisonment with or without hard labour for any term not exceeding three months. Persons knowingly concealing or employing absconding or absenting servants or persuading them to violate agreements are liable to a penalty not exceeding £10, and in default imprisonment for fourteen days. On the other hand wages not exceeding £50 and full costs may be recovered by distress, and in default imprisonment for fourteen days; masters are also liable to a penalty for withholding property of their servants. Independently of these provisions, justice may hear and determine in a summary manner any complaint, difference, or dispute between a servant and his master, and the award may be enforced by cancelling an agreement or imposing a fine, and in default of distress by imprisonment not exceeding fourteen days. The power of imprisonment under the Act does not extend to workmen.

In South Australia, by an Act of 1878 (following in the main the tenor of Lord Elibro's Act, rather than the legislation of 1875), whenever the employer or employed neglects or refuses to fulfil any contract, or the employed neglects or refuses to enter or continue his service or absents himself, or whenever any dispute arises between the parties, the case may be summarily decided by justices, who may order an abatement of wages due, or direct the fulfilment of the contract, with a direction to the party complained against to find security by recognizance or bond with or without sureties; or the contract may be annulled and the amount of wages or compensation apportioned; or, where pecuniary compensation will not, in the opinion of the justices, meet the circumstances of the case, they may impose a fine not exceeding £20. The neglect or refusal to find security for performance of contract may be enforced by imprisonment not exceeding three months.

The Victorian statutes relating to master and servant were consolidated in 1864. Under that Act all agricultural and other labourers and workmen and artisans, as well as domestic servants, were made liable on summary conviction to imprisonment not exceeding three months, or abatement of wages, for breaches of contract or for disobedience or other misconduct or neglect. The like imprisonment was provided for obtaining advances of wages and refusing to serve, and also for wilful or negligent acts

involving a destruction of work or materials committed to the workman's charge, in default of payment of damages (limited to £10). Wages and amends for ill-treatment were made recoverable by order.

It is impossible within the limits of this article to follow the different provisions in various colonies affecting the relation of employer and employed. To render a summary of practical value, local peculiarities and exigencies must be borne in mind. Where native or foreign races form a material part of the industrial population, or where changes have occurred in their condition, the facts must be taken into account, for example, the legislation of Jamaica, although now constituted an ordinary British colony, must be considered in relation to the former existence of slavery and to the intermediate status of apprenticeship before its abolition. So in British Guiana, the large number of emigrants from the East Indies, many of them working on the estates under indentures, must not be lost sight of.

With regard to India, that vast area cannot be dealt with as if the industrial population consisted of Europeans, manufacturing in its ethos. Although natives are increasingly clearing in the labour and ownership involved in the production of manufactures, the cultivation of the soil forms the basis of the support of two-thirds of the population. The true view of India is that as a whole it is divided into a vast number of independent self-acting organized groups, cultivating, trading, and manufacturing, governed by law made up to a great extent of local usages and customs, and where custom is often more a name for trade or occupation,—the village communities comprising families who are hereditary weavers, potters, blacksmiths, harness makers, and so forth.

The condition of the law in European states at the present time with regard to the enforcement of labour contracts is this. In France contracts of work and service stand on the same footing as other contracts. The breach of such contracts is regarded as a private matter, as the subject of a claim for damages, but not of the application of the criminal law. The recovery of damages is regulated by the Code Napoléon. The judge de paix decides the amount when the sum claimed is under 200 francs, when above that amount the tribunal of first instance. So in Belgium there is no criminal penalty attaching to the breach of a contract of labour, such a contract entitles the aggrieved party, as a general rule, only to pecuniary damages; and the same is the case in the Netherlands, Austria Hungary, Italy, Portugal, Sweden, Norway, and Russia. In Sweden there is no criminal liability, provided the breach of duty involves no consequential injury to the public welfare or to the life or health of other persons. The performance of contracts, however, in the larger works in Switzerland is secured by the system of "décoréty," or portion of wages retained as security by the employer. In Prussia, although in 1859 all the penal regulations previously existing against breaches of contract and wrongful cessation of work on the part of workmen in mills, mines, and metallurgical establishments and in underground quarries and pits were repealed, police laws are, it seems, still capable of being enforced by way of fine, and, in default, by a short imprisonment in some provinces, against agricultural labourers, and against boatmen or workmen engaged in special soil or forest work.

Of the United States, the English representative wrote thus to the Foreign Office in 1869—"There are few countries in which the working man is held in such regard as in the United States of America. The labouring classes may be said to embrace the entire American nation. Every man works for a living, follows a profession, or is engaged either in mercantile or industrial pursuits." As might be expected, it may be said that, as to both parties to a contract for labour and service, they stand upon the mere footing of contract, and such contract is not distinguished from any other contract. The matter does not belong to the province of federal legislation, but to the regulation of each particular State. There has been no legislation, however, making the breach of a contract for labour or services the subject of criminal liability. Contracts of apprenticeship are, nevertheless, enforced by statutory provisions.

We have hitherto dealt with the mode of enforcing contracts of labour. It remains to speak of the extent to which the contracts themselves are controlled.

With reference to the period of service, there is no law directly limiting it. A right even to perpetual service founded on a contract may not perhaps be illegal and void; for, if a man can contract to serve for one year, there seems to be no reason to prevent his contracting to serve for one hundred years if he should so long live,—though the courts would be inclined to consider it an improvident engagement, and would not be very strict in enforcing it (Christian). No such perpetual contracts, however, exist in actual practice, and where no time is expressly stipulated or implied the contract is generally construed to endure

until determined by a reasonable notice on either side, to be construed by the general usage in relation to the particular employment. If a time is expressed or implied, the silent continuing in the service after its expiration draws with it in general a renewal of the same terms as were originally stipulated for. In agriculture the general engagement, express or implied, is for a year. In manufacture it is seldom so long, and in journeyman handicrafts it is sometimes by the hour, but the usage to calculate earnings and the time of payment by the hour or day is often of course quite distinct from the duration of the contract. Payment by measure or quantity (piece work) is very general, and so far as the calculation of earnings is concerned supersedes reference to time. Nevertheless the obligation to serve may be conditional on the employer finding a reasonable quantity of work, or may expressly or implicitly endure until a reasonable notice is given on either side. In the pottery manufacture in North Staffordshire most of the workmen in the different branches of the trade are paid by the quantity according to a price list, the engagement being by usage, from Martinmas to Martinmas, and in this and in most other manufactures where the artisan works on the material and in the manufactory or the workshop of the employer he is subject to the usual hours of work, although only paid by the quantity.

Most workmen of all classes and descriptions of labour are paid weekly, in whatever way their earnings accrue or are calculated. The contracts of infants (see INFANTS) for their personal services as necessary for their maintenance are enforceable, for unless they could make such contracts they might starve. As long as these contracts were enforceable by imprisonment the courts looked closely into them, refusing to enforce them unless they were mutual, that is, capable of being enforced against the employer as well as against the servant. If there were an agreement to serve under circumstances which involved no obligation to employ, the courts would not enforce the contract, and young servants were not unfrequently discharged from custody on the ground that no obligation to serve existed by reason of the onesidedness. Contracts of APPRENTICESHIP (*q.v.*) are beyond the limits of this article.

The will of the parties is not interfered with as regards the description of labour or the adequacy of the remuneration agreed upon. In the absence of any verbal or written stipulation, the performance of labour upon an express or implied request in general involves an implied agreement to pay the value of it in the current coin of the realm; and wherever a mutuality of agreement can be implied, that is to say, where it is not occasioned, it can be enforced. As the employer and employed are free, they would primarily have a right to stipulate that the remuneration for service should be for something else than money, as for articles of value, or for an exchange of labour; but the primary right of employer and employed to make their own arrangements as to the mode of remuneration is interfered with in England by legislation, especially by the so-called Truck Act, 1 and 2 Will. IV. c. 37, applying to all persons employed in the manufacture of iron from raising the stone to the completion of the making of the products of iron and steel, and the manufacture of all other hardware and cutlery, and the getting of coal, stone and slate, salt and clay, and the manufacture of pottery, and the weaving, preparation, and dyeing of woollen, worsted, cotton cloth, and silk. The object of the statute is to compel payment of wages in money. For this purpose it prohibits agreements for paying wages otherwise, and prohibits paying them in goods or money's worth. To insure obedience, it enables the artificer to repudiate a contract and payment contrary to its provisions, and, however fairly he may have been dealt with, to enforce payment in such

case over again. It is obvious that such a provision is open to two most important objections:—(1) it interferes with that freedom of contract and conduct which is universally recognized as of the greatest benefit, (2) it enables an artificer who may have requested and received payment otherwise than in money, and who may have benefited thereby and been most justly and kindly treated, to commit a great dishonesty by enforcing payment again. But, grave as these objections are, the legislature has deemed it necessary to face them, in order to guard against the mischiefs of a system under which the workman may receive directly from his employer, or indirectly, as through "tommyshops" in which the employer has an interest, articles not a real equivalent of the wages; so that but for the statute an employer might engage a man to work for him with a promise of payment in goods, and cheat him by giving him goods of inferior quality or overcharged, or engaging him with a promise of money and then cheating him by a pressure to take goods, or by supplying the man with goods beyond his wages, get him into his debt, and then exercise an injurious control over him. It is in vain to say that the master would cheat in cases where money wages were agreed for, by withholding money agreed to be paid, and that the law would redress the one wrong as readily as the other. The answer is that such a cheat is too barefaced, and would certainly be successfully resisted; while more or less of inferiority in the quality or value of goods might be endured, or, if contested, would give rise to more doubtful inquiries. Whether these mischiefs are worth the remedy, or whether the remedy is the best, is not the question to be discussed or determined in this article.

As servants in husbandry are often remunerated in part in other ways than by money, as by land or its produce, or by house room, and in a variety of ways, the Truck Act especially exempts them. Domestic servants are also especially exempted. Moreover, by express provision, the Act does not prevent any employer of any artificer or agent of such employer from supplying or contracting to supply medicine or medical attendance, or any fuel, or any materials, tools, or implements employed by the artificer in his trade or occupation if employed in milking, or any hay, corn, or other provender for horses or other beasts of burden employed by such artificer in his trade or occupation, nor from letting any tenement at a rental to any artificer, workman, or labourer within the Act, nor from supplying or contracting to supply to any artificer any victuals dressed or prepared under the roof of the employer and there to be consumed by such artificer, nor from making deductions or stoppages, or advancing money for any of these purposes, provided that only the real value is charged, and that the agreement for any such stoppage or deduction is in writing. Employers are not prevented from advancing money to an artificer for his contributions to a friendly society or to a savings bank, or for his relief in sickness, or for the education of his children, or from making deductions for such education, if the agreement for such deduction is in writing. The interpretation of the Truck Act has exercised the most subtle intellects. It has been determined by the majority of judges that the obligation to render services personally is necessary to make the Act applicable. The circumstances under which stoppages and deductions may be made, and other exceptions from the operation of the prohibitory clauses of the Act, have also been the subject of divergent opinions. A custom having prevailed among the employers of artificers in the hosiery manufactures of letting out frames and machinery to the artificers employed by them, in 1874 contracts to stop wages for frames were declared illegal, and the stoppage of wages made unlawful. By a provision of the Employers

and Workmen Act 1875, forfeitures on the ground of absence or leaving work cannot, in the case of a child, young person, or woman subject to the provisions of the Factory Acts, be deducted from or set off against a claim for wages or other sum due for work done before such absence or leaving work, except to the amount of the damage (if any) which the employer sustained by reason of such absence or leaving work.

Great evils having arisen in Scotland through the arrestment of wages for debts of labourers, manufacturers, artificers, and other work people, the power to arrest wages earned there not exceeding twenty shillings a-week was in 1870 taken away, and limited in amount where the wages are above that sum. A provision of a statute of the reign of George II, "to prevent oppression of the labourers and workmen employed in any respect in or about making or manufacturing of gloves, breeches, boots, shoes, slippers, wares or goods of that sort," requires the true weight, quantity, or tale to be declared of goods and materials delivered out to be wrought up in those manufactures.

The system of the "livret" (still the law in some European states, although fallen into disuse as no longer in harmony with the direction of modern views), by which it is a condition precedent to a workman entering into a contract, or being engaged by a fresh employer, to produce a document certifying that he has fulfilled his previous engagements, is unknown now in England. The former system of rules stood much on the same footing, and there is something closely resembling it introduced into the rules regulating the employment of drivers of public vehicles in the metropolis. It is only in relation to domestic service that a new employer concerns himself with the antecedents of a servant or with anything beyond the capacity to work; and the former employer in whose interests "livrets" were imposed does not in general deem it worth while, with the present abundance of labour in every field of work, to impose any restraint on the departure of a dissatisfied workman. The practical ground of complaint is not so much a workman exchanging employers, as a neglect of work while remaining in service.

The legal remedies at present in existence for breaches of contract have been necessarily stated in the outline of the last statute on the subject of employer and employed. The weak point is the absence in England of any mode by which the performance of contracts of labour can be enforced, as contracts of other kinds can be where damages do not afford a remedy. Lord Esher's Act of 1867 purposely gave a remedy in the nature of specific performance, and where carefully applied was found to work very well. The commission of 1875 expressly recommended the retention of this power as quite distinct from criminal punishment. Provision for compelling the performance of a contract exists in many countries where any application of criminal law is repudiated. Nevertheless, not so much from any objection on the part of the framers to compulsory performance as from fear of its abuse by the heavy hand (the bane of administrative legislature as of inventive genius), the power is gone. The result is undoubted hardship to employers, particularly to those (and there are many of them) who are themselves workers and entirely dependent on the due performance of contracts by their fellow-workers. That home legislation is defective in this respect may be inferred from the fact that subsequent colonial legislation has given the means of getting labour contracts performed without trenching on the domain of criminal law. As, however, there is little probability of an amendment of home law in the direction indicated, it is to be hoped that compensation for diminished legal remedy will be found in an increased sense of moral responsibility.

Arbitration is frequently employed to settle differences between masters and workmen.

The institution of "conseils de prud'hommes" is known by name as in force in most of the manufacturing districts of France and Belgium and other Continental countries. The council is a recognized tribunal consisting of equal numbers of employers and employed. All disputes between master and workmen, whether as to quality of work or rate of wages, are first submitted to a committee, which sits privately, to endeavour to settle the question amicably and at a nominal expense; failing this, the case is referred to the council, which sits in public once a month, or oftener if required. Though the right of appeal to the regular courts exists, it is seldom resorted to.

In Austria a law of 1869 instituted arbitration courts of this description in every important manufacturing town and district, to settle all disputes respecting wages, continuance of work, fulfilment of contracts, and claims on benefit clubs and relief funds and matters of that kind. Each court of arbitration must be composed of at least twelve and at most twenty-four members,—one half of them employers elected by employers, and the other half workmen elected by workmen, each class voting separately. Workmen sitting on cases judged by these courts are paid by the commune for every day's sitting. In the case of the minor trades, which cannot maintain regular arbitration courts, the trade laws assign the adjudication of all disputes between masters and men in the first instance to the representatives of the trade in which such disputes arise, and, in places where the necessary quorum for that purpose cannot be made up by the local representatives of any particular trade, the deficiency is supplied by a certain number of workmen temporarily appointed by the municipal authorities from amongst the most respectable and intelligent members of their class to act as arbitrators in such cases. Disputes which cannot be settled in this way must be decided by the common law courts; and it is only a court of law which can take cognizance of a claim raised thirty days after the expiration of a contract to which it refers.

In England no such compulsory legislation exists. The old guilds acted as arbitration courts, and, although their decision was practically binding, the guilds were only adapted to deal with small craftsmen acting singly. In modern times the law has been very reluctant to give effect even to voluntary agreements for referring disputes to arbitration, on a notion that to take away the jurisdiction of the ordinary tribunals and to set up another was contrary to settled principles. There are now several statutes, however, for giving legal effect to the awards of arbitrators in trade disputes voluntarily referred to arbitration and sitting in the way pointed out. The most successful arbitrations between employers and employed appear to be under voluntary submissions, in accordance with rules previously agreed to by employers and employed, in particular manufactures, the decisions being acted upon independently of any legislative aid.

Applied to the one pre-eminently important—probably the only great—question, the rate of wages, reference to arbitration is full of difficulties. The difference relates to the future, not to the past. It is an erroneous notion that strikes and lock-outs involve any breach of contract. In former days it may have been that employer and employed refused to carry out a contract on the ground that the other side had first failed in the performance of some condition precedent to the right to call on the other to perform work or to pay for it, as the case might be; but in the present day the disturbance of the previous relationship of employer and employed generally occurs without any such allegation on one side or the other. Thus, in a strike terminated while this article is in the press, the contracts

between employers and employed in the pottery trade of North Staffordshire were previously at an end by lapse of time. The question in such cases is on what terms the parties will agree for the future relationship of employer and employed, there being no such relationship when the strike began, and of course none while it is pending. This goes to the root of the whole matter, although it may seem a technical mode of looking at it. But if no such obstacle existed, there are difficulties of another kind. In such cases a board of conciliation is inevitably equally divided, and reference to an umpire becomes necessary. To give confidence, he must not be an employer or employed in the trade. In general, therefore, he must know nothing previously of the subject he has undertaken to settle. He must deal with it on such imperfect knowledge as he can acquire in the arbitration, and apply such general principles as may occur to him. Nevertheless much good has been done by a good-tempered calm inquiry in which both sides learn perhaps for the first time the grounds on which the demand is made or resisted.

A recent important Act of Parliament, the Employers' Liability Act 1880, must be noticed. To render its provisions intelligible, it is necessary to state the general law on the subject of civil liability for negligence. A person who causes injury to the person or property of another is liable in damages to that person, and if the injury has resulted in death the right of action is extended to the representatives, on behalf of the widow or children, independently of any criminal liability incurred by the negligence. If the person who committed the negligent act is in the service of another, and the negligent act was committed in the course of the discharge of his duty, the civil liability extends to the master. This liability of the master is important to the injured person, because the servant is in most cases a much poorer person than the master. If they were equally able to pay damages, nothing would be gained by resorting to the master. But the liability of the latter was not, before 1880, extended to make the master responsible in damages if the person injured and the negligent servant were both in his service and both were performing the same kind of duty, a "common employment" as it has been termed, and if the master, so far from being guilty of any actual negligence himself, had employed a generally competent person, and had provided him with the means of properly performing his duty. No vindication of the then law seems necessary, for, whether the liability of an employer to strangers is just or not, there is an obvious distinction between such a liability and responsibility where all parties are "rowing in the same boat," to adopt an expression used in one case, whether the injured person be a servant or guest of the master. Both are volunteers, and both know that the master will not personally intervene. There does not appear to be any injustice in such a case in confining the liability to that of the servant personally guilty of the negligence, although a poor man. However, some apparently hard cases, especially arising out of accidents on railways, where, while a passenger could sue the company for negligence, an engine-driver or a guard's remedy was limited to the person actually guilty of the negligence, led to the attention of parliament being called to the subject. In 1877 a committee of the House of Commons, pointing out that the development of modern industry has created large numbers of employing bodies, such as corporations and public companies, to whom it is not possible to bring home personal default, and that there are other cases in which masters leave the whole conduct of their business to agents and managers, themselves taking no personal part whatever either in the supply of materials or in the choice of subordinate servants, reported thus:—

"Your committee are of opinion that in cases such as these, that is, where the actual employers cannot personally discharge the duties of masters, or where they deliberately abdicate their functions and delegate them to agents, the acts or defaults of the agents who thus discharge the duties and fulfil the functions of masters should be considered as the personal acts or defaults of the principals and employers, and should impose the same liability on such principals and employers as they would have been subject to had they been acting personally in the conduct of their business, notwithstanding that such agents are technically in the employment of the principals. The fact of such a delegation of authority would have to be established in each case, but this would not be a matter of difficulty. Your committee are further of opinion that the doctrine of common employment has been carried too far when workmen employed by a contractor and workmen employed by a person or company who has employed such contractor are considered as being in the same common employment."

Three years afterwards the Act in question was passed. By sect. 1, where personal injury is caused to a workman—

"(1) By reason of any defect in the condition of the ways, works, machinery, or plant connected with or used in the business of the employer; or (2) by reason of the negligence of any person in the service of the employer, who has any superintendence entrusted to him, whilst in the exercise of such superintendence; or (3) by reason of the negligence of any person in the service of the employer to whose orders or directions the workman at the time of the injury was bound to conform and did conform, where such injury resulted from his having so conformed; or (4) by reason of the act or omission of any person in the service of the employer done or made in obedience to the rules or bye-laws of the employer, or in obedience to particular instructions given by any person delegated with the authority of the employer in that behalf; or (5) by reason of the negligence of any person in the service of the employer who has the charge or control of any signal, points, locomotive engine, or train upon a railway,—the workman, or in case the injury results in death the legal personal representative of the workman, and any persons entitled in case of death, shall have the same right of compensation and remedies against the employer as if the workman had not been a workman of nor in the service of the employer, nor engaged in his work."

Section 2 provides that a workman shall not be entitled under the Act to any right of compensation or remedy against the employer in any of the following cases:—

(1) Under subsection 1 of section 1, unless the defect therein mentioned arose from, or had not been discovered or remedied owing to, the negligence of the employer, or of some person in the service of the employer, and entrusted by him with the duty of seeing that the ways, works, machinery, or plant were in proper condition; (2) under subsection 4 of section 1, unless the injury resulted from some impropriety or defect in the rules, bye-laws, or instructions therein mentioned; provided that, when a rule or bye-law has been approved or has been accepted as a proper rule or bye-law by one of Her Majesty's principal secretaries of state, or by the Board of Trade, or any other department of the Government, under or by virtue of any Act of Parliament, it shall not be deemed for the purposes of this Act to be an improper or defective rule or bye-law; (3) in any case where the workman knew of the defect or negligence which caused his injury and failed within a reasonable time to give, or cause to be given, information thereof to the employer or some person superior to himself in the service of the employer, unless he was aware that the employer or such superior knew of the said defect or negligence."

Compensation under this Act (which extends to a railway servant and any person to whom the Employers and Workmen Act 1875, already noticed, applies) is enforced by action in the county court (in Scotland the sheriff's court, in Ireland the civil bill court) after notice within six weeks of the nature and particulars of the claim (unless there was reasonable excuse for the want of notice in the case of death). The compensation is limited to three years' earnings, and the action must be commenced within six months from the occurrence of the accident, or in case of death within twelve months from the time of death.

Neither in the United Kingdom nor abroad does the right to damages for breach of contracts override the general law as to offences, so that, if any of the parties do anything amounting to a criminal offence, a prosecution may follow although a breach of contract is involved for which breach damages may be recovered. There are moreover a variety of Acts of Parliament from the reign of Anne still in force

for securing employers from the frauds of workmen employed in various trades in working up materials, not only as regards the misappropriation of property entrusted to them, but also in relation to fraudulent contrivances for misrepresenting the amount of work done. For such offences fine or imprisonment may be inflicted.

Apart from the legislation already mentioned, there are a great number of Acts of parliament directly or indirectly affecting labour. The general direction of all such legislation is to ameliorate the condition of workmen.

The legislation regulating the hours of labour of young persons, originating in the benevolent exertions of the earl of Shaftesbury, and extended by Lord Aberdare as secretary of state for the home department and others, is most important (see FACTORY ACTS). The indirect effects of those provisions in causing better order in the conduct of manufacturing industries cannot be overlooked. The Agricultural Gangs Act 1867, arising out of the practice in the east of England of persons known as gang masters hiring children, young persons, and women, with a view to contracting with farmers and others for agricultural work, is a recent illustration of the direct objects of such legislation. The fencing of machinery, the careful working of coal and metalliferous mines, and the like, have been the subject of minute legislative provisions, which, as well as the Explosives Act 1875, intimately affect the wellbeing of the labouring community and the general safety.

The wants of servants are considered in the preference shown to claims for wages in the case of death and bankruptcy, and the general need of all classes of workmen is kept in view in the provisions relating to workmen's dwellings, and the obligation of railway companies to afford facilities for their conveyance at a low rate. Less directly they are considered in the legislation relating to friendly and provident societies; of equivocal effect was the legislation respecting small loans, intended to facilitate the purchase of tools, but taken advantage of to form loan societies of doubtful general benefit to the community. We cannot notice here the effect of the laws regulating the land and sea forces on contracts relating to labour by persons entering the army or navy.

(J. E. D.)

LABRADOR, in the widest acceptance of the word, is the peninsular portion of North America bounded on three sides by the Gulf of St Lawrence, the North Atlantic, Hudson's Straits, and Hudson's Bay, and vaguely defined towards the south-west by Rupert's river, the Mistassini river, and the Bersiamits river. It extends from about 49° to 63° N. lat., and from the 55th to the 79th meridian. Its greatest length from the Straits of Belle Isle, which separate it from Newfoundland, to Cape Wolstenholme, its most northern extremity, is 1100 miles; its greatest breadth is about 700 miles. The area is approximately 420,000 square miles, equal to the united areas of the British Isles, France, and Prussia. As a permanent abode of civilized man, Labrador is on the whole one of the most uninviting regions on the face of the earth. The Atlantic coast is the edge of a vast solitude of rocky hills, split and blasted by frosts and beaten by the waves. A vast table-land, in one region 2240 feet above the sea-level, occupies much of the interior. This plateau, says Professor Hind, "is pre-eminently sterile, and, where the country is not burned, caribou moss covers the rocks, with stunted spruce, birch, and aspen in the hollows and deep ravines. The whole of the table-land is strewed with an infinite number of boulders, sometimes three and four deep; these singular strata are perched on the summit of every mountain and hill, often on the edges of cliffs, and they vary in size from 1 foot to 30 feet in diameter. Language fails to paint the awful desolation of the table-land of the Labrador peninsula."

The interior of Labrador has been but very partially explored, and even the course of the main rivers is largely matter of conjecture. The largest is probably the Ashwanipi or Hamilton river, which rises in the rear of the Seven Islands, drains a portion of the vast table-land, and falls into Hamilton Inlet, on the Atlantic coast. At its mouth it is nearly a mile and a half in width. One hundred miles from its mouth are the great falls and rapids which extend over 20 miles, and involve fifteen portages. The valley of this river is well wooded, some of the trees, which are chiefly spruce, white birch, and poplar, being of considerable size, and tracts of loamy soil being found at intervals along its banks. The Kenamou and the Nasquapee or North-West river also fall into Hamilton Inlet. The Eagle river, the West and East rivers, all famous for salmon and trout, discharge their waters into Sandwich Bay. Of the rivers falling into Ungava Bay the largest is Koksoak or South river, which is 3 miles wide at its mouth, and has its source in Lake Kanipicaw, 70 miles long and 20 broad, which occupies the very centre of the peninsula, being equidistant from the St Lawrence, Ungava, and Hamilton Inlet, and 350 miles from each. George's river and Whale river also fall into Ungava Bay. The aspect of the country drained by these rivers is forbidding in the extreme, bleak and barren rocks, with a few stunted trees at the mouths of the rivers or around the lakes, being the most marked features. In a few sheltered spots, however, on the margins of the rivers, timber of fair size is to be found. The rivers discharging into Hudson's Bay are Rupert's river, East Main, and Great and Little Whale rivers. The Moisie river, 250 miles in length, the Mingan, and the Ouanamee fall into the Gulf of St Lawrence. The St Augustine falls into a fine bay of the same name, and has its source in the lakes and marshes of the table-land. The country through which these rivers flow is rugged and mountainous, swamps and innumerable lakes occupying the lower grounds.

By far the most important portion of Labrador is the Atlantic seaboard. The coast itself is rugged, but is deeply indented with bays and inlets, and has many fine harbours. The scenery is grand and impressive. Dark and yellow headlands towering over the waters are ever in sight, some grim and naked, others clad in the pale green of mosses and dwarf shrubbery. With miles on miles of rocky precipices alternate lengthened sea slopes, tame and monotonous, or fantastic and picturesque in form, with etony vales winding away among the blue hills of the interior. Battle Harbour at the northern extremity of the straits of Belle Isle, is a busy fishing settlement with a narrow sheltered roadstead about half a mile in length between Battle Islands and Great Caribon Island. The water is of great depth in this neighbourhood, and is noted for its wonderful ground swell, which at times rolls in without wind from the eastward into St Lewis Sound, "bursting," as Admiral Bayfield describes it, "with fury over inlets 30 feet high, or sending sheets of foam and spray sparkling in the sunbeams 50 feet up the sides of precipices." By far the greatest of the numerous inlets which indent the coast is Ekimio Bay or Ivuktoke or Hamilton Inlet, 250 miles north of the straits of Belle Isle. This inlet is 30 miles wide at the entrance, but at Port Rigolette, 50 miles from the sea, it narrows to a mile. On both sides of these narrow hills tower to the height of 1000 feet, wooded with spruce from base to summit. At the termination of this gorge the inlet again expands and forms Lake Melville, 30 miles in length and 20 in breadth. After narrowing again it forms another lake (Goose Bay) 7 miles wide and 20 long, and at its extremity the head of the great inlet is reached, 150 miles from the sea. The scenery along the shores of Hamilton Inlet is wild and rugged, and above Rigolette

taken by American and Canadian fishermen of which no returns can be obtained, but which are estimated to be about an eighth of the quantities taken by Newfoundland fishermen. These last can work the fisheries more successfully than those coming from a distance, and are gradually absorbing the trade. The total catch by Newfoundland, Canadians, Americans, and Eskimo on the Atlantic and St. Lawrence coasts of Labrador may be valued at £1,000,000 sterling per annum, and is increasing steadily. The number of vessels employed annually is estimated at from 1100 to 1200.

Labrador as well as Newfoundland was discovered by John Cabot in 1497, the recent discovery of a map made by under the direction of Sebastian Cabot proves that it must surrender the honour of being his "Prima terra vista" to the present island of Cape Breton. Cabot does not appear to have given any name to Labrador, tradition has it that a Basque whaler, called "Labrador," penetrated as far as Labrador Bay (now Brador Bay), and that, as this bay was in process of time much frequented by Basque fishermen, the name was extended to the whole coast. The Basques were the successors of the Normans. After them, about the year 1530, came the Bretons, who founded the town of Brador in Brador Bay, about 3 miles from Blanc Sablon Harbour, which at one time contained upwards of one thousand permanent residents. The ruins and terraces of this old town are still visible. For a lengthened period extensive fisheries (to which they attached the greatest importance) were carried on by the French on the Labrador coast, near the Straits of Belle Isle. After the British conquest of Canada the whole fisheries along the southern and eastern shores of Labrador were placed under the government of Quebec, and they continued so till 1763, when the Atlantic coast was annexed to the government of Newfoundland, the boundary between the two jurisdictions being fixed at Blanc Sablon. In 1773, owing to difficulties arising out of grants made to a few persons, under French rule, the eastern coast was restored to the government of Quebec; but since 1809 it has been again attached to Newfoundland. In 1824 the governor of Newfoundland was empowered to institute courts of civil justice on the coast of Labrador. At present the civil and criminal court of Labrador is presided over by one judge appointed by the governor in council. All goods landed are subjected to the duties imposed on like goods in any part of the island of Newfoundland. The extent of the jurisdiction of the government of Newfoundland in Labrador is thus defined (Letters-Patent, 28th March 1879): "all the coast of Labrador from the entrance of Hudson's Straits to a line to be drawn due north and south from Anse Sablon on the said coast to the fifty-second degree of north latitude, and all the islands adjacent to that jurisdiction being fixed at Blanc Sablon on the western portion, or that which drains into Hudson's Bay and Hudson's Straits, now forms the North-East Territory of the Dominion of Canada, and the southern portion, draining into the Gulf of St. Lawrence, is incorporated with the province of Quebec. An undefined area of what is now the North-East Territory was formerly known as East Main."

See Cartwright, *Sixteen Years on the Coast of Labrador*, New York, 1890, 11th ed., *Explorations of the Labrador Peninsula*, 1865, Chalmers, in *Journ. Roy. Geog. Soc.*, 1886, 36th, in *Reports of the Geol. Survey of Canada*, 1879, (Vol. II.)

LA BRUYÈRE, JEAN DE (1645-1696), essayist and moralist, was born at Paris in August 1645, and not, as has more commonly been asserted, at Dourdan (Seine-et-Oise) in 1639. His family was of the middle class, and his references to a certain Geoffroy de la Bruyère, a crusader, is only a satirical illustration of a method of self-ennoblement common in France as in some other countries. Indeed he himself always signed the name Delabruyère. In one word, thus avowing his *roture*. His progenitors, however, were of respectable position, and he could trace them back at least as far as his great-grandfather, who had been a strong knight. La Bruyère's own father held a municipal appointment in the capital, and seems as well as his son to have been in easy circumstances. The son was educated by the Oratorians, and at the university of Orleans; he was called to the bar, and in 1673 bought a post in the revenue department at Caen, which gave the status of noblesse and a certain income. He afterwards in 1687 sold this office. His predecessor in it was a relation of Bossuet, and it is thought that the transaction was the cause of La Bruyère's introduction to the great orator. Bossuet, who from the date of his own preceptorship of the dauphin, was a kind of agent-general for tutorships in the royal family, introduced him in 1683 or 1684 to the household of the great Condé, whose grandson Henri Jules

de Bourbon he was charged to educate. The rest of his life was passed in the household of the prince or else at court, and he seems to have profited by the inclination which all the Condé family had for the society of men of letters without suffering from the capricious and tyrannical temper which was also one of the characteristics of the house. Very little is known of the events of this part or indeed of any part of his life. Although he certainly mixed freely in society at a time when more gossip was committed to paper than at almost any other, the notices of him are very few, though they are almost always favourable. The impression derived from them is of a silent observant but somewhat awkward man, resembling in manners our own Addison, whose master in literature La Bruyère undoubtedly was. Yet despite the numerous enemies which his book raised up for him, most of the few personal notices we have are, as has been said, favourable—notably that of St Simon, an acute judge and one bitterly prejudiced against roturiers generally. There is a curious passage in a letter from Boileau to Racine in which he regrets that "nature has not made La Bruyère as agreeable as he would like to be," which, as he at the same time calls him a "fort honnête homme," and says that he would lack nothing were it not for the conduct of nature in this respect, can only refer to the want of manner just noticed. His *Caractères* appeared in 1688, and at once, as Malezeu had predicted, brought him "bien des lecteurs et bien des ennemis." At the head of these were Thomas Corneille, Fontenelle, and Benserade, who were pretty clearly aimed at in the book, as well as innumerable other persons, men and women of letters as well as of society, on whom the cap of La Bruyère's fancy-portraits was fitted by manuscript "keys" which were at once compiled by the scribes of the day. The friendship of Bossuet and still more the protection of the Condé defended the author quite sufficiently, and he continued to insert fresh portraits of his contemporaries in each new edition of his book. Those, however, whom he had attacked were powerful in the Academy, and numerous defeats awaited La Bruyère before he could make his way into that guarded hold. He was defeated thrice in 1691, and on one memorable occasion he had but seven votes, five of which were those of Bossuet, Boileau, Racine, Pellisson, and Bussy-Rabutin. It was not till 1695 that he was elected, and even then an epigram, which, considering his admitted insignificance in conversation, was not of the worst, *hasst latere*.—

"Quand la Bruyère se présente
Pourquoi faut-il crier héra ?
Pour faire un nombre de quante
Ne failloit il pas un zéro ?"

His unpopularity was, however, chiefly confined to the subjects of his sarcastic portraits, and to the hack writers of the time, of whom he was wont to speak with a disdain only surpassed by that of Pope. His description of the leading newspaper of the day as "immédiatement au dessous du ciel" is the best remembered specimen of these unwise attacks which, both in France and England, retarded the establishment of an independent profession of letters for many years. La Bruyère's discourse of admission at the Academy was, like his admission itself, severely criticized, yet it is certainly one of the best of its kind. With the *Caractères*, the translation of Theophrastus, and a few letters, it completes the list of his literary work, with the exception of a curious and much-disputed posthumous treatise. La Bruyère died very suddenly, and not long after his admission to the Academy. He is said to have become suddenly deaf in an assembly of his friends, and, being carried home to the Hôtel de Condé, to have expired of apoplexy a day or two afterwards. It is not surprising that, considering this recent panic about poisoning, the

bitter personal enmities which he had excited, and the peculiar circumstances of his death, suspicious of foul play should have been entertained, but there seems to be no foundation for them. Two years after his death appeared certain *Dialogues sur le Quatrième*, alleged to have been found among his papers incomplete, and to have been completed by the editor. As these dialogues are far inferior in literary merit to La Bruyère's other works, their genuineness has been denied. But the straightforward and circumstantial account of their appearance given by their editor, the Abbé Dupin, a man of acknowledged probity, the intimacy of La Bruyère with Bossuet, whose views in his contest with Fénelon these dialogues are designed to further, and the entire absence at so short a time after the alleged author's death of the least protest on the part of his friends and representatives, seem to be decisive in their favour.

Although for reasons to be given shortly it is permissible to doubt whether the value of the *Caractères* has not been somewhat exaggerated by traditional French criticism, they deserve beyond all question a high place among the great works of French literature. The plan of the book is thoroughly original, if that term may be accorded to a novel and skilful combination of existing elements. That the little treatise of Theophrastus may have furnished the first idea of it is doubtless true, but only a very small part of the Frenchman's work is due to the Greek. With the ethical generalizations and social Dutch painting of Theophrastus La Bruyère combined the peculiarities of the Montaigne essay, of the *Pensées* and *Maximes* of which Pascal and La Rochefoucauld are the masters respectively, and lastly of that peculiar 17th century product, the portrait or elaborate literary picture of the personal and mental characteristics of an individual. The result was quite unlike anything that had been before seen, and it has not been exactly reproduced since, though the essay of Addison and Steele resembles it very closely, especially in the introduction of fancy portraits. In the titles of his work and in its extreme desultoriness La Bruyère reminds the reader of Montaigne, but he aimed too much at sententiousness to attempt even the apparent continuity of the great essayist. The short paragraphs of which his chapters consist are made up of maxims proper, of criticisms literary and ethical, and above all of the celebrated sketches of individuals baptised with names taken from the plays and romances of the time. These last are undoubtedly the great feature of the work, and that which gave it its immediate if not its enduring popularity. They are wonderfully piquant, extraordinarily life-like in a certain sense, and must have given great pleasure or more frequently exquisite pain to the originals, who were in many cases unmistakable and in most recognizable by a society which held to the full Madame de Sévigné's views of the usefulness of "le prochain" as a butt for satirical observation. But there is something wanting in them. The criticism of Charpentier, who received La Bruyère at the Academy, and who was of the opposite faction, has usually been dismissed as one-sided, but it is in fact fully justified as far as it goes. La Bruyère literally "est trop descendu dans le particulier." He has neither like Molière embodied abstract peculiarities in a single life-like type, nor has he like Shakespeare made the individual pass *sub specie eternitatis*, and serve as a type while retaining his individuality. He is a photographer rather than an artist in his portraiture. So too his maxims, admissible as they are expressed, and exact as their truth often is, are on a lower level than those of La Rochefoucauld, which, rather unwise, they sometimes follow very closely. Beside the sculptor's precision, the Roman brevity, the profoundness of ethical intuition "piercing

to the accepted hell beneath," of the great Frondeur, La Bruyère has the air of a literary *petit-maitre* dressing up superficial observation in the finery of *esprit*. It is indeed only by comparison that he loses, but then it is by comparison that he is usually praised. There is no doubt that his abundant wit and his personal "malice" have done much to give him his rank in French literature, but much must also be allowed to his purely literary merits. With Racine and Molière he is probably the very best writer of what is somewhat arbitrarily styled classical French. He is hardly ever incorrect—the highest merit in the eyes of a French academic critic. He is always well-bred, never obscure, rarely though sometimes "precious" in the turns and niceties of language in which he delights to indulge, in his avowed design of attracting readers by form now that in point of matter "tout est dit." It ought to be added to his credit that he was sensible of the folly of impoverishing French by ejecting old words. His chapter on "Les ouvrages de l'esprit" contains much good criticism, though it shows that, like most of his contemporaries except Fénelon, he was lamentably ignorant of the literature of his own tongue.

The editions of La Bruyère, both partial and complete, have been extremely numerous. *Les Caractères de Théophraste imités du Grec, avec les Caractères et les Mœurs de ce Siècle*, appeared for the first time in 1688, being published by Mouchet, to whose little daughter, according to tradition, La Bruyère gave the profits of the book. Two other editions, little altered, were published in the same year. In the following year, and in each year until 1694, with the exception of 1698, a fresh edition appeared, and, in all these five, additions, omissions, and alterations were largely made. A ninth edition, not much altered, was put forth in the year of the author's death. The Academy speech appeared in the eighth edition. The Quotat dialogues were published in 1698, most of the letters, including those addressed to Condé, not till 1697. In the last thirty or forty years numerous editions of the complete works have appeared, notably those of Walckenaer (1846), Servois (1867), Assolant (a scholarly reprint of the last original edition, 1873), and finally Chassang (1876); the last is one of the most generally useful, as the editor has collected almost everything of value in his predecessors. The literature of "keys" to La Bruyère is extensive and uncritical. Almost everything that can be done in this direction and in that of general illustration was done by the late M. Edmond Fournier in his learned and amusing *Commentaire de La Bruyère*. (G. S.)

LABUAN, or LABUAN, an island of the East Indian Archipelago, which has been a British possession since 1846. It lies about 6 miles off the north-west coast of Borneo, opposite the northern end of the great bay of Brunei. Rudely triangular in shape, it measures about 7 miles across the base, and has a length of 11 miles from north to south. The general flatness of the surface is broken by a number of undulating hills, none of which, however, exceed 90 feet in height. At the time of the first settlement most of the ground was occupied by virgin forest, in which camphor trees of noble proportions were conspicuous; but nearly the whole of this has been destroyed either by human effort or by jungle fires. The soil is very poor, except in the valleys of the larger streams. Of the total area, estimated at over 45 square miles, or 29,350 acres, 21,000 acres are supposed to be capable of cultivation; but of this not more than 1500 acres are sown with rice, the only crop attempted on a large scale in the island. The cocoa-nut flourishes to no small profit on the little island of Deat; and the African oil palm promises well. At the time of its occupation a brilliant future was prophesied for Labuan: its harbour was to make it a second Singapore, and its coal beds were to prove an unfailing source of wealth. Such anticipations are far from having been realized. Though the workable coal in the island has been estimated at no less than 400,000,000 tons, the mines have commercially proved an utter failure. The Scottish Oriental Coal Company—the fourth of its kind—came to an untimely end in 1880; from 1868 it had raised 53,741 tons of clean coal, each

ton costing about 72s. and selling for not more than 25s. or 30s. The want of machinery strong enough to keep the workings dry is assigned as one of the chief reasons of the collapse. The coal, which appears to be of Tertiary formation, is of good quality, the mines are on the north end of the island near the village of Lubok Tamiang. The general trade of Labuan consists mainly of the importation and re-exportation of Bornean produce; and most of the Labuan merchants are from Singapore houses. There are several factories for the preparation of sago flour. The total burden of the vessels entering the port in 1879 was only 10,787 tons, of which 8516 was due to steam ships. The population, which in 1861 was 2373 (1627 males, 701 females), was 8731 (3414 males, 2317 females) in 1881. It includes Chinese, Klings, chiefly from Karikal in French India, Malay fishermen, and Kudayans and Tutongs from Borneo. Port Victoria, the principal settlement, has no municipal government.

The colony is now self-supporting. The Chinese have schools for their own children, and Sir Henry Bulver established in 1878 a school for the teaching of Malay and English. The temporary diocese of Labuan includes, not only Sarawak in Borneo, but also Singapore (which is 770 miles distant), and the church of St Andrews in that city is the cathedral of the sea. Convicts have been sent to Labuan from the Straits settlements since 1866.

See Knapton, *Visit to Indian Archipelago*, London, 1888, Monday, *Illustrations of Borneo in Borneo*, London, 1848; Burdidge, *Gardens of the Sea*, London, 1880.

LABURNUM is the specific name of a familiar tree of the genus *Cytisus*, Dec., of the pea family or *Leguminosae*. It is a native of the mountains of France, Switzerland, southern Germany, northern Italy, &c., has long been cultivated as an ornamental tree throughout Europe, and was introduced into north-east America by the European colonists. Gerard records it as growing in his garden in 1596 under the names of anagryis, laburnum, or beane trefoyls (*Historia of Plants*, p. 1239), but the date of its introduction into England appears to be unknown. In France it is called *labour*—a corruption from *laburnum* according to Du Hamel—as also *arbois*, &c., *ar-bois*, “the wood having been used by the ancient Gauls for bows. It is still so employed in some parts of the Mâconnais, where the bows are found to preserve their strength and elasticity for half a century” (Loudon, *Arboretum*, ii. p. 590).

Several varieties of this well-known tree are cultivated, differing in the size of the flowers, in the form of the foliage, &c., such as the “oak-leaved” (*quercifolium*), *pendulum*, *crispum*, &c. One of the most remarkable forms is *C. Adami*, Poir. (*C. purpureocoma*, Hort.), which bears three kinds of blossoms, viz., racemes of pure yellow flowers, others of a purple colour, and others of an intermediate brick-red tint—all three kinds being borne by one and the same tree. The last are hybrid blossoms, and are sterile, with malformed ovules, though, curiously enough, the pollen appears to be good. The yellow and purple “reversions” are fertile. It originated in Paris in 1828 by M. Adam, who inserted a “shield” of the bark of *C. purpureum*, Scop., into a stock of *C. Laburnum*, L. A vigorous shoot from this bud was subsequently propagated. Hence it would appear that the two distinct species mentioned above became united by their cambium layers, and the tree propagated therefrom subsequently reverted to their respective parentages in bearing both yellow and purple flowers, but produce as well blossoms of an intermediate or hybrid character. Such a result, Mr Darwin observes, may be called a “graft-hybrid.” For full details see Darwin's *Animals and Plants under Domestication*.

The laburnum has highly poisonous properties. A case is recorded of nearly fatal results to several boys who masticated the roots on finding they tasted like liquorice, which is a member of the same family as the laburnum. It has proved fatal to cattle, though horses and rabbits eat the bark of it with avidity (*Gardener's Chronicle*, 1881,

vol. xvi. p. 666). The seeds also are highly poisonous, possessing emetic as well as narcotico-acid principles, especially in a green state. Gerard (*loc. cit.*) alludes to the powerful effect produced on the system by taking the bruised leaves medicinally. Pliny records that bees will not visit the flowers (*N. II.*, xvi. 31), but this may be an error, for Mr Darwin found by experiment that insects play an important part in the fertilization of the laburnum.

The heart wood of the laburnum is of a dark reddish-brown colour, hard and durable, and takes a good polish. Hence it is much prized by turners, and used with other coloured woods for inlaying purposes. The laburnum has been called false ebony from this character of its wood.

The roots are subject to a peculiar disease, not at all uncommon in other members of the *Leguminosae*, the fine rootlets swelling into minute club-shaped processes called exostoses, resembling coral-branches in shape. Large masses of such, one or two inches in diameter, may be found at the extremities of the roots of old laburnum trees. They are apparently caused by a fungus which appears to be ubiquitous, as the disease is rarely, if ever, known to be absent, though it does not seem to cause much if any injury to the health of the plants it attacks. See *Studier over Leguminosernas rotksvamp*, 1874, by Dr Jacob Eriksson; also *Gardener's Chronicle*, 1879, xi. p. 209, and xii. p. 112.

LABYRINTH. I. The legendary labyrinth is one of the clearest examples of the close relation between mythology and the early stages of the industrial arts. The word *λαβύρινθος* is derived from the *λαβύρα* or passages of a mine, the digamma before the *p* has become in the latter a vowel, while in the former it retains its consonantal value. The mines of Greece, like those of Thrace and the *Ægean Islands*, were probably first worked by the Phœnician traders; and the simple-minded natives regarded the strange holes in the ground with wonder and awe. To the natural fear of darkness was added the inviolable tendency of the uneducated to regard as supernatural the power conferred by superior knowledge; moreover, the god of the riches of the lower world was also the god of death and the dead. Their fear expressed itself in tales of the extraordinary ramifications of the dark passages and of the danger to which any heedless intruder into them was exposed. The maze of passages was called a labyrinth; the word became a proper name and gained a life and meaning of its own in legend, quite unconnected with its original application. It retained a more antique form, as proper names frequently do, whereas the mining term *λαβύρα* lost the older character of the digamma. It must have been comparatively late before the word labyrinth acquired this new independence and connotation. The best-known instance of its mythic character is found in the legends of Crete. It was interwoven with the tales, partly founded on historical events and partly derived from ancient religion, which clustered round the name of Minos. The skilful workman, Dedalos, who sums up all the legendary conceptions of skill in handicraft, made for King Minos a labyrinth, in the centre of which the Minotaur was placed. No one who entered this labyrinth could find his way out again; he became the prey of the monster. The seven youths and seven maidens sent regularly by the Athenians as tribute were thus devoured, until Theseus slew the Minotaur, and escaped out of the labyrinth by the help of the clue which Ariadne had given him.

Pliny says that there had been in Crete a building called the labyrinth, of which no remains existed in his time; but Hoek has proved quite certainly from the discrepancies and contradictions in accounts and in representations on coins that it had never a real existence. The rocks of Crete are full of winding caves, and these gave the first hint of the legendary labyrinth. This labyrinth is, by the

older writers, placed beside Cuossus, and is figured on coins of that city. Late writers, such as Claudian, represent it as being beside Gortyna, and there is a wonderful set of winding passages and chambers in the rocks near that place, which is still pointed out as the labyrinth. When the name had once acquired this meaning, it was applied to several real buildings, of which the following are the most famous. 1. The Egyptian labyrinth, beside the town of Arsinoe or Crocodilopolis, was in two stories, one of them underground, and contained three thousand rooms. Strabo thinks it was built as a common place of meeting for the people of the various nomes, Herodotus and Diodorus say that it was the burial place of the twelve kings who ruled Egypt about 700 B.C. Muller (*Hist. Greek Art*, § 50-2) also thinks the object of such buildings must have been sepulchral. 2. The Samian labyrinth was built by Theodorus, one of the Samian school of sculptors, for the tyrant Polycrates. It had a hundred and fifty columns, and Pliny says that some scanty remains of it existed in his time. 3. The Lemnian labyrinth, mentioned by Pliny, seems to be a confusion with the Samian (*cf. Pliny*, xxvii, 19, 3 with 83). 4. The Italian labyrinth was a series of chambers in the lower part of the grave of Possema at Clu-tum. Some maintain that this tomb has been found in the mound named Poggio Gajella near Chiusi.

See Herod. ii 148, Str. p. 811, Plin. xxvii 13 and 19, Muller, *Et. usul.*, Dennis, *Cities and Cemeteries of Etruria*, Hook, *Krete Cockerell* (Travel), and Pokeski (*Denkwürdigkeiten*) describe the so-called labyrinth of Gortyna.

II. In gardening, a labyrinth or maze means an intricate network of pathways enclosed by hedges or plantations, so that those who enter become bewildered in their efforts to find the centre or make their exit. It is a remnant of the old geometrical style of gardening, but is yet occasionally introduced into pleasure grounds. There are two methods of forming it. That which is perhaps the more common consists of walks, or alleys as they were formerly called, laid out and kept to an equal width or nearly so by parallel hedges, which should be kept so close and thick that the eye cannot readily penetrate through them. The task is to get to the centre, which is often raised, and generally contains a covered seat, a fountain, a statue, or even a small group of trees. After reaching this point the next thing is to return to the entrance, when it is found that egress is as difficult as ingress. To every design of this sort there should be a key, but even those who know the key are apt to be perplexed. Sometimes the design consists of alleys only, as in fig. 1, published in 1706 by

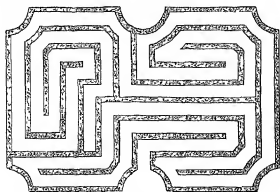


FIG. 1.—Labyrinth of London and Wise.

In such a case, when the further end is reached, there only remains to travel back again. Of a more pretentious character was a design published by Switzer in 1742. This is of octagonal form, with very numerous parallel hedges and paths, and six different entrances, whereof there is but one that leads to the centre.

and that is attended with some difficulties and a great many stops." Some of the older designs for labyrinths, on the other hand, avoid this close parallelism of the alleys, which, though equally involved and intricate in their

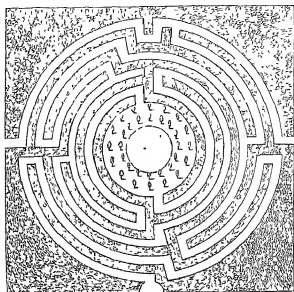


FIG. 2.—Labyrinth of Batty Langley.

windings, are carried through blocks of thick planting, as shown in fig. 2, from a design published in 1728 by Batty Langley. These blocks of shrubbery have been called

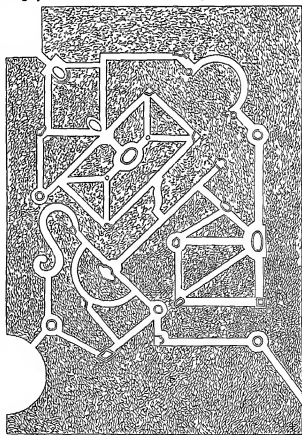


FIG. 3.—Labyrinth at Versailles.

wildernesses. To this latter class belongs the celebrated labyrinth at Versailles (fig. 3), of which Switzer observes, that it "is allowed by all to be the noblest of its kind in the world."

Whatever style is adopted, it is essential that there should be a thick healthy growth of the hedges or shrubones that confine the wanderer. The trees used should be impenetrable to the eye, and so tall that no one can look over them, and the paths should be of gravel and well kept. The trees chiefly used for the hedges, and the best for the purpose, are the hornbeam among deciduous trees, or the yew among evergreens. The beech might be used instead of the hornbeam on suitable soil. The green holly might be planted



Fig. 1—Maze at Hampton Court

as an evergreen with very good results, and so might the American arbutus if the natural soil presented no obstacle. The ground must be well prepared, so as to give the trees a good start, and a mulching of manure during the early years of their growth would be of much advantage to them. They must be kept trimmed in or clipped, especially in their earlier stages, trimming with the knife is much to be preferred to clipping with shears. It is not advisable to allow the hedge to run up too quickly or irregularly, so that any plants getting much in advance of the rest should be topped, and the whole kept to some 4 feet or 5 feet in height until the lower parts are well thickened, when it may be allowed to acquire the allotted height by moderate annual increments. In cutting, the hedge (as indeed all hedges) should be kept lowest at the base and narrowed upwards, which prevents it from getting thin and bare below by the stronger growth being drawn to the top.

The maze in the gardens at Hampton Court Palace (fig. 4) is considered to be one of the finest examples in England. It was planted in the early part of the reign of William III., though it has been supposed that a maze had existed there since the time of Henry VIII. It is constructed on the hedge and alley system, and now, we believe, originally planted with hornbeam, but many of the plants have died out, and been replaced by hollies, yews, &c., so that the vegetation is mixed. The hedges are about half a mile in length, and the extent of ground occupied is a little over a quarter of an acre. The centre contains two large trees, with a path beneath each. The key to reach this resting place is to keep the right hand continuously in contact with the hedge from first to last, going round all the stops

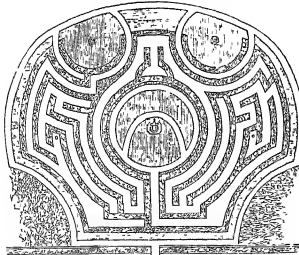


Fig. 5.

The maze in the gardens at Somerleyton Hall, near Lowestoft (fig. 5), was designed by Sir John Thomas. The hedges are of English yew, and are in very fine condition, without a break or flaw. They are about 6½ feet high, and have been planted a little over thirty years. In the centre is a grass mound, which is raised to the height of the hedges, and on this mound is erected a pagoda, which is approached by a curved grass path. At the two corners on the western side are banks of laurels some 15 or 16 feet high, which are kept trimmed with the knife. On each side of the hedges throughout the labyrinth is a small strip of grass.

There was also a labyrinth at Theobald's Park, near Cheshunt, when this place passed from the earl of Salisbury into the possession

of James I. Another is said to have existed at Wimbledon House, the seat of Earl Spencer, which was probably laid out by Brown in the last century. There is an interesting labyrinth, somewhat after the plan of fig. 2, at Mistley Place, Manningtree, the seat of the Rev. C. F. Noiman.

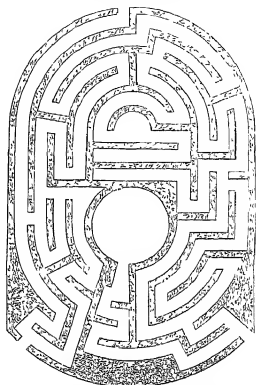


Fig. 6—Labyrinth in Horticultural Society's Garden

When the gardens of the Royal Horticultural Society at South Kensington were being planned, the Prime Consort, the president of the society, especially desired that there should be a maze formed in the arde garden, which was made in the form shown in fig. 6. This labyrinth, which was designed by the late Laet W. A. Stenfield, was for many years the chief point of attraction to the younger class of visitors to the gardens; but at last it was allowed to go to ruin, and had to be destroyed. (T. MO.)

LAC is a compound resinous and tinctorial incrustation formed on the twigs and young branches of various trees by an insect, *Coccus lacca* (*Casteria lacca* of Signoret), which infests them. The species of trees upon which it is principally obtained include *Urostigma religiosum*, *U. indica*, *Croton lacca*, *C. sanguinaria*, *Albizia laccifera*, *Cassia spinarum*, *Mimosa cuneata*, *Erythrina indica*, *Inga dracina*, *Butea frondosa*, *Zuziphus Ayuba*, *Vismia lacca*, *Fernoxia elephantum*, and *Vatica lacca*. Lac is a product of the East Indies, coming especially from Bengal, Pegu, Siam, and Assam. The insect which yields it is closely allied to the cochineal insect, *Coccus cacti*, kermes, *C. sticticus*, and Polish grains, *G. polonicus*, all of which, like the lac insect, yield a red dye colour. The term lac (*Lakha*, Sanskrit, *Lakk*, Hindi) is the same as the numeral lakh—a hundred thousand—and is indicative of the countless hosts of insects which make their appearance with every successive generation. Two evolutions of the young of the lac insect make their appearance annually, one about the beginning of July and the other early in December. As soon as the minute larval insects make their appearance they fasten in myriads on the young shoots, and, inserting their long proboscides into the bark, draw their nutriment from the sap of the plant. The insects begin at once to exude the resinous secretion over their entire bodies, which forms in effect a cocoon, and, the separate excretions coalescing, a continuous hard resinous layer regularly honeycombed with small cavities is deposited

older writers, placed beside Chiosus, and is figured on coins of that city. Late writers, such as Claudian, represent it as being beside Gortyna, and there is a wonderful set of winding passages and chambers in the rocks near that place, which is still pointed out as the labyrinth. When the name had once acquired this meaning, it was applied to several real buildings, of which the following are the most famous.

1. The Egyptian labyrinth, beside the town of Aisinoe or Crocodilopolis, was in two stories, one of them underground, and contained three thousand rooms. Strabo thinks it was built as a common place of meeting for the people of the various nomes, Herodotus and Diodorus say that it was the burial place of the twelve kings who ruled Egypt about 700 B.C. Muller (*Hist. Greek Art*, § 50-2) also thinks the object of such buildings must have been sepulchral. 2. The Samian labyrinth was built by Theodorus, one of the Samian school of sculptors, for the tyrant Polycrates. It had a hundred and fifty columns, and Pliny says that some scanty remains of it existed in his time. 3. The Lemnian labyrinth, mentioned by Pliny, seems to be a confusion with the Samian (*cf.* Pliny, xxxvi. 19, 3 with 83). 4. The Italian labyrinth was a series of chambers in the lower part of the grave of Posenna at Clusium. Some maintain that this tomb has been found in the mound named Poggio Gajella near Chiusi.

See *Herod.* ii. 148, Str. p. 811, Plin. xlviii. 18 and 19, Muller, *Et. uscul.*, Dennis, *Cities and Cemeteries of Etruria*, Hoek, *Revue de l'Art*, and Pöschke (*Denkmäler der Kunst*) describe the so-called labyrinth of Gortyna.

II. In gardening, a labyrinth or maze means an intricate network of pathways enclosed by hedges or plantations, so that those who enter become bewildered in their efforts to find the centre or make their exit. It is a remnant of the old geometrical style of gardening, but is yet occasionally introduced into pleasure grounds. There are two methods of forming it. That which is perhaps the more common consists of walks, or alleys as they were formerly called, laid out and kept to an equal width or nearly so by parallel hedges, which should be kept so close and thick that the eye cannot readily penetrate through them. The task is to get to the centre, which is often raised, and generally contains a covered seat, a fountain, a statue, or even a small group of trees. After reaching this point the next thing is to return to the entrance, when it is found that egress is as difficult as ingress. To every design of this sort there should be a key, but even those who know the key are apt to be perplexed. Sometimes the design consists of alleys only, as in fig. 1, published in 1706 by

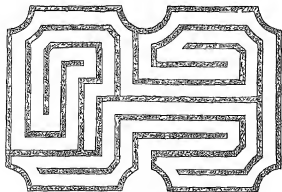


FIG. 1.—Labyrinth of London and Wise

London and Wise. In such a case, when the further end is reached, there only remains to travel back again. Of a more pretentious character was a design published by Switzer in 1742. This is of octagonal form, with very numerous parallel hedges and paths, and "six different entrances, whereof there is but one that leads to the centre,

and that is attended with some difficulties and a great many stops." Some of the older designs for labyrinths, on the other hand, avoid this close parallelism of the alleys, which, though equally involved and intricate in their

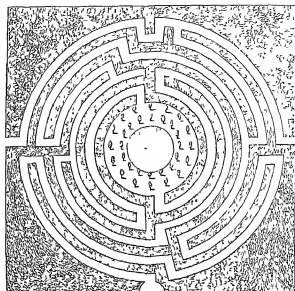


FIG. 2.—Labyrinth of Batty Langley

windings, are carried through blocks of thick planting, as shown in fig. 2, from a design published in 1728 by Batty Langley. These blocks of shrubbery have been called

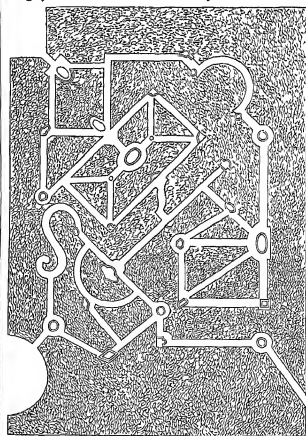


FIG. 3.—Labyrinth at Versailles

wildernesses. To this latter class belongs the celebrated labyrinth at Versailles (fig. 3), of which Switzer observes, that it "is allowed by all to be the noblest of its kind in the world."

Whatever style be adopted, it is essential that there should be a thick healthy growth of the hedges or shrubbery that confine the wanderer. The trees used should be impenetrable to the eye, and so tall that no one can look over them, and the paths should be of gravel and well kept. The trees chiefly used for the hedges, and the best for the purpose, are the hornbeam among deciduous trees, or the yew among evergreens. The locust might be used instead of the hornbeam on suitable soil. The green holly might be planted



Fig. 1—Maze at Hampton Court

as an evergreen with very good results, and so might the American alder vine if the natural soil presented no obstacle. The ground must be well prepared, so as to give the trees a good start, and a mulching of manure during the early years of their growth would be of much advantage to them. They must be kept trimmed in or clipped, especially in their earlier stages, trimming with the knife is much to be preferred to clipping with shears. It is not advisable to allow the hedge to run up too quickly or irregularly, so that any plants getting much in advance of the rest should be topped, and the whole kept to some 4 feet or 5 feet in height until the lower parts are well thickened, when it may be allowed to acquire the allotted height by moderate annual increments. In cutting the hedge (as indeed all hedges) should be kept in contact at the base and narrowed upwards, which prevents it from getting thin and bare below by the stronger growth being drawn to the tops.

The maze in the gardens at Hampton Court Palace (fig. 4) is considered to be one of the finest examples in England. It was planted in the early part of the reign of William III., though it has been supposed that a maze had existed there since the time of Henry VIII. It is constructed on the hedge and alley system, and was, we believe, originally planted with hornbeam, but many of the plants have died out, and been replaced by hollies, yews, &c., so that the vegetation is mixed. The walks are about half a mile in length, and the extent of ground occupied is a little over a quarter of an acre. The centre contains two long, trees, with a seat beneath each. The key to reach this resting place is to keep the right hand continuously in contact with the hedge from first to last, going round all the stops

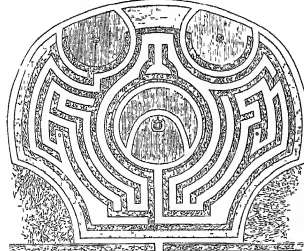


Fig. 5.

The maze in the gardens at Somerleyton Hall, near Lowestoft (fig. 5), was designed by Mr. John Thomas. The hedges are of English yew, and are in very fine condition, without a break or flaw. They are about 6½ feet high, and have been planted a little over thirty years. In the centre is a grass mound, which is raised to the height of the hedges, and on this mound is erected a pagoda, which is approached by a curved grass path. At the two corners on the western side are banks of laurels some 15 or 16 feet high, which are kept trimmed with the knife. On each side of the hedges throughout the labyrinth is a small strip of grass.

There was also a labyrinth at Theobald's Park, near Cheshunt, when this place passed from the earl of Salisbury into the possession

of James I. Another is said to have existed at Wimbledon House, the seat of Earl Spencer, which was probably laid out by Brown in the last century. There is an interesting labyrinth, some laid after the plan of fig. 2, at Mistle Place, Manningtree, the seat of the Rev. C. F. Noiman.

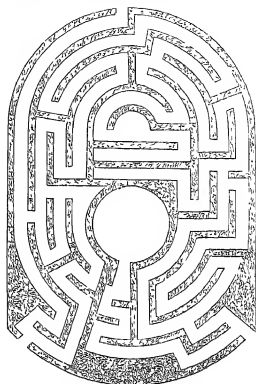


Fig. 6—Labyrinth in Horticultural Society's Garden

When the gardens of the Royal Horticultural Society at South Kensington were being planned, the Prince Consort, the president of the society, especially desired that there should be a maze formed in the ante-garden, which was made in the form shown in fig. 6. This labyrinth, which was designed by the late Lieut. W. A. Nofield, was for many years the chief point of attraction to the younger class of visitors to the gardens, but at last it was allowed to go to ruin, and had to be destroyed. (T. MO.)

LAC is a compound resinous and tinctorial incrustation formed on the twigs and young branches of various trees by an insect, *Coccus lacca* (*Carteria lacca* of Signoret), which infests them. The species of trees upon which it is principally obtained include *Urostigma velutinoso*, *U. indica*, *Croton laccifer*, *C. sanguifer*, *Aleurites laccifera*, *Carissa spinarum*, *Mimosa cuneata*, *Brythia indica*, *Inga edulis*, *Butea frondosa*, *Zizyphus Jujuba*, *Ficus laccifera*, *Feroma elephantum*, and *Vatica laccifera*. Lac is a product of the East Indies, coming especially from Bengal, Pegu, Siam, and Assam. The insect which yields it is closely allied to the cochineal insect, *Coccus cacti*, kermes, *C. illies*, and Polish grains, *C. polonicus*, all of which, like the lac insect, yield a red dye colour. The term lac (*Laksha*, Sanskrit, *Lakh*, Hindi) is the same as the numeral lakh—a hundred thousand—and is indicative of the countless hosts of insects which make their appearance with every successive generation. Two evolutions of the young of the lac coccus make their appearance annually, one about the beginning of July and the other early in December. As soon as the minute larval insects make their appearance they fasten in myriads on the young shoots, and, inserting their long proboscides into the bark, draw their nutriment from the sap of the plant. The insects begin at once to exude the resinous secretion over their entire bodies, which forms in effect a cocoon, and, the separate exudations coalescing, a continuous hard resinous layer regularly honeycombed with small cavities is deposited

over and around the twig. From this living tomb the female insects, which form the great bulk of the whole, never escape. After their impregnation, which takes place on the liberation of the males, about three months from their first appearance, the females develop into a singularly amorphous-like organism consisting in its main features of a large smooth shining crimson-coloured sac—the ovary—with a beak stuck into the bark, and a few papillary processes projected above the resinous surface. The red fluid in the ovary is the substance which forms the lac dye of commerce, and when the young are allowed to hatch out, the greater part of this colouring matter is lost, and only a dead resinous substance remains on the twig. To obtain the largest amount of both resin and dye-stuff therefore it is necessary to gather the twigs with their living inhabitants in or near June and November. Lac encrusting the twigs as gathered is known in commerce as "stick lac"; the resin crushed to small fragments and washed free from colouring matter constitutes "seed lac"; when melted, strained through thick canvas, and spread out into thin layers, this is known as "shell lac," and it is in this last form that the resin is usually brought to European markets. Shell lac, which varies in colour from a dark amber to an almost pure black appearance, may be bleached by dissolving in a boiling lye of caustic potash and passing chlorine through the solution till all the resin is precipitated. Bleached lac takes light delicate shades of colour, and dyed a golden yellow it is much used in the East Indies for working into chain ornaments for the head and for other personal adornments. Lac is a principal ingredient in sealing wax, and forms the basis of some of the most valuable varnishes, besides being useful in various cements, &c. (see LACQUER). Average stick lac contains about 68 per cent. of resin, 10 of lac dye, and 6 of a waxy substance. The resin of lac is a composite body, whose constituents behave differently in presence of chemical reagents.

Lac dye, which is separated by washing stick lac in hot or cold water or in a weak alkaline solution, and dried either by exposure over a fire or in the sun, comes into commerce in this form of small square cakes. It is in many respects similar to, although not identical with, cochineal, and will dye less brilliant shades than that colour. It contains about 50 per cent. of colouring matter, with 25 per cent. of resin and 22 per cent. of earthy admixture, &c. It is used for dyeing silk and wool, for which purposes it is dissolved in dilute sulphuric acid or somewhat stronger hydrochloric acid; and the substance to be dyed is prepared with a mordant of strong lac spirit, which consists of a solution of stannous chloride. Lac dye has been used from time immemorial in the East, but the knowledge of the substance in the West is comparatively recent. It was first brought to Europe by the East India Company as a substitute for cochineal. The best lac dye comes from Calcutta. Lac lake is an alumina lake containing about 50 per cent. of colouring matter, 40 per cent. of resin, and 9 or 10 per cent. of alumina.

LACAILLE, NICOLAS LOUIS DE (1718–1782), a zealous and successful astronomer, was born at Ramigny, near Rheims, March 15, 1713. Left destitute by the death of his father, who held no post in the household of the dukes of Vendôme, his theological studies at the Collège de Laisieux in Paris were prosecuted at the expense of the duke of Bourbon. After he had taken deacon's orders, however, he devoted himself exclusively to science, and, through the patronage of Cassini, obtained employment, first in surveying the coast from Nantes to Bayonne, then, in 1739, in remeasuring the French arc of the meridian. The success of this difficult operation, which occupied two years, and achieved the correction of the anomalous result obtained by the elder Cassini in 1684, was mainly due to Lacaille's

industry and skill. He was rewarded by admission to the Academy, and the appointment of mathematical professor in Mazarin college, where he worked diligently for some years in a small observatory fitted up for his use. His desire to observe the southern heavens led him to propose, in 1760, an astronomical expedition to the Cape of Good Hope, which was officially sanctioned, and fortunately executed (see ARMSTRONG, vol. ii. p. 757). On his return in 1764 he was distressed to find himself an object of public attention, and withdrew to his former retreat in Mazarin college, where he died, March 21, 1762, of an attack of gout aggravated by unremitting toil. Lacaille said of him that, during a comparatively short life, he had made more observations and calculations than all the astronomers of his time put together. And, his carefulness equalling his rapidity, the quality of his work rivalled its quantity. The rectitude of his moral character earned him universal respect, and his career ranks, if not amongst the most brilliant, amongst the most useful and honourable in the annals of science.

His principal works are—*Astronomische Fundamenta*, 1757; *Tabulae Solares*, 1768, giving, for the first time, corrections for planetary perturbations; *Calculus astralis stellarum*, 1768, a catalogue of 10,085 southern stars; *Observations sur 615 étoiles du Zodiaque*, 1763; *Leçons élémentaires de Mathématiques*, 1761, frequently reprinted; *dictionnaire de Mécanique*, 1748, &c.; *dictionnaire d'Astronomie*, 1746, 4th edition augmented by Lacaille, 1770; *dictionnaire d'Optique*, 1750, &c. Calculations by him of eclipses for eighteen hundred years were inserted in *L'art de vérifier les dates*, 1760, he communicated to the Academy in 1766 a classical catalogue of forty-two southern nebulae, and gave in vol. ii. of his *Éphémérides*, 1764, practical rules for the employment of the lunar method of longitudes, proposing in his additions to Delambre's *Traité de Navigation*, 1760, the model of a nautical almanac.

LA CALLE, or LA CALA, a seaport town of Algeria, in the province of Constantine, the centre of the Algerian and Tunisian coral fisheries. It lies 40 miles east of Bono and 10 miles from the Tunisian frontier. The harbour is small and inconvenient, but it is proposed to construct a military port and harbour of refuge a little to the west. La Calle proper, or the old fortified town, is built on a ridge of rocks about 400 yards long, connected with the mainland by a bank of sand; but a new town has grown up along the coast. Besides the coral fisheries the curing of sardines is largely carried on. The population, without the garrison, was 3508 in 1871.

La Calle is mentioned as *Mersa el Kharez* by El Bekri (see *Journ. Asiat.*, 1859), and was even then the residence of coral merchants. In the early part of the 18th century it was the seat of an English trading factory, but on the failure of the company the French-African Company moved their factory from Bastion de France to La Calle. The company was suppressed in 1704. In 1806 Mr. Blansky, British consul-general at Algiers, obtained the right of occupying Bono and La Calle for a French rent of £21,000; but though the money was paid for several years no practical effect was given to the agreement. The French regained possession in 1817, were expelled during the wars of 1827, but returned and rebuilt the place in 1868.

See *Abd. Fatah, Voyage en Barbarie*, Paris, 1787; *Broughton, Six Years in Algeria*; and *Playfair, Travels in the Footsteps of Bruce*.

LACCADIVES, a group of coral reefs and islands in the Indian Ocean, lying between 10° and 12° 20' N. lat. and 71° 40' and 74° E. long. The name Laccadives (*laksha dwipa*, the "hundred thousand isles") is that given by the people of the continent, and was probably meant to include the myriad Maldives; they are called by the natives simply *Diva*, "islands," or *Amenidiv*, from the chief island. There are about nineteen separate reefs, containing, however, only thirteen islands, and of these only eight are inhabited. The islands have in nearly all cases emerged from the eastern and protected side of the reef, and have gradually extended towards the west over the shallow lagoon of which the rest of the space within the barrier-reef consists. The islands are small, none exceeding a mile in breadth, and lie so low that they would be hardly

discernible but for the cocoa-nut groves with which they are thickly covered. The soil is light coral sand, beneath which, a few feet down, lies a stratum of coral stretching over the whole of the island. This coral, which is generally a foot to a foot and a half in thickness, has been in the principal islands wholly excavated, whereby the underlying damp sand is rendered available for cereals. These excavations—a work of vast labour—were made at a remote period, and according to the native tradition by giants. In these places (*totam* = "garden") are cultivated coarse grain, pulse, bananas, and vegetables; cocoa-nuts grow abundantly everywhere, and for rice the natives depend upon the mainland.

Population and Trade.—Of the eight Laccadive islands, four are directly under British rule and form part of the South Kanara collectorate in the Madras presidency. The other four (together with Minicoy, noticed below) form part of the estate of the *bibi* of Cannanore. The following are the names of the islands, with population in 1881:—

British Islands.		Cannanore Islands	
Amini	2080	Agathi	1876
Chadlet	577	Kavathi	2187
Kadamt	845	Androt	2896
Kiltan.	790	Kalpeti	1216
Total	8072	Total .	7615

making a total for all the islands of 11,387, a dense population for so small an area. Amini, Kalpeti, Androt, and Kavathi are the principal or *taravat* islands, and in them only do the high caste natives reside. The others are called *metacheri*, or low caste islands. The people are Moplas, *s.c.*, of mixed Hindu and Arab descent, and are Mohammedans. Their manners and customs are similar to those of the coast Moplas, but they maintain their own ancient caste distinctions. The language spoken is Malayale, but it is written in the Arabic character. Reading and writing are common accomplishments among the men. The chief industries are the manufactures of coir and jaggery, the Laccadive coir being esteemed the best in India, the various processes are entrusted to the women. The men employ themselves with boat-building and in conveying the island produce to the coast—in the case of the English islands to Mangalore, and in that of the *bibi's* islands to Cannanore. In each case the coir is taken by the ruling Government at lower than market rates, and the natives are not subject to any other taxation. At Mangalore they are paid partly in money and partly in rice, and the rates are not altered for many years. On the other hand the varying and oppressive tariff imposed upon the Cannanore islands has led to a diminished and inferior manufacture of coir, and to frequent complaints. This monopoly system, however fairly worked by the British Government, interferes with the trading capabilities of the natives, and puts them at considerable disadvantage with their rivals of Minicoy and the Maldives. The exports from the Laccadives are of the annual value of £17,000.

History and Government.—No data exist for determining at what period the Laccadives were first colonized. The earliest mention of them as distinguished from the Maldives seems to be by Alfridini (*circa* 1000), who divides the whole archipelago (*Diféjât*) into the *Divek Kérah* or Cuvrie Islands (the Maldives), and the *Divek Kander* or Coir Islands (the Laccadives). See *Journ. Asiat.*, September 1844, p. 955. According to native tradition, the islands were first occupied about a thousand years ago. The early polity, according to Mr. Robinson, was patriarchal, conducted by a *modiat*, or chief inhabitant, and the heads of the principal families. Each island was independent. This kind of internal economy seems to have lasted until the advent of the Portuguese. During their independence the islands were converted to Islam by an Arab apostle named Mumba Mulyake, whose grave at Androt still imparts a peculiar sanctity to that island. The kases of Androt was in 1847 still a member of his family, and was said to be the twenty-second who had held the office in direct line from the saint. This gives colour to the tradition that the conver-

sion took place about 1250. It is also further corroborated by the story given by Ibn Batuta of the conversion of the Maldives, which occurred, as he heard, four generations (say one hundred and twenty years) before his visit to these islands in 1342. The Portuguese discovered the Laccadives in 1499, and built forts upon them, but about 1646 the natives rose upon their oppressors, and with the aid of the raja of Chornel exterminated them. For this aid the raja obtained the suzerainty of the group, but he afterwards conferred them upon the head of the Cannanore moplas for an annual tribute. The Cannanore raja ceased to pay this tribute about the middle of the 18th century. In 1784 the Amul islands threw off the yoke, and put themselves under the protection of Tippoo, from whom, at the fall of Seringapatam in 1799, they passed to the East India Company. The remaining islands had already in 1791 fallen into the power of the Company by the storming of Cannanore, but by the peace of Seringapatam (1792) were permitted to remain under the management of the *bibi* at a yearly tribute. This has been often in arrears, and on this account these islands have been sequestered by the British Government since 1877, to the general satisfaction of the inhabitants. See Mr. Robinson's *Report*, Madras, 1874, Mr. Hume in *Stray Feathers*, vol. iv., 1878, Calcutta.

Minicoy (called Maldiva by the natives), a small island 6 miles in length, 108 miles south of Kalpeti and 68 miles north of the Maldives, belongs politically to the Laccadives in so far as it forms part of the estate of the *bibi* of Cannanore. The natives, however, are of the same race and speak the same language as the Maldivians. The population in 1881 was 5915. The people are well behaved, but of a very independent character, they are active and enterprising sailors, and busy cultivators. They are divided into four classes, *vaidikans*, the aristocracy, *malummas*, the pilots and mates of vessels, *klases*, smaller landed proprietors and sallows, and *metacheries*, toddy drawers. Minicoy anciently formed part of the Maldiva realm, but, probably in the 16th century, was given by a Maldiva sultan to his brother. In 1607 when it was visited by Pyrard, it was governed by a lady who for greater security held it of the raja of Cannanore (Pyrard's *Voyage*, chap. xxiii.). The island has never been restored to the Maldiva king.

LACE¹ is the name applied to an ornamental open work of threads of flax, cotton, silk, gold, or silver, and occasionally of mohair or aloë fibre. Such threads may be either looped or plaited or twisted together in one of three ways:—(1) with a needle, when the work is distinctively known as "needlepoint lace"; (2) with bobbins, pins, and a pillow or cushion, when the work is known as "pillow lace"; and (3) by machinery, when imitations of both needlepoint and pillow lace patterns are produced.

History.—Special patterns for needlepoint and pillow lace date from the beginning of the 16th century. Before that period such works as might now be classified as laces consisted of small cords of plaited and twisted threads fastened in loops (or "purls") along the edges of costumes, of darning work done upon a net ground, and of drawn and cut embroidery. From these classes of earlier work lace is descended. Pillow lace can be distinctly traced up to the "merletti a pombini" of the 16th century. At a very early period embroidery of geometrical patterns in coloured silk, &c., on a network of small square meshes was known and made throughout Europe. This in the 13th and 14th centuries was known in ecclesiastical circles as "*opus filatorum*" or "*opus araneum*" (spider work), and examples dating from the 13th century still exist in public collections. The productions of this art, which has some analogy to weaving, in the early part of the 16th century came to be known as "*punto a maglia quadra*" in Italy and as "*lacs*" in France—the patterns, stiff and geometrical, being sometimes cut out of linen or separately sewed and applied to the meshed surface; but more frequently they were darned in, the stitches being counted as in tapestry, and hence it was known as "*point conté*" or darned netting. With the development of the renaissance of art, free flowing patterns and figure subjects were introduced and worked in lace.

Drawn and cut works were ancient forms of embroidery

¹ Italian, *maricette*, *tréna*; Genoese, *giaco*; German, *Spitzm*; French, *dentelle*; Dutch, *kanten*; Spanish, *enagles*. The English word is the Fr. *lacs* or *lase*, connected with the Latin *lascivus*. Early French laces were also called *passemens* ("insertions").

which directly developed into point lace. The methods of producing them were various. A common way was to fasten on a light frame a reticulation of threads, under which was fastened, by gum or otherwise, a piece of fine lawn. Then along these threads the pattern to be formed was stitched to the lawn background in button-hole stitching, and the superfluous parts of the lawn were afterwards drawn or cut away,—whence the names “punto a reticella” and “punto tagliato”. In other cases no cloth at all was used, and the pattern, consisting of an interlacing framework of threads, was simply sewed over with button-hole stitches. This was “punto in aria.” The early geometrical patterns of the “punto a reticella” or “punto tagliato” and “punto in aria” were probably derived from the Ionian Islands and Greece, and the out-work itself was indeed also known as Greek lace. The close connexion of the proud and powerful Venetian republic with Greece and the eastern islands, and its commercial relations with the East, sufficiently explain the early transplanting of these arts into Venice. Once fairly established, they quickly grew in beauty and variety of pattern, complexity of stitch, and delicacy of execution, until Venetian lace attained an artistic grace and perfection which baffles all description. The making of the principal and most important variety of Venetian needlepoint lace, the “punto in aria,” began to be practised in the middle of the 16th century.¹

It is a noteworthy circumstance that the two widely distant regions of Europe where pictorial art first flourished and attained a high perfection, North Italy and Flanders, were precisely the localities where lace-making first took root, and became an industry of importance both from an artistic and from a commercial point of view. The invention of pillow lace is generally credited to the Flemings; but there is no distinct trace of the time or the locality. In a picture said to exist in the church of St Gammar at Lierre, and sometimes attributed to Quentin Matsys (1495), is introduced a girl working lace with pillow, bobbins, &c., which are somewhat similar to the implements in use in more recent times.² From the very infancy of Flemish art as an active intercourse was maintained between the Low Countries and the great centres of Italian art; and it is therefore only what might be expected that the wonderful examples of the art and handicraft of Venice in lace-making should soon have come to be known to and rivalled among the equally industrious, thriving, and artistic Flemings. And so we find that, at the end of the 16th century, laces and needlepoint lace were also known and made in Flanders, and pattern-books were issued having the same general character as those published for the instruction of the Venetians and other Italians. In Italy, under the name of “merletti a piombini,” the art of twisting and plaiting threads by means of bobbins or *juсти* was early practised; and in later times fine scrolls in great widths for altar frontals were made in Italy on the pillow.

France and England were not far behind Venice and

Flanders in adopting lace. Henry III of France (1574–1589) appointed a Venetian, Federico Vascuolo, to be pattern maker for varieties of laces, needle works and laces to his court. Though the influence of this fertile designer the seeds of a taste for lace in France were principally sown. But the event which *par excellence* would seem to have fostered the art of lace making there was the aid and patronage officially given it in the following century by Louis XIV., acting on the advice of his minister Colbert. Intrigue and diplomacy were put into action to secure the services of Venetian lace-workers; and by an edict dated 1605 lace-making centres were founded at Alençon, Quenoy, Arras, Rheims, Sedan, Châteaun-Thierry, London, and elsewhere. The state made a contribution of 36,000 francs in aid of a company to carry out the organization of these establishments; and at the same time the importation of Venetian, Flemish, and other laces was strictly forbidden.³ The edict contained instructions that the lace-makers should produce all sorts of thread work, such as those done on a pillow or cushion and with the needle, in the style of the laces made at Venice, Genoa, Ragusa, and other places; these French imitations were to be called “points de France.” By 1671 the Italian ambassador at Paris writes, “Gallantly is the minister Colbert on his way to bring the ‘lavori d’aria’ to perfection.” Six years later an Italian, Domingo Contarini, alludes to the “punto in aria,” “which the French can now do to admiration.” The styles of design which emanated from the chief of the French lace centres, Alençon, were more fanciful and floral than the Venetian, and it is quite evident that the Flemish lace-makers adopted many of these French patterns for their own use. The importance of the French designs, which owe so much to the state patronage they enjoyed, was noticed early in the 18th century by Bishop Berkeley. “How,” he asks, “could France and Flanders have drawn so much money from other countries for figured silk, lace, and tapestry, if they had not had their academies of design?”

The humble endeavours of peasantry in England (which could boast of no schools of design), Germany, Sweden, Russia, and Spain could not result in work of high artistic pretension. Lace making is said to have been promoted in Russia through the patronage of the court there, after the visit of Peter the Great to Paris in the early days of the 18th century. In Germany, Barbara Utmann, a native of Nuremberg, instructed peasants of the Harz mountains to twist and plait threads in 1561. She was assisted in this by certain refugees from Flanders. A sort of “purling” or imitation of the Italian “merletti a piombini” was the style of work produced here. It did not develop in any important way, nor have German laces acquired great artistic reputation. Spain has been considered to have been a lace-making country, and no doubt a good deal of lace, having, however, no distinctive character, was made in Spanish conventual establishments. The “point d’Espagne,” however, appears to have been a commercial name given by French manufacturers of a class of lace greatly esteemed by Spaniards in the 17th century. No lace pattern books have been found to have been published in Spain. The point laces which came out of Spanish monasteries in 1830, when these institutions were dissolved, were not distinguishable from similar Venetian needle-made laces. The lace vestments preserved at the cathedral at Granada lithographically presumed to

¹ The prevalence of fashion in the above-mentioned sorts of embroidery during the 16th century is marked by the number of pattern-books then published. In Venice an early work of this class was issued by Alessandro Fagnolino in 1527; another of a similar nature, printed by Pierre Quinty, appeared in the same year at Cologne; and *La fleur de la science de pourtravailler et patronne de broderie, façon arabesque et ysaïenne*, was published at Paris in 1580. From these early dates until the beginning of the 17th century pattern-books for embroidery in Italy, France, Germany, and England were produced and published in great abundance. The designs contained in many of those dating from the early 16th century were to be worked for costumes and hangings, and consisted of scrolls, arabesques, birds, animals, flowers, foliage, herbs, and grasses. So far, however, as their reproduction as laces might be concerned, the execution of complicated work was involved which none but practical lace-workers, such as those who arose a century later, could be expected to overcome.

² The picture, however, as Boguin has pointed out, was probably painted some thirty years later, and by Jean Matsys.

³ See the postcard edit *René de Passaments et Broderies*, written by Mademoiselle de la Touche, cousin of Madame de Sévigné, in the middle of the 17th century, which marks the favour which foreign laces at that time commanded amongst the leaders of French fashion. It is fairly evident too that the French laces themselves, known as “bleuets,” “guines,” “compans,” and “maignettes,” were small and comparatively insignificant works, without pretence to design.

be of Spanish work are Flemish of the 17th century. The industry is not alluded to in Spanish ordinances of the 15th, 16th, or 17th centuries. Much Flemish lace was imported into Spain from Spanish Flanders. The black and white silk pillow laces, or "blondes," date from the 18th century. They were made in considerable quantity in the neighbourhood of Chantilly, and imported by Spain for mantillas. Although after the 18th century the making of silk laces has more or less ceased at Chantilly and the neighbourhood, the craft is now carried on in Normandy—*at Bayeux and Caen*—as well as in Auvergne. Silk pillow lace making is carried on in Spain, especially at Barcelona. The patterns are almost entirely imitations from the French. Malta is noted for producing a thick pillow lace of black, white, and red threads, chiefly of geometric pattern, in which circles, wheels, and radiations of shapes resembling grains of wheat are a principal feature. This characteristic of design, appearing in laces of similar make which have been identified as Genoese pillow laces of the early 17th century, reappears in Spanish and Paraguayan work. Pillow lace in imitation of Maltese, Buckinghamshire, and Devonshire laces is made in Ceylon, and in different parts of India where attempts have been made to introduce European arts to native labour.

At present the chief sources of hand-made lace are Belgium, England, and France, but a successful effort has also been made to re-establish the industry in the island of Burano near Venice, and much fine work of good design is now (1882) made there. Russian peasants in the districts of Vologda, Bialakura (Nijni-Novgorod), Bieleff (Tula), and Mzensk (Orel) make pillow laces of simple patterns. But by far the greatest amount of lace now made is that which issues from machines in England and France. The total number of persons employed in the lace industry in England in 1871 was 49,870; and according to official returns of the year 1873, 240,000 women were similarly employed in France.

The early history of the lace-making machine coincides with that of the stocking-frame, that machine having been adapted about the year 1768 for producing open-looped stitches, which had a net-like appearance. In the years 1808 and 1809 John Heathcoat of Nottingham obtained patents for machines for making bobbin net, which form the real foundation of machine making of lace. These machines were improved on in 1813 by John Leavers, whose lace-making machines are in use at the present time. The application of the celebrated Jacquard apparatus to these net machines has enabled manufacturers to produce all sorts of patterns in thread work in imitation of the patterns for hand-made lace. The latest improvement in machinery for lace making has resulted in a French machine called the "dentellière" (see *La Nature* for 5d March 1881). The work produced by this machine is said. That produced by the English and by other French machines is of twisted threads. At present, however, the expense attending the production of plaited lace by the "dentellière" is as great as that of pillow lace made by the hand.

Before considering technical details in processes of making lace, the principal parts of a piece of lace may be named. A prominent feature is the ornament or pattern. This may be so designed that the different parts may touch one another, and so be fastened together, no ground-work of any sort being required. Ground works are useful to set off the pattern, and either consist of links or ties, which give an open effect to the pattern, or else of a series of meshes like net. Sometimes the pattern is outlined with a thread or cord line, or more strongly marked by means of a raised edge of button-hole stitched or plaited work.

¹ See Felkin's *Machine-wrought Hosiery and Lace Manufactures*.

Fanciful devices are sometimes inserted into various portions of the pattern. In some of the heavy laces, which resemble delicate carving in ivory, little clusters of small loops are distributed about the pattern. French terms are frequently used in speaking of details in laces. Thus the pattern is called the *toile* or *gimp*, the links or ties are called *brides*, the meshed grounds are called *réseau* (*reticula*), the outline to the edges of a pattern is called *cordannel*, the insertions of fanciful devices *modes*, the little loops *picots*. These terms are applicable to the various portions of all laces made with the needle, on the pillow, or by the machine.

The history of patterns in lace is roughly as follows. From about 1510 to 1890 the forms were geometric, chiefly common, without *brides* or *réseau*. From 1590 to 1630 may be dated the introduction of floral and human forms and slender scrolls held together by *brides*. At this time lace makers enriched their works with insertions of *modes*. To the period extending from 1620 to 1670 belongs the development of scrolls and elaboration of details like the *cordannel* with massings of *picots*. Much heavy raised lace enriched with fillings in *of modes* was made at this time. About 1660 *réseau* came into use. From 1650 to 1720 the scroll patterns gave way to arrangements of detached ornamental details which were frequently filled in with elaborate *modes*. A closer imitation of all sorts of subjects was attempted in lace patterns. Pictorial representations of figures, incidents, persons, arose. The purely conventional scrolls were succeeded by naturalistic renderings of garlands, flowers, birds, and such like. The use of meshed grounds extended, and grounds composed entirely of varieties of *modes* were made. From 1720 to 1780 small details of bouquets, sprays of flowers, single flowers, leaves, buds, spots, and such like were adopted, and sprinkled over meshed grounds. Since that time down to the present day all these styles of pattern have been used as fashion has required.

Needlepoint Lace—The way in which the early Venetian "punto in aria," as already described, was made appears to correspond precisely with the elementary principles upon which needlepoint lace is now worked. The pattern is first drawn upon a piece of parchment. The parchment is then stitched to a stout bit of linen. Upon the leading lines drawn on the parchment threads are laid, which are here and there fastened through to the parchment and linen by means of stitches.

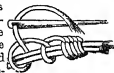


Fig 1



Fig 3

When the skeleton thread pattern is completed, a compact covering of thread in button-hole stitches is cast upon it (fig 1). The portions which may be required to be represented as close linen work or *toile* are worked as indicated in the enlarged diagram (fig 2).

Between the leading lines of the pattern may be inserted ties (links) or meshes, so that the pattern is held together. When all is finished, a knife is passed between the parchment and the stout linen, cutting the stitches which have passed through the parchment and linen, and so releasing the lace itself from its pattern parchment. For about sixty years the laces thus made were chiefly geometric in pattern (fig 3). They were used both for insertions between seams and for borders. Following closely upon these geometric laces

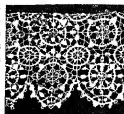


Fig 3—Part of a Border of Needlepoint Lace, geometric design. About 1650.

came laces of a fiercer style of design, and towards the end of the 16th century designs for scrolls with the introduction of all kinds of odd figures and leaves and blossoms were produced (fig. 4). Links or ties—*brides*—came to be inter-



FIG. 4—Italian Needlepoint Scallop



FIG. 5—Needlepoint Lace, showing use of ties or "links"

spersed between the various details of the patterns (fig. 5). The work was of a flat character. Some large and elaborate specimens of this flat point lace were made at this time. The lace workers occasionally used gold thread with the white thread. The nomenclature of these earlier needle-made laces is somewhat modern. At the present time the

different sorts of early Venetian point laces are called "flat Venetian point," "rose (raised) point," "caterpillar point," "bone point," &c., and works of bold design done in relief are called "gros point de Venise." Lace of this latter class (figs. 6, 7) was used for altar cloths, flouncings, and heavily trimmed *jackets* or neckcloths which hung beneath the chin over the breast. *Tabliers* and ladies' aprons were also made of such lace. The laces which have hitherto been referred to are laces in which no regular ground was used. All sorts of minute embellishments, like little knots, stars, and loops or *piquets*, were worked on to the irregularly arranged *brides* or ties holding the main patterns together, and these devices as a rule gave a rich effect to the lace work. Following this style of treatment came laces with groundworks, and grounds of *brides* or ties arranged in a honey-comb pattern were, it appears, first used early in the 17th century (fig. 8). To them succeeded a lighter sort of lace, one in which the rich and compact relief gave place to much flatter work with a ground of meshes. The needle-made meshes were sometimes of single and sometimes of double threads. A diagram is given of an ordinary method of making such meshes (fig. 9). The delicate Venetian point lace made with a



FIG. 6—Venetian Needlepoint Lace

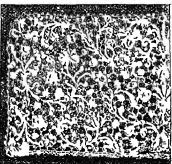


FIG. 7—Venetian Needlepoint Lace

ground of meshes is usually known as "point de Venise à réseau." It was contemporary with the famed needle-made French laces of Alençon and Argentan. "Point d'Argentan" has been thought to be especially distinguished on account of its ground of hexagonally arranged *brides*. But this has been noticed as a peculiarity in certain Venetian point laces of earlier date.¹ Often intermingled

with this stiff hexagonal *brides* ground is the fine-meshed ground of *réseau*, which has been held to be distinctive of "point d'Alençon" (fig. 10). But, apart from the assumedly distinctive grounds, the styles of patterns and the methods of working them, with rich variety of insertions or *modes*, with raised button-hole-stitched edgings or *cordonnets*, are

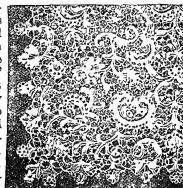


FIG. 8—Venetian Needlepoint Lace

precisely alike in the two classes of Argentan and Alençon needle-made laces. Besides the hexagonal *brides* ground and the ground of meshes there was another variety of grounding used in the Alençon laces, which was extensively used and forms a third class. This ground consisted of button-hole-stitched skeleton hexagons within each of which was worked a small solid hexagon connected with the outer surrounding hexagon by means of six little ties or *brides* (see fig. 11). Lace with this particular ground has been called "Argentanella," and some writers on lace have thought that it was a specialty of Genoese or Venetian work. The character of the work and the style of the floral patterns worked upon such grounds are those of Alençon laces, and specimens of this "Argentanella" often contain insertions of the Argentan *brides* and the Alençon fine meshes.

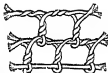


FIG. 9



FIG. 10—French Needlepoint Lace.



FIG. 11

There are very slight indications respecting the establishment of a lace manufactory at Argentan, whereas those regarding Alençon are numerous. A family of thread and linen dealers, inhabitants of Alençon, by name Monthuley, are credited with the establishment of a branch manufactory or *succursale* for lace at Argentan. In the course of business, the Monthuleys assisted the interchange of lace patterns between Argentan and Alençon, which are distant one from another about 10 miles. Thus if a piece of lace was produced at Alençon it was called "point d'Alençon," and if at Argentan "point d'Argentan," though both works might have been made

¹ The lace workers at Alençon and its neighbourhood produced work of a daintier kind than that chiefly made by the Venetians. As a rule the hexagonal *brides* grounds of Alençon laces are smaller than similar details in Venetian laces. The average size of a diagonal taken from angle to angle in an Alençon (or so-called Argentan) hexagon was about one-sixth of an inch, and each side of the hexagon was about one-tenth of an inch. An idea of the minuteness of the work can be formed from the fact that a side of a hexagon would be overcast with some nine or ten button-hole stitches.

from one design. From about 1670 to 1780 a great deal of point lace was made at Alençon and in the neighbouring villages. The styles of patterns varied, as has been stated. Point d'Alençon is still made.

In Belgium, Brussels has acquired some celebrity for needle-made laces. These, however, are chiefly in imitation of those made at Alençon. Brussels needlepoint lace is often worked into meshed grounds made on a pillow. The Brussels needle-lace workers used a plain thread as a *cordonnet* for their patterns instead of a thread overcast with button-hole stitches as in the Venetian and French needlepoint laces.

This kind of lace has also been produced in England. Whilst the character of English design in needlepoint laces of the early 17th century (fig. 12) is simpler than that of



FIG. 12.—English Point Lace

the contemporary Italian, the method of workmanship is virtually the same. Specimens of needle-made work done by English school children may be met with in samplers of the 17th and 18th centuries. Point lace is successfully made in Irish convents. In all great towns like London, Paris, Brussels, Vienna, lace dealers undertake to supply demands for finely executed modern imitations of old needle-made lace. At Buano the lace-making school lately established there produces hand-made laces which are, to a great extent, careful reproductions of the more celebrated classes of point laces, such as "punto in aria," "rose point de Venise," "point de Venise à l'étoile," "point d'Alençon," "point d'Argentan," and others. A weaving of threads with a needle into a foundation of net—very distinctive, and different from the "punto a maglia" or "laces"—has been done for a long time in Spain. Its leading characteristic is the pattern of repeated squares, filled up with star figures. When fine thread is used the effect of heavy cobwebs is produced. Work of this description has been made in Paraguay, where a coarse "torchon" pillow lace is also produced.

Pillow-made Lace.—Pillow-made lace is built upon no substitute, like a skeleton thread pattern, such as is used for needlepoint lace. It is the representation of a pattern obtained by twisting and plaiting threads. The only pre-existing analogue of pillow laces is to be found in the primitive twistings and plaitings of fibres and threads. The English word "lace" in the 15th century was employed to describe fine cords and braids. In a Harleian MS of the time of Henry VI and Edward IV, about 1471, directions are given for the making of "lace Bascon, lace indented, lace bordered, lace coveit, a brode lace, a round lace, a thynne lace, an open lace, lace for hattys," &c. The MS. opens with an illuminated capital letter, in which is the figure of a woman making these articles. Her implements are not those with which pillow lace of ornamental quality from the middle of the 16th century and onwards has been made. The MS. supplies a clear description how threads in combinations of twos, threes, fours, fives, to tens and fifteens, were to be twisted and plaited together. Instead of the pillow, bobbins, and pins with which pillow lace is made, the hands were used.

Each finger of a hand served as a peg. The writer of the MS. says that it shall be understood that the first finger next the thumb shall be called A, the next B, and so on. According to the sort of twisted cord or braid which had to be made, so each of the four fingers A, B, C, D might be called upon to act like a reel, and to hold a "lowys" or "bow," or little ball of thread. Each ball might be of different colour from the other. A "thynne lace" might be made with three threads, and then only fingers A, B, C would be required. A "round" lace, stouter than the "thynne" lace, might require the service of four or more fingers. By occasionally dropping the use of threads from certain fingers a sort of indented lace or braid might be made. But when laces of more importance were wanted, such as a broad lace for "hattys," the hands of assistants were required.

Pillow lace making was never so strictly confined to geometric patterns as point lace making. Curved forms, almost at its outset, seem to have been found easy of execu-

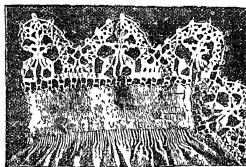


FIG. 13.—Cell trimmed with Plaited and Twisted Thread Work in Points, or Scallops. Late 16th century

tion (fig. 13). One reason for this no doubt is that the twisted and plaited work was not constrained by a foundation of any sort. The plaitings and twistings gave the workers a greater freedom in reproducing designs. At the same time, little speciality of pattern seems to have been produced for the pillow lace workers, and so laces worked on the pillow, particularly those of higher pretensions to artistic design, were similar in pattern to those worked with the needle. The early wry-looking twisted and plaited thread laces were soon succeeded by laces in which flattened and broader lines occupy a prominent position (fig. 14). Tape was also sometimes used for the broad lines. The weaving of tape appears to have been begun in Flanders about the end of the 16th or the beginning of the 17th century. In England it dates no farther back than 1747, when two Dutchmen of the name of Lanfort were invited by an English firm to set up tape looms in Manchester and give instructions in the method of weaving tape.

The process by which lace has been made on the pillow from about the middle of the 17th century is very roughly and briefly as follows. A pattern is first drawn upon a piece of paper or parchment. It is then picked with holes by a skilled "pattern pricker," who determines where the principal pins shall be stuck for guiding the threads. This pricked pattern is then fastened to the



FIG. 14.—Plaited and Twisted Thread Work known as "Melleto" or "Pomellum." About 1660



FIG. 15.—Diagram showing six bobbins in use

pillow. The pillow or cushion varies in shape in different countries. Some lace makers use a circular pad, backed with a flat board, in order that it may be placed upon a table and easily moved as the worker may wish. Other lace workers use a well-stuffed round pillow or short bolster, flattened at the two ends, so that they may hold it between their knees. On the upper part of the pattern are fastened the ends of the threads from the bobbins. The bobbins thus hang across the pattern. Fig. 15 shows the commencement of a double set of three-thread platings. The compact portion in a pillow lace has a woven appearance (fig. 16).



Fig. 16

In the 17th century pillow lace in imitation of the scroll patterns of point lace was made. This sort of work, produced chiefly in Flanders, went under the name of "point d'Angleterre" (fig. 17). Into Spain and France much lace from Venice and Flanders was imported as well as into England, where from the 16th century the manufacture of "bone lace" by peasants in the midland and southern counties was carried on. This bone lace consisted chiefly of borders done in imitation of the Venetian "merletti a piombini". In Charles II's time its manufacture was of sufficient importance to demand parliamentary attention. The trade was threatened with extinction by the more artistic and finer Flemish laces. The importation of the latter was prohibited. Flemish lace workers sought to evade the prohibitions by calling certain of their laces "point d'Angleterre". But the difficulties which attended the smuggling into England of these "points d'Angleterre" appear to

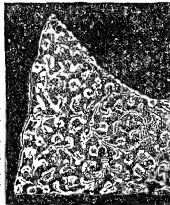


Fig. 17 —Pillow-made Lace "à brides" have stimulated English Flemish 17th century. Sometimes called "Point d'Angleterre".

supply the demands of fashion to obtain the services of Flemish lace makers and to induce them to settle in England. It is from some such cause that English pillow lace closely resembles in character of design pillow laces of Brussels, Mechlin, and Valenciennes.

Fig. 18 gives three sorts of Buckinghamshire pillow laces, the patterns of which have been in use since the middle of the 18th century. In (a) is a variety of filling-in, which give the name of "trolley" to such specimens. It is an adaptation of Mechlin "trolley kant" or sampler lace, sent round to dealers and purchasers to show the variety of patterns which the lace makers happened to be at work upon. Specimens (b) and (c) are both in the style of certain 18th century Mechlin laces, (c) being also like laces made at Lille and Arras.

As skill in making lace developed, patterns and particular platings came to be identified with certain localities. Mechlin enjoyed a high reputation for her production, which was in the 17th century poetically styled the "queen of laces". The chief features of this pillow lace are the plating of the meshes, and the outlining of the pattern or *rolé* with a thread. The ordinary Mechlin mesh is hexagonal in shape. Four of the sides are of double twisted threads, two are of four threads plaited three times (fig. 19). The mesh of Brussels pillow lace is also hexagonal. Four of the sides are of double-twisted threads, two are of four threads plaited four times (fig. 20). The finer specimens of Brussels lace are remarkable for the fidelity and grace

with which floral compositions are rendered. Many of these compositions are either reproductions or adaptations of designs for point d'Alençon, and in such patterns the soft quality of fine pillow-made lace contrasts with the hard and more crisp appearance of needlepoint lace. In

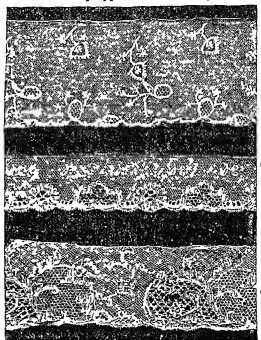


Fig. 18 —English Pillow Laces 18th century

the Brussels pillow lace (fig. 21) much realistic effect is obtained by the delicate modelling imparted to the flowers by means of a bone instrument used to give concave shapes to petals and leaves, the edges of which are often marked

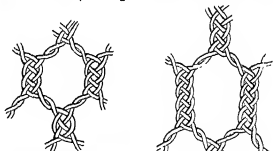


Fig. 19 —Mechlin Mesh.

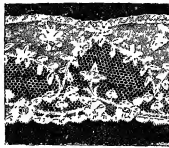


Fig. 21 —Pillow Lace Brussels 18th century

Fig. 20 —Enlargement of Mesh of Brussels ground, showing the four-twisted and two-plaited sides in each mesh.

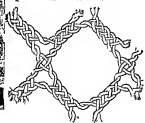


Fig. 22.

by a flattened and slightly raised *con donnet* of plaited work. Houton pillow lace resembles Brussels lace. As a rule it is made with a coarser thread, and the designs lack the careful drawing and composition which may be seen in Brussels pillow laces. In Valenciennes lace there are no

twisted sides to the mesh, all are closely plaited (fig 25), and as a rule the shape of the mesh is diamond. No outline or

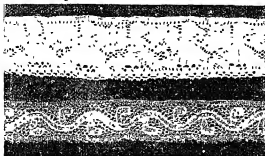


Fig 23—Peasant Lace from Crete
cordonnet is used in Valenciennes lace. Besides these distinctive classes of pillow-like laces, there are others in which

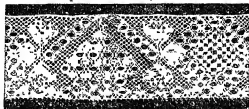


Fig 24—German Pillow-made Lace 18th century

equal ingenuity is displayed, though the character of the design remains primitive, as for instance in peasant laces from Crete (fig. 23), Russia, and Germany. Pillow lace making in Crete would seem to have arisen in consequence of Venetian intercourse with the island. The art is now said to be extinct. The laces were chiefly made of silk. The patterns in many specimens are outlined with one, two, or three bright-coloured silken threads. As a rule the motives of the Cretan lace patterns are traceable to orderly arrangement and balance of simple symmetrical and geometrical details, such as diamonds, triangles, and odd polygonal figures. Uniformity in character of design may be observed in many of the German and Russian laces, especially in respect of patterns like that shown in fig 24 and fig 25a. This sort of pattern is used in peasant laces of Sweden, in common French "torchon" laces, and in a lace made at Ripon in Yorkshire. The meshed grounds (*véseaux*) of the Chantilly silk laces were generally simple in character, as shown in fig 26.

Guyure.—This name, often applied to needlepoint and pillow laces, properly designates a kind of lace or "passemont" made with "cartisane" and twisted silk. "Cartisane" is a little strip of thin parchment or vellum, which was covered with silk, gold, or silver thread. *Guyure* was also made with fine wires whipped round with silk, and with cotton thread similarly treated. These stiff threads, formed into a pattern, were held together by stitches worked with the needle. Such work, which is very much dependent upon the ductile characteristics of the

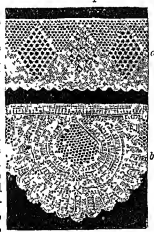


Fig 25—Russian Pillow Laces 19th century

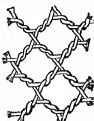


Fig 26

materials employed, is now called gump work. Gold and silver thread laces were usually made on the pillow.

Machine-made Lace.—We have already seen that a technical peculiarity in making needlepoint lace is that a single thread and needle are alone used to form the pattern, and that the button-hole stitch and other loopings which can be worked by means of a needle and thread mark a distinction between lace made in this manner and lace made on the pillow. For the process of pillow lace making a series of threads are in constant employment, plaited and twisted the one with another. A button-hole stitch is not producible by it. The machine does not attempt to make either a button-hole stitch or a regular plait. Up to the present, however ingenious may be the contrivances of design of all sorts of lace produced by the machine, an essential principle of the machine-made work is that the threads are merely twisted together. The only exception which could be made to this statement would be as regards the plaited lace made by the "dentelliers" already mentioned. The Leavers lace machine is that which is generally in use at Nottingham and Calais. French ingenuity has developed improvements in this machine whereby laces of delicate thread are made, but as fast as France makes an improvement England follows with another, and both countries virtually maintain an equal position in this branch of industry. The number of threads brought into operation in a Leavers machine is regulated by the pattern to be produced, the threads being of two sorts, beam or warp threads and bobbin or weft threads. Upwards of 8880 are sometimes used, sixty pieces of lace being made simultaneously, each piece requiring 148 threads—100 beam threads and 48 bobbin threads. The ends of both

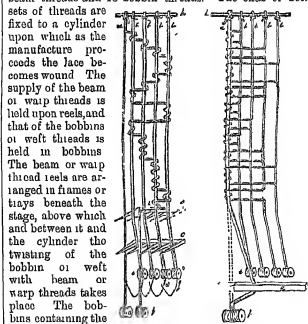


Fig 27

Fig 28

sets of threads are fixed to a cylinder upon which as the manufacture proceeds the lace becomes wound. The supply of the beam or warp threads is held upon reels, and that of the bobbins or weft threads is held in bobbins. The beam or warp thread reels are arranged in frames or trays beneath the stage, above which and between it and the cylinder the twisting of the bobbin or weft with beam or warp threads takes place. The bobbins containing the bobbin or weft threads are flattened in shape so as to pass conveniently between the stretched beam or warp threads. Each bobbin can contain about 120 yards of thread. By most ingenious mechanism varying degrees of tension can be imparted to warp and weft threads as required. The bobbins of the weft threads as they pass like pendulums between the warp threads are made to oscillate, and through this oscillation the threads twist themselves or become twisted with the warp threads. As the twistings take place, combs passing through both warp and weft threads compress the twistings. Thus the usual machine-made lace may generally be detected by its compressed twisted threads. Figs. 27 and 28 are intended

to show effects obtained by varying the tensions of weft and warp threads. For instance, if the weft, as threads *b, b, b, b* in fig. 27, be tight and the warp thread slack, the

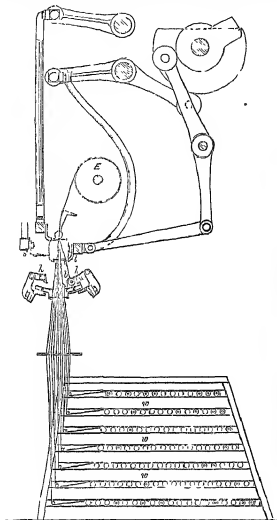


FIG. 29.—Section of Lace Machine

warp thread *a* will be twisted upon the weft threads. But if the warp thread *a* be tight and the weft threads *b, b, b, b* be slack, as in fig. 28, then the weft threads will

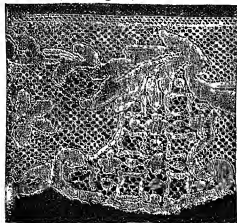


FIG. 30.—Pillow-made Lace Mechlin. Early 18th century
be twisted on the warp thread. At the same time the twisting in both these cases arises from the conjunction of movements given to the two sets of threads, namely, a movement from side to side of the beam or warp threads,

and the swinging or pendulum-like oscillations of the bobbin or weft threads between the warp threads. Fig. 29 represents a section of part of a lace machine. It is the cylinder or beam upon which the lace is rolled as made, and upon which the ends of both warp and weft threads are fastened at starting. Beneath are *w, w, w*, a series of trays or beams, one above the other, containing the reels of the supplies of warp threads, *c, c* represent the slide bars for the passage of the bobbin *b* with its

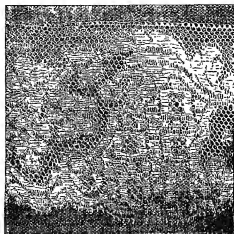


FIG. 31.—Machine-made Imitation of Mechlin Pillow Lace

thread from *l* to *l*, the landing bars, one on each side of the rank of warp threads; *s, s* are the combs which take it in turns to press together the twistings as they are made. The combs are so regulated that they come away clear from the threads as soon as they have pressed them together and fall into positions ready to perform their pressing operations again. The contrivances for giving each thread a particular tension and movement at a certain time are connected with an adaptation of the Jacquard

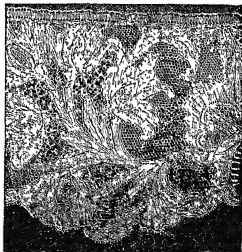


FIG. 32.—Venetian Point Lace, à réseau. 17th century.

system of pierced cards. The machine lace pattern drafter has to calculate how many holes shall be punched in a card, and to determine the position of such holes. Each hole regulates the mechanism for giving movement to a thread. Fig. 30 is a specimen of a Flemish pillow lace of the early 18th century. The meshes of the ground are variegated in appearance. A thread outlines the pattern. In fig. 31 it will be seen that the manufacturer has merely attempted to reproduce the pattern of the foregoing. His meshes are regular. No outlining thread marks the pattern, which, instead of being firm, like cambric, is ribbed. This steel-

men, recently made at Calais with a Leavers machine, is produced at a cost of 1s 3d. a yard, whilst the value of the original hand-made pillow lace is at least £1, 5s. a yard. Fig 33 is taken from a piece of fine needle-made lace (point de Venise à l'éseau). The flat and even appearance in the close portions (the *toile*) of the pattern, the slight thread (*cordonnet*) outlining the pattern, and the delicate fillings-in or motives of tacey work may be noted for comparison

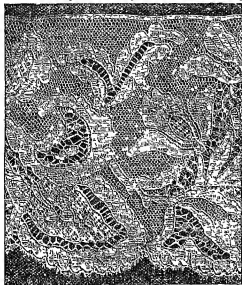


FIG 33 — Machine-made imitation of Venetian Point Lace, à l'éseau

with corresponding details in the machine-made imitation (fig 33). In this the close portions are ribbed, the *cordonnet* is stouter and stands in relief, and the tacey motives are simpler in composition.

Literature.—The literature of the art of lace making is considerable. The series of 16th and 17th century lace pattern-books, of which the more important are perhaps those by F. Vinciolo (Paris, 1557), Cesare Vecellio (Venice, 1592), and Isabella Cattaneo Pissarello (Venice, 1650), not to mention several kindred works of earlier and later date published in Germany and the Netherlands, supplies a large field for exploration. Recently Signor Ongania of Venice has published a limited number of facsimiles of the majority of such works. M. Alvin of Brussels issued a brochure in 1863 upon these patterns, and in the same year the Marquis Giuliano d'Aldia contributed two bibliographical essays upon the same subject to the *Gazette des Beaux Arts* (vol. xv p. 842 sq., and vol. xvi p. 421 sq.). In 1864 Cavaliero A. Merli wrote a pamphlet (with illustrations) entitled *Origine ed uso delle Trine a filo di seta*, Mons. F. de Valenciennes compiled a brief and rather fanciful *Histoire de la Dentelle* in 1848, in which he reproduced statements to be found in Diderot's *Encyclopédie*, subsequently quoted by Roland de la Platière. The first *Report of the Department of Art and Manufactures*, 1853, contains a "Report on Cotton Point Works and Lace Making" by Octavius Hudson, and in the first *Report of the Department of Science and Art* are some "Observations on Lace," with magnified representations of delicate shoeing stitches and points used in various lace. Mr. Hudson delivered two lectures, "On Lace made by Hand" in 1853. Reports upon the International Exhibitions of 1851 (London) and 1867 (Paris), by M. Aubry, Mrs. Palliser, and others, contain information concerning lace making. But the most important work first issued upon the history of lace making is that by the late Mrs. Bayly Palfrey (*History of Lace*, 1869, latest edition, 1875). In this work the history is treated rather from an antiquarian than a technical point of view, and wondrous accounts, inventories, state papers, fashionable journals, diaries, plays, poems, have been laid under contribution with surprising diligence. *The Queen's Lace Book*, an historical and descriptive account of the hand-made laces of all countries, published in London in 1874, relies for much of its data upon Mrs. Palliser's book, and contains some illustrations of excellent specimens of work. In 1875 the Arundel Society brought out a folio volume of permanently printed photographs taken from some of the finest specimens of ancient lace which were collected for the International Exhibition of 1874. These were accompanied by a brief history of lace, written from the technical aspect of the art, by Mr. Alan S. Cole. At the same time appeared a bulky imperial octo volume by M. Seguin, entitled *La Dentelle*, which is illustrated with woodcuts and fifty photo-typographical plates. M.

Seguin divides his work into four sections. The first of these is devoted to a sketch of the origin of lace, the second deals with pillow laces, bibliography of lace, and a review of sumptuary edicts, the third relates to needle-made lace, and the fourth contains an account of places where lace has been and is made, remarks upon commerce in lace, and upon the industry of lace makers. This method of treating the subject entails the repetition of numerous facts, and observations. Without sufficient conclusive evidence M. Seguin accords to France the palm for having excelled in producing the richer sorts of laces, which both before and since the publication of his otherwise valuable work have been identified as being Italian in origin. Descriptive catalogues are issued of the lace collections at South Kensington Museum, at the Science and Art Museum, Dublin, and at the Industrial Museum, Nuremberg. In 1881 a series of four Cantor Lectures on the art of lace making were delivered before the Society of Arts by Mr. Alan S. Cole, and have since been extracted from the journal of the society, and published in a pamphlet form, with illustrations. The latest work on the subject is a *Technical History of the Manufacture of Venetian Laces*, by G. M. Urbani de Ghelfo, with plates, translated by Lady Leyland, and published at Venice by Signor Ongania. *The History of Machine-wrought History and Lace Manufacture* (London, 1887), by Pollard, has already been referred to. There is also a technological essay upon lace made by machinery, with diagrams of lace stitches and patterns (*Technologische Studien am Sächsischen Erbsenigen, Leipzig*, 1878), by Hugo Fischer. (A. S. C.)

LACÉDÉMON. See LACONIA and SPARTA.

LACÉPÈDE, BERNARD GERMAIN ETIENNE DE LA VILLE, COMTE DE (1756-1825). French naturalist, was born at Agen in Guyenne, December 26, 1756. His education was carefully conducted by his father, and the early perusal of Buffon's *Natural History* awakened an interest in that branch of study, which for the remainder of his life absorbed his chief attention. His leisure he devoted to music, in which, besides becoming a good performer on the piano and organ, he acquired considerable mastery of composition, two of his operas, which, however, were never published, meeting with the high approval of Gluck, and in 1781-85 he also brought out in two volumes his *Poétique de la Musique*. Meantime he wrote two treatises, *Essai sur l'Electricité* (1781) and *Physique générale et particulière* (1782-84), which gained him the friendship of Buffon, who in 1785 appointed him sub-demonstrator in the Jardin du Roi, and proposed to him to become the continuator of his *Histoire Naturelle*. This continuation was published under the titles *Histoire des Quadrupèdes onivores et des Serpents* (2 vols., 1788-89) and *Histoire Naturelle des Reptiles* (1789). After the Revolution Lacépède became a member of the legislative assembly, but during the Reign of Terror he deemed it advisable to leave Paris, his life having become endangered by his disapproval of the massacres. When the Jardin du Roi was reorganized as the Jardin des Plantes Lacépède was appointed to the chair set apart to the history of reptiles and fishes, which he conducted with such success that in 1796 he was chosen a member of the Institute. Two years afterwards he published the first volume of *Histoire Naturelle des Poissons*, the 5th volume appearing in 1803, and in 1804 appeared *Histoire des Cétacés*. From this period till his death the part he took in politics prevented him from making any further contribution of importance to science. In 1790 he became a senator, in 1801 president of the senate, in 1803 grand chancellor of the legion of honour, in 1804 minister of state, and at the Restoration in 1810 he was created a peer of France. He died at Épinay, October 6, 1825. During the latter period of his life he wrote *Histoire générale physique et civile de l'Europe*, which was published posthumously in 18 vols., 1826. A collected edition of his works on natural history was published in the same year, and has been frequently reprinted. See ICHTHYOLOGY, vol. xii. p. 633.

LA CHALOTAIN, LOUIS RENÉ DE CARADEUC DE (1701-1785), representative of the French provincial parliaments in their struggles with Louis XV., was born at Rennes in Brittany, March 6, 1701. He entered with

keen vigour into the question of the suppression of the Jesuits, which began to be most openly mooted after the affair of Martinique; and as procureur général of the parliament of Brittany he submitted to the parliament in 1761 and 1762—the very heat of the conflict—two *Comptes Rendus des Constitutions des Jésuites*, which dealt the society some of the most powerful blows it had received since Pascal, and undoubtedly contributed largely to secure the edict of suppression in 1764. In the friends of the Jesuits La Chalotais had thus prepared for himself bitter enemies, and he was to feel their power in the events of the quarrel between the court and the parliaments. The breach between the estates of Brittany and the king, in which La Chalotais was more immediately concerned, originated in an order passed by Government that the voices of two of the three estates should bind the other, that is, that the clergy and citizens should control the landed proprietors. To this order, designed to secure the registration of certain fiscal edicts in spite of the proprietors, who formed a majority in the estates, and upon whom the taxes would fall most heavily, the opposition was marked by all the obstinacy of the Breton character. La Chalotais endeavoured to carry through a compromise, but at the same time animadverted somewhat acrimoniously upon the coercive efforts of the Duc d'Aiguillon, governor of Brittany, who already, as a supporter of the Jesuits, regarded the procureur with animosity. When the estates, therefore, absolutely refused to register the edicts, the court chose to regard La Chalotais as the moving spirit in the opposition, and in November 1765 he was arrested on a charge of having written certain anonymous and seditious letters to the king. No attention was paid to his protestations of innocence; and, when the parliament of Rennes tried to force matters to a crisis by resigning in a body, Louis merely appointed commissioners to sit as a new parliament and to try La Chalotais, with his son and some other magistrates who had been arrested at the same time. But the question had spread beyond Brittany; other provincial parliaments, and even the parliament of Paris, took it up; and the strife began to assume the ominous significance of one between the people and the crown. No lower tribunal ventured to pass sentences upon La Chalotais, and in 1769 the king, calling the case before himself in council, attempted to settle it in his own autocratic way: silence was imposed as to the future, oblivion as to the past; the innocence of the accused was acknowledged, but they were exiled from their province. Such a decision was no settlement. The parliament, now restored, accused the Duc d'Aiguillon of having suborned witnesses against La Chalotais, and, when he published memoirs retorting the charge, caused them to be burned by the hand of the common hangman. Maupeou, minister of the king, after vainly endeavouring to enforce the royal edict of silence, summoned the case before the parliament of Paris in 1770. That body, however, gave such unequivocal signs of favour to La Chalotais, that the king interfered and quashed the whole proceedings by a "bed of justice." The entire matter thus lay over so far as it affected the procureur, till the death of the king in 1774 allowed him to return to his official duties. La Chalotais died at Rennes, July 13, 1785.

Besides the *Comptes Rendus* and the *Discours sur les Jésuites* (three parts, 1766-67), written in prison, La Chalotais was the author of an *Essai d'Éducation Nationale* (1765), a work extravagantly praised by Voltaire. It was written in view of the disorganisation in matters educational that would follow the expected expulsion of the Jesuits from France.

LACHISH (לַחִישׁ), a town in the low country of Judah (Josh. xv. 39), and one of the strong fortresses that offered an obstinate resistance to Nebuchadnezzar (Jer. xxxiv. 7). It was to Lachish that Amaziah fled from the conspiracy

raised against him at Jerusalem, and there he was killed (2 Kings xiv. 19). From an obscure allusion in Micah i. 13 it would appear that the place was a chariot city. For this it was doubtless recommended by its position in the rich low country, and the same reason, together with the fact that it commanded the line of advances from Egypt, is sufficient to explain why it was the headquarters of Sennacherib during part of his Judean campaign (2 Kings xviii. 14; Isa. xxxvii. 8). The name of Lachish occurs on the monuments of Sennacherib, and a bas-relief now in the British Museum, representing the king receiving its spoils, is given in G. Smith's *History of Sennacherib* (1878). Lachish was recaptured by the Jews after the captivity (Neh. xi. 30), and the *Onomasticon* places it 7 miles from Eleutheriopolis on the southern road. The site has not been identified. Umm Lakis does not agree with the statement of the *Onomasticon*, and the name ("Mother of Ich") has no connexion with the Hebrew, while El Hasi, suggested by Conder, has still less to recommend it. As the cities in this district were built of brick, the ruins may probably have all but disappeared.

LACHMANN, KARL KONRAD FRIEDRICH WILHELM (1793-1851), a highly distinguished philologist and critic, was born March 4, 1793, at Brunswick, where his father held an appointment as preacher in the Andreas Kirche. In his eighth year he entered the Katherineum of his native town, where the strong bent of his vigorous mind towards philology and literature soon made itself unmistakably evident. In 1809 he passed to the university of Leipzig as a student of philology and theology; in the same year he transferred himself to Göttingen, where, under the influence of Heyne, his enthusiasm for philological pursuits almost completely extinguished his interest in theology; the pagan classics and particularly the Roman poets became his absorbing study. Stronger even than that of Heyne was the influence of Dissen over the young and rising scholar, who found additional intellectual stimulus in the companionship of such fellow students as C. K. J. Bunsen, Ernst Schultz, and C. A. Brandt. Under G. F. Benecke he also devoted himself to Italian and English, and ultimately to Old German. In 1815 he was led by the stirring political events of the day to interrupt his studious life and join the Prussian army as a volunteer chasseur, in this capacity he accompanied his detachment to Paris, but to his great regret never encountered the enemy. The regiment being disbanded he went to Berlin, where he became an assistant master in the Friedrich Werder gymnasium, and in the spring of 1816 he "habilitated" at the university. His thesis was published immediately afterwards, the subject being "The original form of the *Nibelungenlied*." Almost simultaneously appeared his edition of Propertius. The same summer he became one of the principal masters in the Fridericianum of Königsberg, where he assisted his colleague Karl Kopke with his edition of Rudolf von Monfort's *Barlaam und Josaphat* (1818), and also took part in the researches of his friend towards an edition of the works of Walther von der Vogelweide. In January 1818 he became professor extraordinary of classical philology in the university of Königsberg, where Lobeck also was; he at the same time began to lecture on Old German grammar and the Middle High German poets. In connexion with this task he devoted himself during the following seven years to an extraordinarily minute study of all that could be found, whether in print or in manuscript, relating to these subjects, and in the summer of 1824 he obtained leave of absence in order that he might search the libraries of Middle and South Germany for further materials. In February 1825 Lachmann was nominated extraordinary professor of classical and German philology in the university of Berlin;

in June 1827 he was promoted to the ordinary professorship in the same department; and in 1830 he was admitted a member of the Academy of Sciences. The remainder of his laborious and fruitful life as an author and a teacher presents no episode requiring special record. In January 1851 he was seized with an inflammatory affection of the left foot, to which he ultimately succumbed on March 13, 1851. See Hertz, *Karl Lachmann, eine Biographie* (Berlin, 1851).

Lachmann, who was the translator of the first volumes of P. E. Müller's *Engenheitslehre des Schandens von den Alterthümern*, published at Berlin in 1816, is a figure of considerable importance in the history of German philology (see Rudolf von Raumer, *Gesch. d. germanischen Philologie*, 1870). In his "*hahliatunsmacht*," on the *Nichtungsmacht*, and still more in his review of Hagen's *Abhandlungen* and Bencke's *Donnerstag*, contributed in 1817 to the *Jenaische Literaturzeitung*, he had already laid down the rules of text criticism and elucidated the phonetic and metrical principles of Middle High German in a manner which marked a very distinct advance in that branch of learned investigation. The rigour and exactness of his method became increasingly apparent in the *Auswahl aus den Hochdeutschen Dichtern des dreizehnten Jahrhunderts* (dedicated to Bencke, 1820), in the edition of Hartmann's *Isen* (the text being Lachmann's special care, while the explanatory notes are by Bencke, 1827), in those of Walther von der Vogelweide (1827) and Wolfram von Eschenbach (1833), in the papers "Ueber das Hildebrandelied," "Ueber althochdeutsche Betonung und Verskunst," "Ueber den Eingang des Parzivals," and "Ueber die Bräutigamsniederung niederdeutscher Gedichte," published in the *Abhandlungen* of the Berlin Academy, and in *Der Nibelungen Not mit der Klinge in der ältesten Gestalt mit den Anmerkungen der gemeinen Lesart* (1826), which was followed by a critical commentary in 1838. Lachmann's "Bemerkungen über die Ilias," first published in the *Abhandlungen* of the Berlin Academy in 1837 and 1841, in which he sought to show that the *Iliad* consists of sixteen independent "lays" variously enlarged and interpolated, have had considerable influence on modern Homeric criticism. See HOMER. His smaller edition of the New Testament appeared in 1831, 3d ed. 1846, the larger, in two volumes, in 1842-50 (*Novum Testamentum Graece et Latine* - *Cervinus Lachmannus recensuit, Philippus Buttmannus Graece lectioes auctoritates appendit*). The plan of Lachmann's edition, which has been explained by himself in the *Stud. u. Krit.* of 1830, is a modification of the unaccomplished project of Bentley. It seeks to restore the most ancient reading current in Eastern MSS. on the consent of the Latin authorities (Old Latin and Greek Western Unions) as the main proof of antiquity of a reading where the oldest Eastern authorities differ. Besides Propertius, Lachmann edited Catullus, 1839; Tibullus, 1839; Seneca, 1844; Terentianus Maurus, 1836; Babrius, 1846; Avianus, 1848; Gauc, 1841-43; the Agrippensens Romani, 1848-49; and Lucan, 1850. The last, which was the main occupation of the closing years of his life, from 1845, was perhaps his greatest achievement, and has been characterized by Mommsen as "a work which will be a landmark for scholars as long as the Latin language continues to be studied."

LA CONDAMINE, CHARLES MARIE DE (1701-1774), French geographer and mathematician, born at Paris, January 28, 1701, was trained for the military profession, but turned his attention to science and geographical exploration. He was a member with Godin and Bouguer of the expedition sent to Peru in 1735 to determine the length of a degree of the meridian in the neighbourhood of the equator (see vol. vi. 698), and on his homeward route made the first scientific exploration of the river Amazon. He returned to Paris in 1745, and published the results of his measurements and travels with a map of the Amazon in *Mém. de l'Académie des Sciences*, 1745 (English translation 1745-47). La Condamine continued to interest himself in metrical problems, and on a visit to Rome made careful measurements of the ancient buildings with a view to a precise determination of the length of the Roman foot. The journal of his voyage to the equator was published at Paris in 1751. He also wrote in favour of inoculation. He died February 4, 1774.

LAONIA, the Greek Λαονία, is the name generally applied in modern times to the country which occupied the south-eastern corner of the Peloponnese, often called Laedemon, Λαεδαίμων, which is the only name used in Homer. The history of the district has already been given (see

GREKOR), and it only remains to give a slight sketch of its physical features. These are very peculiar, and had great influence in producing the marked and distinctive character of the section of the Dorian race which occupied Laonia throughout the historical period. The country is a deep valley almost completely surrounded by mountains, and it is the general opinion that both names, Laonia and Laedemon, refer to this hollow sunken character, being connected with *laos*, *laikos*, &c. The mountains of Arcadia shew in this valley on the north, and from them two parallel chains of mountains stretch down bounding the valley on the east and on the west. The eastern chain bore in ancient times the name Taygetos, the western, Parnon; both ridges stretched far out into the sea, forming respectively the promontories of Taenarus and Maleas. Taygetus, now called Pentadaktylon, is a splendid unbroken chain of lofty peaks, well deserving its Homeric epithet *πεντάκροτος*, the highest point is the ancient Taiston, now St Elias, 7900 feet high. Mount Parnon is not such a fine ridge, but still forms a strong barrier along the sea-coast. Through the whole length of the valley from north to south flows the river Eurotas, which has only one tributary of any consequence, the Oenai. The soil was not remarkably fertile, except in the low ground towards the sea; but the sides of Taygetus were covered with dense forests which afforded excellent sport to the inhabitants of the plain. The people were thus inured to the hardy life of mountaineers; they were so securely defended by nature against invasion that the vicious Epaminondas hesitated to attack the country; while with command of the passes they could at any time invade the neighbouring countries. Over Mount Taygetus there was hardly any pass practicable for an army; from Arcadia there were only two entrances, both easily defended, one by the course of the Oenai, the other by the Eurotas. Mount Parnon stretched along the east coast, which offered no harbour, hardly even a landing place, for foreign ships. While adding to the security of the country, the same causes isolated it greatly from intercourse with other peoples, tended to keep the inhabitants backward and to prevent education, and led to that jealous and exclusive character which distinguished the Laedemonians.

LAORDAIRE, JEAN BAPTISTE HENRI (1802-1861), French orator, was born at Rebecy-sur-Ource, Côte d'Or, 12th March 1802. He was the second of a family of four, the eldest of whom travelled a great deal in his youth, and subsequently occupied the chair of comparative anatomy at Liège, from which he contributed some valuable treatises on entomology. For several years Laordaire studied at Dijon, showing a marked talent for rhetoric; this naturally led him to the pursuit of law, and in the local debates of the advocates he attained a high celebrity. At Paris he for a time thought of going on the stage, but was induced to finish the course, and, having done so with credit, applied himself for eighteen months with much success to the consideration of briefs. Meanwhile a great change was passing over his convictions. Lamennais had published his *Essai sur l'Indifférence*,—a passionate vindication of belief as against the tolerant contempt of a generation which regarded truth and falsehood in every department of life with equal complaisance, a demonstration of the weakness of individual reason and an assertion of the rightful supremacy of a central religious authority. Laordaire read and was convinced. His ardent and believing nature was weary of the theological negations of the Encyclopedists. He was impelled towards a delictal explanation of the universe, from which in turn he went on to Catholicism as the only faith calculated to keep society from disintegration. In 1828 he became a theological student at the seminary of Saint Sulpice; four years later

he was ordained and became almoner of the college of Henry IV. He was called from it to co-operate with Lamennais in the editorship of *L'Avenir*, a journal established for the purpose of advocating the union of the democratic principle with ultramontanism. To be a Catholic was to be a royalist in the popular definition; Lacordaire strove to show that Catholicism was not bound up with the idea of dynasty, and definitely allied it with a well-defined liberty, equality, and fraternity. But the new propagandism was denounced from Rome in an encyclical. In the meantime Lacordaire and Montalembert, believing that, under the charter of 1830, they were entitled to liberty of instruction, opened an independent free school and began to teach in it. It was closed in two days, and the teachers fined before the court of peers. These reverses Lacordaire accepted with quiet dignity; but they brought his relationship with Lamennais to a close. He now began the course of Christian conferences at the Collège Stanislas, which attracted the art and intellect of Paris, thence he went to Notre Dame, and for two years his sermons were the delight of the capital. His presence was dignified, his voice capable of indefinite modulation, and his gestures animated and attractive. He still preached the gospel of the people's sovereignty in civil life and the pope's supremacy in religion, but brought to his propagandism the full resources of a mind familiar with philosophy, history, and literature, and indeed led the reaction against Voltairian scepticism. He was asked to edit the *Univers*, to take a chair in the university of Louvain, but declined both appointments, and in 1836 set out for Rome, reviving a great scheme for Christianizing France by restoring the old order of St Dominic. At Rome he prepared himself for the life of the new brotherhood, donning the habit of the preaching friar and joining the monastery of Minerva. His *Mémoire pour le rétablissement en France de l'ordre des frères prêcheurs* was then prepared and dedicated to his country; at the same time he collected the materials for the life of his avowed master, St Dominic. But he did not return to France until 1841, when he resumed his preaching at Notre Dame, and was successful in re-establishing the order of which he ever afterwards called himself monk. His funeral orations are the most notable in their kind of any delivered during his time, those devoted to the death of Dronot and O'Connell being especially predominant in the qualities of point and clearness. He next thought that his presence in the Assembly would be of use to his cause; but he remained there only a short while, finding the true field of his influence to be the pulpit. Many popular movements he advocated with the fervour of high conviction. In 1860 he went back to Rome and was made provincial of the order, and for four years laboured to make the Dominicans a religious power. In 1864 he retired to Sorèze to become director of a private lyceum, and remained there in self-chosen obscurity until he died, 22d November 1861.

LACQUER, or **LACKER**, in general terms may be said to be coloured and frequently opaque varnishes applied to certain metallic objects and to wood. The term is derived from the resin lac, which substance is the basis of lacquers properly so called. Technically, among Western nations, lacquering is restricted to the coating of polished metals or metallic surfaces, such as brass, pewter, and tin, with prepared varnishes which will give them a golden, bronze-like, or other lustre as desired. Of the numerous recipes for the preparation of the various lacquers, the following for a gold lacquer for brass work may be taken as a sample:—shell-lac 8 oz., sandarach 2 oz., turmeric 8 oz., annatto 2 oz., dragon's blood $\frac{1}{2}$ oz., dissolved in 1 gallon of rectified spirit. Throughout the East Indies the lacquering of wooden surfaces is universally practised, large articles

of household furniture, as well as small boxes, trays, toys, and papier mâché objects, being decorated with bright-coloured and variegated lacquer. The lacquer used in the East is, in general, variously coloured sealing-wax, applied, smoothed, and polished in a heated condition, and by various devices intricate marbled, streaked, and mottled designs are produced. Quite distinct from these, and from all other forms of lacquer, is the lacquer work of Japan. The source and nature of the raw material of Japanese lacquer has been referred to under **JAPANIKO**, and there also will be found some allusion to its extraordinary durability and resistance to all ordinary solvents. Not less extraordinary is the manipulative skill shown by the Japanese in this kind of work, and the variety and exquisite perfection of its decorative treatment, which all go to place Japanese lacquer of high quality among the rarest and most prized treasures of decorative art. In the preparation of Japanese lacquer work the wooden object to be treated is first coated with several layers of raw lacquer mixed with brick dust, &c., which, when hardened, are smoothed with gritty stone. A few layers of common or inferior varnish of the colour desired in the finished object are then successively added. After each coating the objects are placed to dry in an enclosed box, the sides of which are kept moist with water, so that hardening takes place in a dark damp atmosphere. The final coating is composed of the best quality of lacquer, and it is smoothed with great care and polished with powdered deer horn. The brilliant smooth polish of plain black lacquer is brought up by repeated thin rubbings over with uncoloured lacquer and polishes with deer horn. Such are the elaborate processes used for entirely unornamented lacquer; but most Japanese work is enriched with decorations which introduce an endless variety of treatment and much more complex, tedious, and costly processes of operation. Flat work, variously coloured and speckled, ornamented with gilt patterns, is among the simplest of the artistic lacquer productions of Japan. Relief or raised lacquer work, on the other hand, is a most elaborate and costly production, the labour of months and even years being expended on the preparation of fine high-relief examples. The raised designs are produced with a mixture of red oxide of iron and lacquer repeatedly applied till the desired elevation is attained, the form of the raised surface being carefully modelled and controlled between successive applications by rubbing and grinding with charcoal powder. Metallic powders—gold, silver, bronze, &c.—are applied with the final coat while the work is still in a viscous condition, and these sinking into the lacquer produce a strongly adherent surface with a fine subdued metallic lustre. Other methods of ornamental treatment consist of inlaying and incrusting the lacquer with mother of pearl, ivory, gold, bronze, or tinfoil. A great variety of decorative effect may be thus produced, but lacquers so treated are not held in the same high esteem as the raised or even the flat varieties. Thin sections of the substance to be inlaid are placed on the surface of a freshly coated and yet "tacky" object, and imbedded by the repeated applications of additional coatings; the surface is then rubbed and reduced till the inlay and lacquer form one smooth continuous surface. Relief incrustations are managed in an analogous manner, the lacquer being smoothed and polished around the incrustated object or pattern. Lacquer is also ornamented by carving, a style mostly applied to red lacquer, although it is also occasionally done in black and other dark colours. This method of treatment has been introduced from China, where red carved lac or Peking lac is a characteristic ornamental substance.

LACRETELLE, **CHARLES DE** (1766-1865), historian and journalist, was born at Metz. Shortly before the

Revolution he was introduced to some of the constitutional leaders, and soon joined the staff of the *Moniteur*, and the *Débat*, then he became secretary to the Duc de la Rochefoucauld-Liancourt. He returned to journalism and joined Chénier and Boucher on the *Journal de Paris*. The triumph of the Jacobins was not without danger for him, and to avoid it he enlisted in the army, but after Thermidor returned once more to Paris and to newspaper work. The 13th Vendémiaire again drove him from both, and he took to serious composition. He had more than one fluctuation of fortune of the same kind still to undergo, and was actually imprisoned for a considerable time, but continued his historical work, to which after the establishment of Napoleon's power he wholly devoted himself. He became a member of the Academy in 1811, and professor of history in the Parisian faculty of literature next year. The Restoration pleased him from the constitutional point of view, and after it the July monarchy. In 1848 he retired to Mâcon, where he died seven years later. Lacretelle's chief work is a series of histories of the 18th century, the Revolution, and its sequel (*Eighteenth Century*, 1808; *Revolution*, 1821-26; *Consulate and Empire*, 1840; *Restoration*, 1846). He had previously given a *Précis Historique* of the Revolution (1801-6). Mr Carlyle's sarcastic remark on Lacretelle's *History of the Revolution* that it "exists but does not profit much" is partly true of all his books. The author was a moderate and fair-minded man, but possessed neither great powers of style, nor striking historical insight, nor the special historian's power of uniting minute accuracy of detail with breadth of view. If his history of the 18th century deserves to be singled out from his other books, it is chiefly because no exact successor to it has appeared. Besides the works mentioned, he also wrote a *History of the Religious Wars*, some sketches of his personal adventures in the Revolution, &c. As a journalist, if not as an historian, Lacretelle was not scrupulous about absolute accuracy. The legend of the Abbé Edgeworth's last words to Louis XVI. has been traced to him.

LACROSSE is the national ball game of Canada, as cricket is of England and base ball of the United States of America. The aborigines had the game before the discovery of the New World, and different Indian tribes played it in different manners, generally with much roughness and violence. The present name was given it by French Canadians, owing to the resemblance of the curved netted stick, the chief implement used in the pastime, to a bishop's crozier or *crosse*. As whites men gradually took up the game it became more refined. In 1867 the National Lacrosse Association of Canada was formed, and drew up a recognized code of rules. Lacrosse cannot be aptly compared to hockey or football, since striking or even touching the ball with the hands or feet is inadmissible. The *crosse* somewhat resembles a racket bat. It is a stick with one end curved, and the hook so formed is fitted with network, which must not bag. The ball is of indiarubber, from 8 to 9 inches in circumference. The other requisites are a level piece of turf, about 200 by 100 yards, and the goals. These may be any distance apart, according to agreement and the space available. Each goal is composed of two flag posts, 6 feet high and a like distance apart. The usual number of players is twelve on each side, and the captains station them somewhat as in football. A game is scored by one side driving the ball between their opponents' goal posts, and a match is three games out of five. There is no "off side" as in football, and the chief test of the player is to catch the ball on the network of the *crosse*, dodge his opponents by running as far as practicable, and then throw the ball to one of his own side who is nearer the enemy's goal. A game is commenced by the ball being placed on the ground midway

between the two goals and a player from each side "facing" it with the *crosse* till one of them succeeds in sending it on the way to the opposite goal. After each game goals are changed. During winter the game is played by skaters on the ice, or on the snow with the aid of snow shoes. A native Indian team introduced the pastime into England in 1867; several amateur clubs were formed; and a set of rules was drawn up by an English Lacrosse Association on February 12, 1868. They differ somewhat from the Canadian regulations,—the goal posts being 7 feet apart with a tape across the top, and a match being decided by the number of goals won during a specified time. The pastime, however, never took deep root in England, so many other old established games of ball being more popular, and is now but little practised.

LACROSSE, chief city of La Crosse county, Wisconsin, United States, is situated on the east bank of the Mississippi, at the confluence of the Black and La Crosse rivers, 196 miles by rail west-north-west of Milwaukee. La Crosse is the second commercial city and the fourth in the scale of population in the State. An extensive lumbering trade is carried on by means of the Black river. The city contains foundries, machine-shops, saw-mills, flour-mills, shipbuilding yards, and manufactories of agricultural implements, beer, and leather. It has 3 English dailies and 5 weekly newspapers (2 English, 2 Norwegian, 1 German), 20 churches, and a public library containing 3300 volumes. La Crosse became a city in 1856. The population in 1880 was 14,505.

LACRYMATORY, a modern word employed to describe a class of small vessels of terra-cotta, or, more frequently, of glass, found in Roman and late Greek tombs, and fancifully supposed to have been bottles into which mourners dropped their tears. They were used to contain unguents, and it is to the need of unguents at funeral ceremonies that the finding of so many of these vessels in tombs is due. They are shaped like a spindle, or a flask with a long small neck and a body in the form of a bulb.

LACTANTIUS FIRMIANUS, also called Lucius Caelius or Lucius Caelius Lactantius Firmianus, was a Christian writer who from the beauty of his style has been called the "Christian Cicero." His history is very obscure. His very name is doubtful; his birthplace, whether in Italy or in Africa, is uncertain; it is impossible to say with any accuracy when his writings were published; and the date of his death is unknown. His parents were heathens; he was a pupil of Arnobius in Sica in Africa, he went to Nicomedia in Bithynia while Diocletian was emperor to teach rhetoric, but found little work to do in that Greek-speaking city; he became a convert to Christianity, probably late in life; and about ten or twelve years before his death (312-318) he went to Gaul on the invitation of Constantine the Great, and became tutor to his eldest son Crispus. These facts, with his writings, are all that is known about Lactantius. His chief work *Divinarum Institutionum Libri Septem* is a long introduction to Christianity, written in exquisite Latin, but displaying such ignorance as to have incurred the charge of favouring the Arian and Manichean heresies. The date of publication has been variously given from 302 to 323 A.D. One sentence seems to say that a persecution, which can scarcely be any other than the Diocletian, was raging while the book was being written (v. 17, 6); whilst in the first, second, fourth, and fifth books Constantine is addressed as emperor. Those who assert the earlier date of publication point out that the references to Constantine are omitted in several MSS. Others adopt the conjecture of Baluze that an early edition was published in Nicomedia and a later twenty years afterwards (*cf.* Ebert, *Ueber den Verfasser des Buches De Mort. Persecut.*, p. 129 *sq.*). The seven books

of the institutions have separate titles given to them either by the author or by a later editor. The first, *De Falsa Religione*, and the second, *De Origine Erroris*, attack the polytheism of heathendom, show the unity of the God of creation and providence, and try to explain how men have wandered from truth into polytheistic error. The third book, *De Falsa Sapientia*, describes and criticizes the various systems of prevalent philosophy, showing how baseless and contradictory they are. The fourth book, *De Vera Sapientia et Religione*, insists upon the inseparable union of true wisdom and true religion, and maintains that this union is made real in the person of Christ. The fifth book, *De Justitia*, maintains that true righteousness is not to be found apart from Christianity, and that it springs from piety which consists in the knowledge of God. The sixth book, *De Vero Cultu*, describes the true worship of God, which is righteousness, and consists chiefly in the exercise of Christian love towards God and man. The seventh book, *De Vita Beata*, discusses, among a variety of subjects, this chief good, immortality, the second advent, and the resurrection. Jerome tells us that Lactantius wrote as epitomes of these *Institutiones*, and such a work was discovered in the royal library at Tain in 1713 by C. M. Plaff; it is doubtful, however, whether this MS is the epitome of Lactantius. Besides the *Institutiones*, Lactantius wrote a treatise, *De Ira Dei*, addressed to one Donatus and directed against the Epicurean philosophy; an argument for the wisdom and goodness of God as exhibited in the creation and preservation of the world, *De Opificio Dei sive de Formatione Mundi*, and a very celebrated treatise *De Mortibus Persecutorum*, which describes God's judgments on the persecutors of his church from Nero to Diocletian, and has served as a model for numberless subsequent writings of a like nature. *De Mort. Persecut.* is not included in the earlier editions of Lactantius; it was discovered and printed by Baluze in 1679. Many critics do not believe it to be the work of our author, and ascribe it to an unknown Lucius Caelius (see the work of Ebert above quoted). Jerome speaks of Lactantius as a poet, and several poems have been attributed to him:—*De Phenice*, *Symposium*, *De Pascha ad Felicem Episcopum*, and *De Passionis Domini*. It is extremely probable that all these are the productions of a much later age.

MSs of Lactantius are very numerous, a very complete catalogue of these and of the earlier printed editions will be found in Le Brun and Lenglet Dufresnoy's edition, 3 vols. Paris, 1746. The best editions besides Dufresnoy's are those of Walch, Leipzig, 1716; of Blassmann, Leipzig, 1799; and in Migne's *Patrologia Latina*, vols. vi. and vii. A new edition is promised in the *Vienna Corpus Script. Eccles. Latin.*

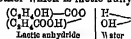
LACTIC ACID, a chemical term, which, though originally invented to designate the particular acid contained in sour milk, has now, through the discovery of other acids isomeric with and very similar to that acid, acquired a generic, in addition to its original specific, meaning.

1. *Lactic Acid properly so called, Fermentation Lactic Acid, Ethylidene Lactic Acid*.—Scheele (*Transactions of Stockholm Acad.*, 1780) was the first to isolate this acid (from sour milk) and establish its individuality. About twenty-four years later Bouillon Lagrange, and, independently of him, also Fourcroy and Vauquelin maintained that Scheele's new acid was nothing but impure acetic. But this notion was combated by Berzelius, and finally refuted (in 1833) by Liebig and Mitscherlich, who by the elementary analyses of lactates proved the existence of this as a distinct acid.

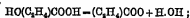
In the article **FERMENTATION** (vol. ix. p. 97) it is explained how lactic acid is produced from milk-sugar and from ordinary glucose by "lactic fermentation." The most convenient process for the preparation of the acid is Bénédict's. A solution of "invert-sugar" (see vol. ix. p. 86) is produced by dissolving 8 parts of cane-sugar and $\frac{1}{10}$ th part of tartaric acid in 95 parts of boiling

water and allowing to stand for two days. There is then added $\frac{1}{10}$ th part of foul cheese, 8 parts of sour milk, and 24 parts of carbonate of zinc, and the mixture kept at 46° to 46° C for eight to ten days. The sugar, $C_6H_{12}O_6$, ferments into lactic acid, $C_3H_5O_2$, which, by the carbonate present, is converted into lactate of zinc. But part of the lactate is irreversibly lost through "butyric fermentation" with evolution of hydrogen, which latter converts part of the sugar into mannite, $C_4H_8O_4$. The fermented liquid is heated to boiling, strained clear, and allowed to cool, when the lactate of zinc separates out in crystalline crusts, which are purified by recrystallization from hot water. The free acid is obtained by decomposing the hot aqueous solution of the salt with sulphurated hydrogen and filtering off the sulphide of zinc. The filtrate is evaporated on a water bath to a syrup, which is treated with ether. Mannite and other impurities remain, and the acid passes into the filtrate, from which the ether is easily expelled by distillation, and subsequent evaporation in an open basin. What ultimately remains is a thick colorless syrup, which, in ordinary chemical parlance, goes as *lactic acid*, although it is at best only an approximation to the hydrate, $C_3H_5O_2 \cdot H_2O$. The extra H_2O is easily enough removed by continued evaporation, but no portion of it can be thus got rid of without the acid $C_3H_5O_2$ itself suffering dehydration into *lactic anhydride*, $C_3H_4O_2$, and *lactide*, $C_6H_8O_4$, by successive subtractions of H_2O from $2C_3H_5O_2$.

The behaviour of lactic acid solution to basic reagents and of the acid itself to alcohols (in the presence of dehydrators) is strictly that of a monobasic acid $C_3H_5O_2$, i.e., so much lactic acid is strictly equivalent to one molecule of acetic acid, and as the latter is proved to be CH_3COOH , lactic acid must be assumed to be $(C_3H_5O_2)COOH$. But the radicle $C_3H_5O_2$ (unlike the CH_3 of acetic acid) still contains one hydrogen atom, which, although not replaceable by metals, can be replaced by acid radicles such as acetyl $C_2H_3O_2$ or, conjointly with the oxygen atom, by Cl , Br , I . Thus, for instance, lactic ether, $(C_3H_5O_2)COOC_2H_5$, when treated with chloride of acetyl, $C_2H_3O_2Cl$, gets converted into acetyl-lactic ether, $[C_2H_3O_2(C_3H_5O_2)O]COOC_2H_5$, with formation of hydrochloric acid. By the action of hydrochloric acid the same H conjointly with the O of the radicle is replaced by iodine with formation of water. In a word, lactic acid, besides being as acid and analogous to, for instance, acetic acid, CH_3COOH , is at the same time an alcohol analogous to ordinary spirit of wine, C_2H_5OH , as shown by the formula $HO-C_3H_4-COOH$. This twofold character of our substance explains the readiness with which it passes into anhydrides. Lactic acid the acid acts upon lactic acid the alcohol; the replaceable H in the former unites with the OH of the latter, and the two tests combine into an ether which is lactic anhydride. Thus:—

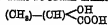


The slanting lines show the mode of combination after the reaction. The anhydride, as we see, still contains an OH and $COOH$, and a repetition of the group within its molecule leads to lactide, $C_6H_8O_4$. This latter body could be presumed to be formed from one molecule of lactic acid:



but this vapour density determination proves the molecular weight to be in accordance with the larger formula $C_6H_8O_4$.

Admitting, as well we may, that lactic acid is a compound of $COOH$ and OH with C_3H_4 , what is this C_3H_4 , itself? This question has been satisfactorily answered. While lactic acid is distilled rapidly, it breaks up into formic acid, $HCOOH$, and aldehyde, $(CH_2)COH$. Conversely when aldehyde is treated with hydrocyanic acid and muriatic acid it is converted into lactic acid, in two steps, thus: (1) the $O-H$ in the aldehyde combines with the (NOH) , the H going to the O and the (NO) by its O to the C , to form the group $(NO)-C-O-H$; and (2) the NO of this group, by the action of the water, gets converted into a $COOH$, with formation of NH_3 , which combines with the muriatic acid. $NC + 2H_2O = NH_3 + COOH$. The (CH_2) and H in the original aldehyde retain their places, so that what we obtain ultimately must be



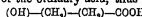
and this consequently is the structure of lactic acid. The radicle

($\text{CH}_2\text{=CH}$) is called ethylidene, to distinguish it from "ethylene," which is ($\text{CH}_2\text{)}_2$.

3 *Paralactic* or *Sarcolactic Acid*.—This acid was discovered by Berzelius in the juices of flesh. It is almost identical with ordinary lactic, but differs from it in this that it (and its salts) turn the plane of polarized light, and also in this that the sarcolactates in general are more readily soluble than ordinary lactates, and contain different proportions of crystal water from these. Thus, for instance, we have for the zinc salts

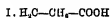
Ordinary	Sarco-
$\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 8\text{H}_2\text{O}$.	$\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$.
Soluble in 60 parts of cold and in 6 parts of boiling water.	Soluble in 17 parts of cold water

The isomerism of the two acids used to be explained by assuming that the sarco-acid contained ethylene in lieu of the ethylidene of the ordinary acid, thus—

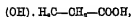


i.e., that the OH and COOH were attached to different carbon atoms. But this has been proved by Erlenmeyer to be a mistake. The sarco acid has precisely the same structure as ordinary lactic acid. It is a case of absolute (i.e., of unexplained) isomerism.

3 *Hydracrylic Acid*.—From glyceric acid by the action of hydriodic acid we obtain β -iodopropionic, which, when treated with water and oxide of silver, exchanges its iodine for OH.



gives



which is hydracrylic, an ethylene-lactic acid. That this really is so was proved by Erlenmeyer, who obtained it by the action of water (+HCl) on undoubted ethylenecyanhydride ($\text{OH}-(\text{C}_2\text{H}_2)-\text{CN}$). As suggested by the formula, it differs markedly in its reactions from the two more properly so-called lactic acids.

All lactic acids, when heated with hydriodic acid in sealed-up tubes, pass ultimately into (the same) propionic acid, ($\text{CH}_3-(\text{CH}_2)-\text{COOH}$). (w. d.)

LADAK AND BALTI The name *Ladak* (pronounced in Tibetan *Lata*) belongs primarily to the broad valley of the upper Indus in West Tibet, but includes several surrounding districts in political connexion with it, the present limits are between $75^\circ 40'$ and $80^\circ 30'$ E. long., and between $32^\circ 25'$ and 36° N. lat. It is bounded N. by the Kuen-lun range and the slopes of the Karakorum, N.W. and W. by the Mussulman state of Balti or Little Tibet, S.W. by Kashmir, S. by British Himalayan territory, and E. by the Chinese Tibetan provinces of Ngari and Rndok.¹ The whole region lies very high, the valleys of Rndok in the south-east being 15,000 feet, and the Indus near Lé 11,000 feet, while the average height of the surrounding ranges is 19,000 feet. The proportion of arable and even possible pasture land to barren rock and gravel is very small.

The natural features of the country may be best explained by reference to two native terms, under one or other of which every part is included, viz. *changtang*, i.e., "northern, or high plain," where the amount of level ground is considerable, and the hills proportionally further apart; and *rong*, i.e., "deep valley," where the contrary condition prevails. The former predominates in the east, diminishing gradually westwards. There, although the vast alluvial deposits which once filled the valley to a remarkably uniform height of about 15,000 feet have left their traces on the mountain sides, they have undergone immense denudation, and their debris now forms secondary

deposits, flat bottoms, or shelving slopes, the only spots available for cultivation or pasture. These masses of alluvium are often found either metamorphosed to a sub-crystalline rock still showing the composition of the strata, or simply consolidated by lime.

Grand scenery is exceptional, for the valleys are confined, and from the higher points the view is generally of a confused mass of brown or yellow absolutely barren hills, of no great apparent height. The parallelism characteristic of the Himalayan ranges continues here, the direction being north-west and south-east. A central range divides the Indus valley, here 4 to 8 miles wide, from that of its north branch the Shayok, which with its fertile tributary valley of Nubra is again bounded on the north by the Karakorum. This central ridge is mostly syenitic gneiss, and north-east from it are found, successively, Silurian slates, Carboniferous shales, and Triassic limestones, the gneiss recurring at the Turkestan frontier. The Indus lies along the line which separates the crystalline rocks from the Eocene sandstones and shales of the lower range of hills on the left bank, the lofty mountains behind them consisting of parallel bands of rocks from Silurian to Cretaceous.²

There are several lakes in the east districts at about 14,000 feet. They have evidently been of much greater extent, and connected with the river systems of the country, but they are now mostly without outlet, saline, and in process of desiccation.

The climate is intensely dry, practically rainless, the little snow which falls soon disappearing;³ above a certain height no dew is deposited. The altitudes of temperature are great; the sun's direct rays are hotter than in the Indian plains,⁴ while the afternoon winds are piercingly cold, except in summer it freezes every night, even in the lower districts, and nightly throughout the year at 15,000 feet.

Vegetation therefore is confined to valleys and sheltered spots, where a stunted growth of tamarisk and *Myrica*, *Hippophae* and *Elaeagnus*, furze, and the roots of *Berberis*, a salsolaceous plant, supply the traveller with much-needed firewood. The trees are the pencil cedar (*Juniperus procera*), the poplar and willow (both extensively planted, the latter sometimes wild), apple, mulberry, apricot, and walnut. Agriculture depends on irrigation, which is skillfully managed, the principal products being wheat, common and naked barley (from which the returns are usually small), millet, buckwheat, peas, beans, and turnips. Lucerne and prongoes (an umbelliferous plant) are used as fodder.

Among domestic animals are the famous shawl goat, two kinds of sheep, of which the larger (*kuniya*) is used for carrying burthens, and is a principal source of wealth, the yak, and the dzo, a valuable hybrid between the yak and common cow. Among wild animals are the kyang or wild ass, ibex, markhor, antelope, *Ovis Poli*, marmot, hare, and other Tibetan fauna.

The capital, Lé (population 4000), lies 4 miles from the river on the right bank, 11,540 feet above the sea, at the southern base of a spur from the central range,—a terraced slope, with scattered hamlets, extending thence to the Indus. It contains the palace of the old gyalpoes, an imposing structure seven stories high, and a wide basar where polo is played. It is surrounded by poplar plantations, with manis⁵ and ch'hortens⁶ beyond. The houses

¹ Here, in the Zanekar, as the name implies, copper is found.

² The average height of the snow-line is about 15,000 feet.

³ General records 16° in Bengal, i.e., only 2° below boiling point at that altitude.

⁴ "Mani," a long stone wall, several feet high, running along the roadsides, covered with loose stones deposited by the passes-by, inserted with the prayer or ejaculation, "One manu padme hom."

⁵ Ch'hortens, "the monumental tomb of a lama."

¹ Geographically the east boundary is a mountain ridge some way within Chinese territory, which, running north, is the watershed between East and West Tibet, and from the north part of which the Indus, from the south the Sutlej, takes their rise.

are usually two-storied, with flat roofs and balconies to the south or west, the doors and shutters striped red and white.

The numerous monasteries are built (as the houses used to be, for defence) in lofty and picturesque situations, and would be strategically strong but for the absence of water. They are supported partly by their own lands, but chiefly by liberal gifts from the peasantry, with whose interests the lamas identify themselves. The latter are hospitable, and their superiors often refined, intelligent, and genial.

The religion is Buddhist, chiefly of the Dupa or Red sect, but traces of an older faith linger, to which the masked dances of the monks may possibly be referred. Mohammedanism, previously on the increase, is discouraged by the Kashmir Government, its Hindu influence tending, as Hinduism has done in Nepal, to introduce caste ideas.

Polyandry is general, except among the rich.

The home trade is worth little over £4000, the chief exports are wool, dried fruits, salt, and small quantities of gold, borax, and sulphur; the chief imports, provisions, hardware, and tea; but the transit trade is relatively very important, the chief routes from the Punjab, Afghanistan, and Kashmir into Eastern Turkestan and Chinese Tibet all passing through Ladak. It is carried by coolies, or on ponies, sheep, or yaks, over difficult passes often 18,000 feet high, and is further hampered by the exclusive policy of China and Russia. The mechanical and political obstacles have long engaged the attention of the Indian Government.

History.—The earliest notice of Ladak is by the Chinese pilgrim Fa-hien, A.D. 405, who, travelling in search of a purer faith, found Buddhism flourishing there, the only novelty to him being the pnyer-cylinder, the efficacy of which he declares is incredible. Ladak formed part of the Tibetan empire until its disruption in the 10th century, and since then has continued ecclesiastically subject, and sometimes tributary, to Lhasa. Its inaccessibility saved it from any Muselman invasion until 1630, when Sultan Saad of Kashmir marched an army across the Karakoram, one division fighting its way into Kashmir and wintering there. Next year they invaded eastern Tibet, where nearly all perished from the effects of the climate.

Early in the 17th century Ladak was invaded by its Mohammedan neighbours of Balti, who plundered and destroyed the temples and monasteries, and again, in 1686-88, by the Sikhs or Calmucks, who were expelled only by the aid of the lieutenant of Auranzeb in Kashmir, Ladak thereafter becoming tributary. The gyalpo or king then made a nominal profession of Islam, and allowed a mosque to be founded at Ld, and the Kashmiris have ever since addressed his successors by a Mohammedan title. When the Sikhs took Kashmir, Ladak, dreading their approach, offered allegiance to Great Britain. It was, however, conquered and annexed in 1841 by Ghalub Singh of Jammu—the muwarliko Ladakis, even with native fighting on their side, and against indifferent generalship, being no match for the Dogra troops. These next turned their arms successfully against the Baltis (who in the 18th century were subject to the Mogals), and were then tempted to revive the claims of Ladak to the Chinese provinces of Kinkok and Sngari. This, however, brought down an army from Lhasa, and after a three days' fight the Ladak force was almost annihilated—chiefly indeed by frostbite and other sufferings, for the battle was fought in mid-winter, 15,000 feet above the sea. The Chinese then marched on Ld, but were soon driven out again, and peace was finally made on the basis of the old frontier. The widespread prestige of China is wonderfully illustrated by the fact that tribute, though disguised as a present, is paid to her, for Ladak, by the maharajah of Kashmir.

The adjoining territory of Balti—possibly the Byltæ of Ptolemy—forms the west extremity of the vast region known as Tibet, whose natural limits here are the Indus from its abrupt southward bend in 74° 46' E. long., and the mountains to the north and west, separating a comparatively peaceful Tibetan population from the fierce

Aryan tribes beyond. Mohammedan writers about the 16th century speak of Balti as "Little Tibet," and of Ladak as "Great Tibet," thus ignoring the really Great Tibet altogether. The Balti people call Gihlat "a Tibet," and Dr Leitner says that the Chilai, a Dard people west of the Indus, call themselves Botâ, or Tibetans,² but, although these districts may have been, like Kashmir, overrun by the Tibetans, or have received rulers of that race, the ethnological frontier coincides with the geographical one here given. Balti is a mass of lofty mountains, the prevailing formation being gneiss. In the north is the Baltoro glacier, the largest out of the arctic regions, 35 miles long, contained between two ridges whose highest peaks to the south are 25,000 and to the north 28,265 feet. The Indus, as in Lower Ladak, runs in a narrow gorge, widening for nearly 20 miles after receiving the Shayok. The capital, Skardo, a scattered collection of houses, stands here, perched on a rock 7740 feet above the sea. The house roofs are flat, occupied only in part by a second story, the remaining space being devoted to drying apricots, the chief staple of the main valley, which supports little cultivation. But the rapid slope westwards is seen generally in the vegetation. Birch, plane, spruce, and *Pinus ecclesiæ* appear; the fruits are finer, including pomegranate, pear, peach, vine, and melon, and whose irrigation is available, as in the North Shigar, and at the deltas of the tributary valleys, the crops are more luxuriant and varied.

Population.—The Ladakis, numbering about 21,000, are Tibetan, with a slight Caucasian admixture, and there are numerous Baltis and Dards (the latter superficially Buddhist) in the western districts. The Changpa, &c., "mountaineers," in the east are also Tibetan. They are singularly hardy, good-humoured, not stupid though simple and clumsy, dirty (washing, it is said, once a year, but not regularly), fond of social gatherings. The national drink, chang, is a sort of beer made from barley. The Balti type contains a much larger Aryan element, the isolated Dard (or Shin) communities being probably relics of an early Aryan population, subsequently overlaid by a Tibetan. The cross is a good one, the Baltis being more intelligent, if less genial, than the Ladakis, and equally industrious. They are taller, less beardless, and their noses less flat. They eschew pigstails. Polo is played more generally, and with more spirit, than in Ladak. The two languages are mutually intelligible. Like many Tajik and other mountain tribes westwards, the Baltis are Shiah Mohammedans. The women are thus more secluded than in Ladak, where they are particularly independent. They have abandoned polyandry, and (possibly in consequence) their numbers—some 68,000 in Balti and western Ladak—are larger than the country can support. Many emigrate to Kashmir and to British territory, where they do well. In the west the Dards are numerous, and a Dard element is especially observable in the families of the chiefs, some of whom, as in Ladak, were semi-independent before the annexation.

The principal works consulted have been Mr F. Drew's excellent book on *The Jummoo and Kashmir Territories*; a valuable paper by General H. Strachey "On the Physical Geography of Western Tibet," in *the Roy Geog. Soc. Journ.*, vol. xiii., Cunningham's *Ladak: The Tribes of the Hindu Kosh*, by Major J. Biddulph; the travels of Vigne, and of Moorcroft and Trebeck; papers by H. Lydekker, in *Records of the Geological Survey of India*, vols. xii. and xiv., and by Dr F. Stollz, in *Report of Sir T. D. Forsyth's mission to Yarkand*. (C. T.)

LA DIXMERIE, NICOLAS BRICAIRE DE (1730-1791), French man of letters, was a native of Champagne, and was born about 1730. While still young he removed to Paris, where the rest of his life was spent in considerable

¹ The trade registered at Ld, chiefly between India and Eastern Turkestan, averages £184,000, the principal exports from India being cotton goods, value £29,200; silk ditto, £8000; skins, £2800; and tea, £2650; and from Eastern Turkestan—raw silk, £14,100, silver, £28,700, gold, £7000; charms, £2400; horses, £3200.

² This, however, it has been said, is only taken from the name of a former ruling family.

literary activity. He died suddenly on November 26, 1791. His numerous works include *Contes Philosophiques et Moraux* (1765), characterized by Sábater as "less agreeable than those of Marmontel, but more moral, more varied, and showing a keener sensibility," *Les deux âges du Dieu et du Génie sous Louis XIV et sous Louis XV*, a parallel and contrast, in which the decision is given in favour of the latter; *L'Espagne littéraire* (1774); *Éloge de Voltaire* (1779) and *Éloge de Montaigne* (1781).

LADOGA, formerly Næva, a lake of northern Russia, situated between 59° 56' and 61° 46' N. lat. and 29° 53' and 32° 50' E. long., surrounded by the governments of St Petersburg, Olonetz, and Wiborg. It has the form of a quadrilateral, elongated from north-west to south-east. Its eastern and southern shores are flat and marshy, whilst the north-western margin is craggy and fringed by numerous small rocky islands, the largest of which are Valaam and Konevets, and which occupy altogether an area of 223 square miles. Lake Ladoga is 7000 square miles in area, that is, thirty-one times as large as the Lake of Geneva; but, its depth being less, it contains only nineteen times as much water as the great lake of Switzerland. The greatest depth, 244 yards, is in a cavity situated in the north-western part of the lake, the average depth not exceeding 100 yards. The level of Lake Ladoga is 55 feet above the Gulf of Finland, but it rises and falls about 7 feet according to atmospheric conditions. The western and eastern shores consist of boulder clay, as well as a narrow strip on the southern shore, south of which runs a ridge of crags of Silurian sandstones; the hills of the north-western shore afford a variety of granites and crystalline slates of the Laurentian system, whilst the Valaam island is made up of a rock which Russian geologists describe as orthoclasic hypersthénite. The granite and marble of Serdobol, and the sandstone of Poutilovo, are much used for buildings at St Petersburg, copper and tin from the Pitkaranta mine are exported. No less than sixty rivers enter Lake Ladoga, pouring into it the waters of numberless smaller lakes which lie at higher levels around it. The Volkhov, which conveys the waters of Lake Ilmen, is the largest; Lake Onega discharges its waters by the Svir; and the Selma system of lakes of eastern Finland contributes the Wuoxen and Taipala rivers; the Syass brings the waters from the smaller lakes and marshes of the Valdai plateau. Lake Ladoga discharges its surplus water by means of the Neva, which flows from its south-western corner into the Gulf of Finland, rolling down its broad channel 104,000 cubic feet of water per second. The water of Lake Ladoga is very pure and cold; in May its temperature on the surface does not exceed 36° Fahr., and even in August it reaches only 50° and 53°, the average yearly temperature of the air at Valaam being 36°·3. The lake begins to freeze in October, but it is only about the end of December that it is frozen in its deeper parts; and it remains under the ice covering until the end of March, whilst wide icefields continue to float in the middle of the lake until they are broken up by gales and scattered on the shores. Only a small part of the Ladoga ice is discharged by the Neva; but it is enough to produce in the middle of June a return of cold in the northern capital. The thickness of the ice does not exceed 3 or 4 feet; but during the alternations of cold and warm weather, with strong gales, in winter, heaps of ice, 70 and 80 feet high, are raised on the banks and on the icefields. The water of the lake is in continuous rotary motion, being carried along the western shore from north to south, and along the eastern from south to north. The vegetation on the shores is poor; immense forests, which formerly covered them, are now mostly destroyed; but the fauna of the lake is somewhat rich;

a species of seal which inhabits its waters, as well as several arctic species of crustaceans, recall its former connexion with the Arctic Ocean. The great variety of sweet water *Diatomaceæ* which are found in the ooze of the deepest parts of the lake has also an arctic character. Fishing is very extensively carried on. Navigation on the lake, which is practicable for only one hundred and eighty days in the year, is rather difficult owing to fogs and gales, which are often accompanied, even in April and September, with snow storms. The prevailing winds are north-west and south-west, north-east winds cause the water to rise in the south-western part of the lake, sometimes from 3 to 5 feet. A phenomenon very similar to the *esches* of the Lake of Geneva is observed in connexion with the rise and fall of the barometer. Steamers ply regularly in two directions from St Petersburg—to the monasteries of Konevets and Valaam, and to the mouth of the Svir, whence they go up that river to Lake Onega and Petrozavodsk; and no less than from 600 to 800 small vessels transport timber, firewood, planks, iron, kaolin, granite, marble, fish, hay, and various small wares from the northern shore to Schlusseeburg, and thence to St Petersburg. The rivers Volkhov, Syass, and Svir being parts of the three great systems of canals which unite the upper Volga with the Gulf of Finland, and the navigation on Lake Ladoga being too dangerous for small craft, three canals with an aggregate length of 70 miles were dug along the southern shore of Lake Ladoga, uniting the mouths of these three rivers with the Neva at Schlusseeburg; thousands of vessels pass yearly along them on their way to St Petersburg. The population on the shores of the lake is sparse, and the towns Schlusseeburg, with 6000 inhabitants, New Ladoga (4500), Kexholm (1000), and Serdobol (800) are poor; many small villages are situated on the southern, north-eastern, and western shores, but the total population of the shores of Lake Ladoga does not exceed 35,000. The monasteries of Valaam, founded in 980, on the island of same name, and Konevsky, on the Konevets island, founded in 1393, are highly venerated, and are visited every year by many thousands of pilgrims.

LADRONE or MARIANA ISLANDS, a chain of fifteen islands in the North Pacific Ocean, situated to the north of the Carolines, and between 13° and 21° N. lat. and 144° and 146° E. long. The name *Isas de los Ladrones*, or "Islands of the Thieves," was given them by the ship's crew of Magellan on account of the thieving propensity of the inhabitants. Magellan himself styled them *Isas de las Velas Latinas*, or "Islands of the Lateen Sails." San Lazarus archipelago, Jardines, and Praseras are among the names applied to them by later navigators. They received their present recognized official appellation "Las Marianas" in 1668 in honour of Maria Anna of Austria, widow of king Philip IV. of Spain, and they still form a Spanish colony under the general government of the Philippines. A broad channel divides the Ladrones into two groups, containing a total area of about 417 square miles. The northern group (Gani) consists of ten islands, now uninhabited; five islands, of which four are inhabited, form the southern group, viz., Guahan (Guam, Spanish Guajan, the San Juan of old Spanish charts), Rota, Aguijan, Tinian, and Saypan. On Guahan, the largest and southernmost of the group, is the only town in the colony, San Ignacio de Agaña, and the fortified harbour of Umata.

The general surface of the southern islands is far inferior in elevation to that of the northern group, which is mountainous, though the altitudes do not exceed 2600 to 2700 feet. The predominant rock in the southern group is magnesian limestone, but in some instances, and especially at Guahan, volcanic formations occur. The northern

islands are entirely of igneous origin, and on Pagan and Uraeas are smoking craters. The coasts of the southern islands are in many instances surrounded by reefs. All the islands except Ferallon de Medinilla and Mange (in the northern group) are more or less densely wooded, and the vegetation is luxuriant, much resembling that of the Philippines, whence many species of plants have been introduced. Owing to the humidity of the soil cryptogams are very numerous, as also most kinds of grasses. Among the useful vegetable products may be mentioned arca and cocoa-nut palms, rice, maize, sugar, tobacco, cotton, indigo, breadfruit, bananas, and castor oil. In consequence of the laziness of the native population, agriculture is almost entirely neglected, in spite of the exceptional advantages offered by the climate and soil. On most of the islands there is a plentiful supply of water; at Guahan, however, the partial clearing away of the woods has caused several full streams to dwindle to mere brooks.

The fauna of the Ladrões, though inferior in number and variety, is similar in character to that of the Carolines, and certain species are indigenous to both colonies. Swine and oxen are allowed to run wild, and are hunted when required: the former were known to the earlier inhabitants, the latter with most other domestic animals were introduced by the Spaniards. The roe was imported from the Philippines.

The climate of the Ladrões, though humid, is salubrious, whilst the heat, being tempered by the trade winds, is milder than that of the Philippines. The yearly mean temperature at Guahan is about 81° Fahr. August and September are the warmest months, but the variations of temperature are not great. The year may be divided into a wet and dry season, though even in the latter rain often falls. From October to May the general winds are north-easterly; during the other four months they are often north-westerly and south-westerly, the latter being accompanied by much rain.

The present population of the Ladrões consists of descendants from the original inhabitants, called by the Spaniards Chamorroes, of Tagal settlers from the Philippines, and of a mixed race formed by the union of Spaniards and Chamorroes. On the island of Saypan there is a colony from the Carolines. With the exception of the last-mentioned settlers, who are very active, and have founded the village of Garapan, the inhabitants are generally wanting in energy, of indifferent moral character, and miserably poor. Little has yet been done for the improvement of their intellectual and social condition, with the exception of the establishment of a few schools, now mostly fallen into decay. The number of the original inhabitants previous to the subjection of the islands by the Spaniards in 1688 has been variously estimated at from 40,000 to 60,000. The Spanish conquest and the forcible suppression of the protracted opposition of the natives reduced their numbers to such an extent that in 1741 the population was only 1816. From that date, however, owing to the introduction of new colonists from the Philippines, the population began to increase, and in 1866 was 9500. In the last year a severe epidemic carried off more than a third of the inhabitants. Since 1871 the total population of the Ladrões has been roughly estimated at 8000. All the inhabitants understand and are able to speak Spanish, which is gradually supplanting the native language, a Micronesian dialect nearly allied to that used by the Tagals of the Philippines. The residence of the governor is at Agaña in Guahan. Spain gains no revenue by the possession of these islands.

The honour of the discovery of this archipelago, the first found by Europeans in the Pacific, is due to Magellan, who upon the 6th of

March 1521 observed the two southernmost islands, and sailed between them (O. Paschel, *Geschichte des Zeitalters der Entdeckungen*, Stuttgart, 1877, p. 600). Modern research in the archipelago began with the visit of Commodore Anson, who in August 1742 landed upon the island of Tinian, where he found extensive ruins (Anson's *Pacific*, bk. iii.). The Ladrões were visited by Byron in 1766, Wallis in 1767, and Crozet in 1772. Great additions to our knowledge of the islands were made in the present century by Freycinet, in 1820 (*Voyage autour du monde*, part. hist. ii.), and the Spanish captain Sanchez y Zayas, in 1866.

Besides works above mentioned, see especially O. R. Meinicke, *Die Inseln des Stillen Ozeans*, Leipzig, 1875-76, part ii., "Die Marianen Inseln," in the *Nautical Magazine*, vols. xxiv., xxx., London, 1865, 1866, and P. A. Lesau, *Les Philippines*, *leur origine*, &c., Paris, 1868. (C. D. J.)

LADY DAY, the Feast of the Annunciation of the Virgin Mary. See ANNUNCIATION.

LAENNEC, RENS THÉODORE HYACINTHE (1781-1826), inventor of the stethoscope, was born at Quimper in Brittany, February 17, 1781. Early trained to medicine under his uncle at Nantes, he completed his medical studies at Paris, where he received the degree of doctor in 1804. He especially distinguished himself by his researches in pathological anatomy, and was regarded as one of the first practitioners of the capital when in 1810 he was appointed physician at the Necker hospital. There he continued those researches which resulted in the discovery of the stethoscope in the manner already fully described under AUSCULTATION (vol. iii. p. 100). Laennec himself fell a victim to phthisis, the disease which, of all others, he had especially studied. For a few years he was able to occupy a medical chair in the Collège de France; but he died on August 13, 1826.

Laennec's chief work is the *Traité de l'Auscultation médiate*, 1819, in which he announced his discovery. It has been translated into various languages. He was the author also of *Propositions sur les doctrines médicales d'Hippocrate*, 1804; of *Mémoires sur les vers cutanés*, 1804, and of articles in the *Dictionnaire des Sciences Médicales*, and other publications.

LAER, or **LAAR**, PIETER VAN (1613-1675), painter, was born at Laere in Holland in 1613. The influence of a long stay in Rome begun at an early age is to be traced in his landscape and backgrounds, but in his subjects he remained true to the Dutch tradition, choosing generally lively scenes from peasant life, as markets, fairs, bowling scenes, farmers' shops, robbers, hunting scenes, peasants with cattle, and the like. From the taste, or from his personal deformity, he was nicknamed Bamboccio by the Italians. On his return to Holland about 1630, he lived chiefly at Amsterdam and Haarlem, in which latter city he died in 1674 or 1675. Pieter van Laer's pictures are marked by skilful composition and good drawing; he was especially careful in perspective. His colouring, according to Crowe, is "generally of a warm brownish tone, sometimes very clear, but oftener heavy, and his execution broad and spirited." Certain etched plates are also attributed to him.

LAESTRYGONES, a mythic race of giants, mentioned in the *Odyssey*. After leaving the island of Æolus, Ulysses reached in six days the coast of the Laestrygonians and the city of Lamus, where the palis of day and night approach so close that a sleepless man might make double wages by herding continuously, watching one flock while the other rested. This feature of the tale obviously contains some hint of the long nightless summer in the Arctic regions, which perhaps penetrated to the Greeks with the merchants who fetched amber from the Baltic coasts. The Laestrygonians were cannibals; and, when three sailors sent as scouts incautiously entered the city, the king Antiphates ate one and the people pursued the others to the ships. As the vessels tried to escape from the harbour, the giants pelled them with masses of rock, and sunk all except the one in which Ulysses was. The Laestrygonians must be a mythic multiplication of the one ultimate demon who is called their king, just

as the kindred race of the Cyclopes is a multiplication of the single one-eyed sun god Polyphemus, the Cyclops *par excellence*. The name Antipathes is a fanciful one, but the other name Lamus takes us into a religious world where we can trace the origin of the legend, and observe the god of an older religion becoming the subject of fairy tales in a later period (see LAMIA). Among the Greeks it was usual to place the country of the *Lestrygones* in Sicily, either beside Etna or towards the north-west promontory of the island; but, on the other hand, Horace and other Latin authors speak of them as living in southern Latium, near Formis.

LA FARINA, GIUSEPPE (1815-1863), Italian author and politician, was born at Messina in 1815. On account of the part taken by him in the insurrection of 1837 he found it necessary to quit Sicily, but returning in 1839 he conducted various newspapers of liberal tendencies, until his efforts were completely interdicted, when he removed to Florence. In 1840 he had published *Messina ed i suoi Monumenti*, and after his removal to Florence he brought out *La Germania coi suoi Monumenti*, 1842; *L'Italia coi suoi Monumenti*, 1842; *La Svizzera Storica ed Artistica*, 1842-43; *La China*, 4 vols., 1843-47; and *Storia d'Italia*, 7 vols., 1846-54. He also in 1847 established a democratic journal *L'Alba* in the interests of Italian freedom and unity, but on the outbreak of the revolution in Sicily in 1848 he returned thither and was elected one of the committee of war. In the following year he was chosen to represent Messina in parliament, where he moved the deposition of King Ferdinand and the adoption of a new constitution. In April 1849 the provisional government, in which La Farina was minister successively of public instruction, of public works, and of the interior, resolved, notwithstanding his strong advocacy of resistance, to submit to the royal authority, and he removed to France. In 1850 he published *Storia della Rivoluzione Siciliana*, and in 1851-52, in 6 vols., *Storia d'Italia dal 1815 al 1860*. He also began in 1851 *Rivista Enciclopedica Italiana*, and in 1856 *Piccolo Corriere d'Italia*, an organ which had great influence in propagating the political sentiments of the Società Nazionale Italiana, of which he ultimately was chosen president. During the remainder of his life he was a devoted supporter of Victor Emmanuel, and in 1860 he was chosen a member of the first Italian parliament. He died 5th September 1863. See Franchi's *Epistolario di Giuseppe La Farina*, 2 vols., 1869.

LA FAYETTE, the capital of Tippecanoe county, Indiana, U.S., is situated at the head of navigation on the Wabash river, and near the battle-ground of Tippecanoe, where, in 1811, General Harrison, afterwards president, defeated a large force of Indians. The city—which is much the largest of the twenty-four towns in the United States named in honour of General La Fayette—is beautifully situated in the centre of a rich agricultural region and amid an amphitheatre of hills, which are covered with suburban homes. La Fayette has eight lines of railway communication and ten graded turnpikes extending in various directions. The La Fayette car-works employ eight hundred men. There are four national banks, three daily and nine weekly newspapers, five large boot and shoe manufactories, four breweries, one distillery, four large cooperage establishments, a paper mill, porkhouses for summer and winter curing, a horning mill, iron-works, together with numerous foundries and smaller manufacturing enterprises. The city is supplied with gas and water-works, and sulphur water, valuable for drinking and bathing purposes, flows from an artesian well in the public square. It is the seat of Purdue university, an agricultural college, richly endowed by a congressional land grant, and named in honour of John Purdue, who gave it \$150,000. Population in 1880, 14,860.

LA FAYETTE

Copyright, 1862, by John Bigelow.

MARIE JEAN PAUL ROCH YVES GILBERT MOTIER, MARQUIS DE LA FAYETTE (1767-1834), was born at the château of Chavagnac in Auvergne, France, September 6, 1767. Left an orphan with a princely fortune at the tender age of thirteen, he married at sixteen a daughter of the Duc d'Angoulême and granddaughter of the Duc de Noailles, then one of the most influential families in the kingdom. In selecting a career, the choice of a young man of his rank in France at that time was practically limited to the court or the camp. He chose to follow the career of his father, and entered the Guards.

La Fayette was nineteen years of age and a captain of dragoons when the English colonies in America proclaimed their independence. "At the first news of this quarrel," he afterwards wrote in his memoirs, "my heart was enrolled in it." The count de Broglie, whom he consulted, discouraged his zeal for the cause of liberty. "I have seen your uncle die in the wars of Italy; I witnessed your father's death at the battle of Minden; and I will not be accessory to the ruin of the only remaining branch of the family." Finding his purpose unchangeable, however, the count presented the young enthusiast to the Baron de Kalb, who was also seeking service in America, and through Denne, an American agent in Paris, an arrangement was concluded, December 7, 1776, by which La Fayette was to enter the American service as major-general. At this critical moment the news arrived of a series of grave disasters to the American arms, including the evacuation of New York. La Fayette's friends again advised him to abandon his purpose. Even the American envoys, Franklin and Lee, who had superseded Denne the very day after the contract was signed, and who did not feel authorized to confirm his engagements, deemed it their duty to withhold any further encouragement of the plans of the marquis, and the king himself forbade his leaving. So far from being discouraged by these difficulties La Fayette proceeded to purchase a ship on his own account, and to invite such of his friends as were willing to share his fortunes. The British ambassador at Versailles remonstrated, and at his instance orders were issued to seize the ship then fitting out at Bordeaux, and La Fayette himself was arrested. But the ship was sent from Bordeaux to the neighbouring port of Passages in Spain, La Fayette escaped from the custody of his guards in disguise, and before a second *lettre de cachet* could reach him he was aloft with eleven chosen companions. Though two British cruisers had been sent in pursuit of him, he effected a safe landing near Georgetown in South Carolina, after a tedious voyage of nearly two months, and hastened to Philadelphia, thence to the seat of government of the colonies.

When this lad of nineteen, with the command of only what little English he had been able to pick up on his voyage, presented himself to the Congress of the Revolution, then sitting in Philadelphia, with Denne's authority to demand a commission of the highest rank after the commander-in-chief, it is not surprising that his reception seemed to him a little chilly. Nor did he then know all the disadvantages under which he presented himself. Denne's contracts were so numerous, and for officers of such high rank, that it was quite impossible for Congress to ratify them without injustice to Americans who had become entitled by their service to promotion. La Fayette appreciated the situation as soon as it was explained to him, and immediately addressed a note to the president of Congress, in which he expressed his desire to be permitted to serve in the American army upon two conditions,—that he should receive no pay, and that he should not as a volunteer. These terms were so different from those made

by other foreigners, they had been attended with such substantial sacrifices, and they promised such substantial indirect advantages, that Congress had no hesitation in passing a resolution, on the 31st of July 1777, "that his services be accepted, and that, in consideration of his zeal, illustrious family, and connexions, he have the rank and commission of major-general of the United States." Next day La Fayette met Washington, who invited him to make the quarters of the commander-in-chief his own, and to consider himself at all times as one of his family. This invitation, as useful as it was flattering to the young officer, was joyfully accepted, and thus commenced a friendship which only death terminated. La Fayette was now anxious to have active employment, but it appeared that Congress intended his appointment as purely honorary, and the question of giving him a command was left entirely to Washington's discretion. At this time La Fayette went into camp the British commander was trying to secure possession of Philadelphia and the line of the Hudson from the Canadian frontier to New York, which, if accomplished, might prove fatal to the American cause. By the capture of Burgoyne at Saratoga, on the 17th of October 1777, that portion of the scheme was effectually spoiled. In the southern campaign the British arms were more fortunate. The fall of Philadelphia was one of the immediate results of the battle of Brandywine on the 11th of September. This was the first battle in which La Fayette was engaged, and in an attempt to rally his troops in their retreat he had the good fortune to receive a musket ball in his leg. We say good fortune, for it doubtless secured him what of all things in the world he most desired, the command of a division—the immediate result of a communication from Washington to Congress of November 1, 1777, in which among other things he said:—

"The Marquis de la Fayette is extremely solicitous of having a command equal to his rank. I do not know in what light Congress will view the matter, but it appears to me, from a consideration of his illustrious and important connexions, the attachment which he has manifested for our cause, and the consequences which his return in disgust might produce, that it will be advisable to gratify his wishes, and this more so as several gentlemen from France who came over under some assurances have gone back disappointed in their expectations. His conduct with respect to them stands in a favourable point of view,—having interested himself to remove their uneasiness and urged the impropriety of their making any unfavourable representations upon their arrival at home. Besides, he is supple, discreet in his manner, has made great proficiency in our language, and from the disposition he discovered at the battle of Brandywine possesses a large share of bravery and military ardour."

The recommendation of Washington was conclusive, and La Fayette's happiness was now complete. Barely twenty years of age, he found himself invested with a most honourable rank, purchased by his blood in fighting at once to secure the independence of a strange people and to punish the enemies of his own. He had justified the boyish rashness which his friends deplored and his sovereign resented, and had already acquired a place in history.

Of La Fayette's military career in the United States there is not much to be said. Though the commander of a division, he never had the command of many troops, and whatever military talents he possessed were not of the kind which appeared to conspicuous advantage on the theatre to which his wealth and family influence rather than his soldierly gifts had called him. He fought at the battle of Monmouth in 1778, and received from Congress a formal recognition of his services in the field, and of his probably more valuable exertions in healing dissensions between the French and native officers. His retreat from Barren Hill was also commended as masterly.

The treaty of commerce and defensive alliance, signed by the insurgents and France on the 6th of February 1778, was promptly followed by a declaration of war by England against the latter, and La Fayette felt it to be his duty to

ask leave to revisit France and consult his king as to the farther direction of his service. This leave was readily granted, it was not difficult for Washington to replace the major-general, but it was impossible to find another equally competent, influential, and devoted champion of the American cause near the court of Louis XVI. In fact, he went on a mission rather than a visit. He embarked in January 1779, and on the 4th of March following Franklin wrote to the president of Congress. "The Marquis de la Fayette, who during his stay in France has been extremely zealous on all occasions, returns again to fight for it. He is infinitely esteemed and beloved here, and I am persuaded will do everything in his power to merit a continuance of the same affection from America."

La Fayette was absent from America about six months, and his return was the occasion of a complimentary resolution of Congress. From this time until October 1781 he was charged with the defence of Virginia, in which Washington gave him the credit of doing all that was possible with the forces at his disposal; and he showed his zeal by borrowing money from the bankers in Baltimore on his own account to provide his soldiers with necessities. The battle of Yorktown, in which La Fayette bore an honourable if not a distinguished part, was the last serious trouble of the war, and terminated his military career in the United States. He immediately sought and obtained leave to return to France, where it was supposed he might be useful in the negotiations looking to a general peace, of which prospects had begun to dawn. He was also much occupied in the preparations for a combined French and Spanish expedition against some of the British West India Islands, of which he had been appointed chief of staff, and a formidable fleet had already assembled at Cadix, when, on the 30th of November 1782, the preliminary treaties of peace between the several belligerents put an end to the war. To La Fayette was accorded the grateful privilege of first communicating the welcome intelligence to Congress. He returned to his native land one of the heroes of a noble conflict, and fortified with the most flattering testimonials from his commander-in-chief and from the Government he had served, which were crowned by a notification from the French minister of war that he should have the same rank in the army of his sovereign that he had held in America, his commission to date from the surrender of Cornwallis at Yorktown. He visited the United States again in 1784, to gratify his curiosity as well as his affections, and while he remained—some five months—was the guest of the nation, and received every mark of public and private consideration which his hosts supposed would be acceptable.

La Fayette did not appear again in public life until 1787, when he took his seat in the Assembly of Notables. From this time till near the close of the Revolution he was a conspicuous figure in the history of France, and almost the only one who, at no stage of that cycle of horrors, seems to have lost his reason or his humanity.

When the States-General, convened after the Assembly of Notables had proved wholly unequal to its task, met at Versailles in May 1789 the throne was occupied by a shadow. The royal authority was gone. France was already, though few if any, and least of all the sovereign, suspected it, in full revolution. On the 11th of July 1789 La Fayette presented to the National Assembly, into which the States-General had been fused, a declaration of rights, modelled on Jefferson's Declaration of Independence in 1776. The struggle between the expiring monarchy and popular sovereignty was already big with the horrors of the French Revolution. The palace and the assembly were guarded by troops; a national guard was organized, which soon embraced the whole kingdom, and

numbered over three millions of men, the command of which was confided to La Fayette. For the succeeding three years, until the end of the constitutional monarchy in 1792, his history is largely the history of France. His life was beset with inconvertible responsibility and peril, for he was ever the minister of humanity and order among a crazed people who had come to regard order and humanity as phases of treason. He rescued the queen from the murderous hands of the populace on the 6th and 6th of October 1789, not to speak of multitudes of humbler victims who had been devoted to death. He risked his life in many unsuccessful attempts to rescue others. He was obliged to witness the butchery of Foulon, and the seething heart of Berthier torn from his lifeless body and held up in triumph before him. Disgusted with enormities which he was powerless to prevent and could not countenance, he resigned his commission; but so impossible was it to replace him that he was induced to resume it. In the Constituent Assembly, of which he was a member, his influence was always felt in favour of Republican principles, for the abolition of arbitrary imprisonment, for religious tolerance, for popular representation, for the establishment of trial by jury, for the gradual emancipation of slaves, for the freedom of the press, for the abolition of titles of nobility, and the suppression of privileged orders. When the Constitution was proclaimed, on the 14th of July 1790, the first anniversary of the destruction of the Bastille, he again and definitively resigned his command, and retired to private life. Shortly after his resignation he was invited by the friends of liberty with order to stand for the office of mayor of Paris. By a strange madness the remnants of the royal party supported his competitor Pétion, the most rancorous of Jacobins, and were for the royal family but too fatally successful.

The royalist party, and certain members of the royal family who had taken refuge in frontier states, were already intriguing with the Austrian Government to march an army into France and restore absolutism, while the king, after an unsuccessful attempt to escape from France, was reduced to the humiliating necessity of declaring war against Austria and her allies. Three armies of 50,000 each were levied. Of one of these the command was given to La Fayette. But it was with sad misgivings that the general left his country retreat to take this command. As he passed through Paris the president of the Assembly said to him in full session that "the nation would oppose to its enemies the constitution and La Fayette", but what was to be expected of a war conducted by a king in secret league with the nation's enemies, or of a legislature conspiring to destroy the king and constitution to which they had only just sworn allegiance and support? La Fayette's loyalty to his king, to his constitution, and to his country seemed only to strengthen as the situation grew desperate. Four days before the outrages which occurred at the Tuileries on the 16th June 1792 he publicly denounced the Jacobin Club, and called upon the Assembly to suppress them. Henceforth he became the special object of Jacobin rage. On the 8th of August a motion was made to have him arrested, and tried as an enemy of his country. Though the motion was defeated by 446 votes against 224, scarce two days elapsed before the palace was stormed, and the king and queen were sent to the prison from which they passed to the scaffold.

With the destruction of the constitution, the monarchy, and the Government, La Fayette's occupation as the priest of liberty, humanity, and order was gone. He would have marched to Paris to defend the constitution, but his troops were too generally infected with the sentiments which triumphed in the disorders of the 10th of August. He was compelled to take refuge in the neutral territory of

Lidge, where he was taken by the Austrians and held as a prisoner of state for five years, first in Prussian and afterwards in Austrian prisons, in spite of the intercession of America and the pleadings of his wife Napoleon, however, who called him a "noodle," stipulated for his release, 19th September 1797. He was not allowed to return to France by the Directory; when he did, it was to vote against the life consulate of Napoleon, as he, later on, voted against the imperial title. Many years of his life were then spent in retirement at the castle of La Grange. He was called from it to become vice-president of the Assembly, under Louis XVIII., before the battle of Waterloo. He afterwards sat for Meaux and became a frequent speaker upon foreign politics and military economy. But his early influence was gone, except in America, to which he returned in 1824, to be overwhelmed with popular applause and to be voted the sum of \$200,000 and a township of land. During the Revolution of 1830 he again took command of the National Guard and pursued the same line of conduct, with equal want of success, as in the first Revolution. In 1834 he made his last speech,—on political refugees. He died at Paris, May 20, 1834.

Few men have owed more of their success and usefulness in the world to their family rank than La Fayette, and still fewer have abused it less. He never achieved distinction in the field, and his political career proved him to be incapable of ruling a great national movement; but he had strong convictions which always impelled him to study the interests of humanity, and a pertinacity in maintaining them, which, in all the marvellous vicissitudes of his singularly eventful life, secured him a very unusual measure of public respect. No citizen of a foreign country has ever had so many and such warm admirers in America, nor does any statesman in France appear to have ever possessed uninterruptedly for so many years so large a measure of popular influence and respect. He had what Jefferson called a "canine appetite" for popularity and fame, but in him this appetite only seemed to make him more anxious to merit the fame which he enjoyed. He was brave even to rashness; his life was one of constant personal peril, and yet he never shrunk from any danger or responsibility if he saw the way open to spare life or suffering, to protect the defenceless, to sustain the law and preserve order.

See *Mémoires historiques et véridiques authentiques sur M. de La Fayette pour servir à l'histoire des révolutions*, Paris, l'an second de la liberté française; *La Fayette et la Révolution de 1830, histoire des choses et des hommes de Jullé*, by B. Barthe, Paris, 1832; *Mémoires et Manuscrits de La Fayette*, published by his family, 6 vols., Paris, 1837-38, and numerous eulogies and monographs in French and English. (J. B.)

LA FLECHE, chief town of an arrondissement in the department of Sarthe, France, is situated on the right bank of the Loir, about 24 miles south-west of Le Mans. The chief buildings are the military academy (Prytanée), originally a college founded in 1607 by Henry IV., the church of St Thomas, the prison, and the hospital. Near the bridge are the ruins of an ancient castle. La Fleche carries on manufactures of cloth, gloves, hose, candles, and glue, besides wax bleaching, tanning, and paper-making. It has the usual country trade, managed mainly by means of fairs. The population in 1876 was 7468.

LA FONTAINE, JEAN DE (1621-1696), one of the most popular and original of French poets, was born at Château Thierry in Champagne, probably on the 8th of July 1621, and died at Paris on the 13th of April 1696. His father was Charles de La Fontaine, "maître des eaux et forêts"—a kind of deputy-ranger—of the duchy of Château Thierry; his mother was Françoise Pidoux. On both sides his family was of the highest provincial middle class, but was not noble; his father was also fairly wealthy. Jean, who was the eldest child of his parents, was educated

at the *collège* (grammar school) of his native town, and at the end of his school days he had, singularly enough, an idea of taking orders. He entered the Oratory in May 1641, and the summary of St Magloire in October of the same year, but a very short sojourn proved to him that he had mistaken his vocation. He then apparently studied law, and is said to have been admitted as *avocat*, though there does not seem to be actual proof of this. He was, however, settled in life, or at least might have been so, somewhat early. In 1647 his father resigned his rangership in his favour, and arranged a marriage for him with Marie Héricart, a young girl of sixteen, who brought him twenty thousand livres, and expectations. She seems to have been both handsome and intelligent, but the two did not get on well together. There appears to be absolutely no ground for the vague scandal as to her conduct, which was, for the most part long afterwards, raised by gossip or personal enmities of La Fontaine. All that is positively said against her is that she was a negligent housewife and an inveterate novel reader, La Fontaine on the other hand was constantly away from home, was certainly not strict in point of conjugal fidelity, and was so bad a man of business that his affairs became involved in hopeless difficulty, and a *séparation de biens* had to take place in 1668. This was for the benefit of the family, and was a perfectly amicable transaction; by degrees, however, the pair, still without any actual quarrel, ceased to live together, and for the greater part of the last forty years of La Fontaine's life he himself lived in Paris while his wife dwelt at Châteaufort, which, however, he frequently visited. One son was born to them in 1663, and was educated and taken care of wholly by his mother.

Even in the earlier years of his marriage La Fontaine seems to have been much at Paris, but it was not till about 1656 that he became a regular visitor to the capital. The duties of his office, which were only occasional, were compatible with this non-residence, and he continued to hold it till 1672. It was not till he was past thirty that his literary career began, for he was by no means a precocious writer. The reading of Malherbe, it is said, first awoke poetical fancies in him, but for some time he attempted nothing but trifles in the fashion of the time—epigrams, ballades, rondeaux, &c. His first serious work was a translation or adaptation of the *Eunuchus* of Terence (1654). At this time the Mécènes of French letters was the superintendant Fouquet, to whom La Fontaine was introduced by Jacques Jannart, a connexion of his wife's. Few people who had paid their court to Fouquet went away empty-handed, and La Fontaine soon received a pension of 1000 livres (1659), in repayment possibly of the poem of *Adonis* which in 1658 he had, in manuscript, dedicated to the financier. He began too a medley of prose and poetry, entitled *Le Songe de Vaux*, on Fouquet's famous country house. It was about this time, as has been said, that his wife's property had to be separately secured to her, and he seems by degrees to have had to sell everything of his own; but, as he never lacked powerful and generous patrons, this was of small importance to him, especially as he had no establishment to maintain. In the same year he wrote a ballet, *Les Rieurs du Beau-Richard*, and this was followed by many small pieces of occasional poetry addressed to various personages great and small, from the king downwards. Fouquet soon incurred the royal displeasure, but La Fontaine, like most of his literary protégés, was not unfaithful to him, the well-known elegy *Pléiades, Nymphes de Vaux*, being by no means the only proof of his devotion. Indeed it is thought not improbable that a journey to Limoges which he took in 1663 in company with Jannart, and of which we have an account written to his wife, was not wholly spontaneous, as it

certainly was not on Jannart's part. Just at this time his affairs did not look promising. His father and himself had assumed the title of esquire, to which they were not strictly entitled, and, some old edicts on the subject having been put in force by the king, an informer procured a sentence against the poet fining him 2000 livres, which from what is known of the state of his private affairs it was probably impossible for him to pay. He found, however, a new protector in the duke and still more in the duchess of Bouillon, his feudal superior at Châteaufort, and nothing more is heard of the fine. Some of La Fontaine's liveliest verses are addressed to the duchess, Anne Mancini, the youngest of Mazarin's nieces, and it is even probable that the taste of the duke and duchess for Ariosto had something to do with the writing of his first work of real importance, the first book of the *Contes*, which appeared in 1664. He was then, let it be remembered, forty-three years old, and his previous printed productions had been comparatively trivial, though, as was the habit of the time, much of his work was handed about in manuscript long before it was regularly published. It was about this time that the quartette of the Rue du Vieux Colombar, so famous in French literary history, was formed. It consisted of La Fontaine, Racine, Boileau, and Molière, the last of whom was almost of the same age as La Fontaine, the other two considerably younger. Chapelle was also a kind of outsider in the coterie. There are many anecdotes, some of which are pretty obviously apocryphal, about these meetings. The most characteristic of these is perhaps that which asserts that a copy of Chapelle's unlucky *Pucelle* always lay on the table, a certain number of lines of which was the appointed punishment for offences against the company. The coterie furnished under feigned names the personages of La Fontaine's version of the Cupid and Psyche story, which, however, with *Adonis*, was not printed till 1669. Meanwhile the poet continued to find friends. In 1664 he was regularly commissioned and sworn in as gentleman to the duchess dowager of Orleans, and was installed in the Luxembourg. He still retained his rangership, and in 1666 we have something like a reprimand from Colbert suggesting that he should look into some malpractices at Châteaufort. In the same year appeared the second book of the *Contes*, and in 1668 the first six books of the *Fables*, with more of both kinds in 1671. In this latter year a curious instance of the docility with which the poet lent himself to any influence was afforded by his officiating at the instance of the Port-Royalists as editor of a volume of sacred poetry dedicated to the Prince de Conti. A year afterwards his situation, which had for some time been decidedly flourishing, showed signs of changing very much for the worse. The duchess of Orleans died, and he apparently had to give up his rangership, probably selling it to pay debts. But there was always a providence for La Fontaine. Madame de la Sablière, a woman of great beauty, of considerable intellectual power, and of high character, invited him to make his home in her house, where he lived for some twenty years. He seems to have had no trouble whatever about his affairs thenceforward; he was free to amuse himself or to work as he liked, and as a matter of fact he worked steadily at his two different lines of poetry. Besides these he ventured on a third, in which he met and indeed deserved much less success,—that of theatrical composition.

The next event of importance in La Fontaine's life, apart from the publication of his works, did not occur till after nearly ten years. In 1682 he was a man of more than sixty years old, recognized as one of the first men of letters of France. Madame de Sévigné, one of the soundest literary critics of the time, and by no means given to praise

mere novelties, had spoken of his second collection of *Fables* published in the winter of 1678 as divine; and it is pretty certain that this was the general opinion. It was not unreasonable therefore that he should present himself to the Academy, and, though the subjects of his *Contes* were scarcely calculated to propitiate that decorous assembly, while his attachment to Fonquet and to more than one representative of the old Frondeur party made him suspect to Colbert and the king, most of the members were his personal friends. He was first proposed in 1682, but was rejected for Dangeau. The next year Colbert died and La Fontaine was again nominated. Boileau was also a candidate, but the first ballot gave the fabulist sixteen votes against seven only for the critic. The king, whose assent was necessary, not merely for election but for a second ballot in case of the failure of an absolute majority, was ill-pleased, and the election was left pending. Another vacancy occurred, however, some months later, and to this Boileau was elected. The king hastened to approve the choice effusively, adding, "Vous pouvez incessamment recevoir La Fontaine, il a promis d'être sage." His admission was indirectly the cause of the only serious literary quarrel of his life. A dispute, into the particulars of which there is no need to enter here, took place between the Academy and one of its members, Furetière, on the subject of the latter's French dictionary, which was decided to be a breach of the Academy's corporate privileges. Furetière, a man of no small ability, bitterly assailed those whom he considered to be his enemies, and among them La Fontaine, whose fault probably was not so much that he was a principal offender as that the unlucky *Contes* made him peculiarly vulnerable. His second collection of these tales had been actually the subject of a police condemnation, of which, as may be supposed, Furetière did not fail to make the most. The death of the author of the *Roman Bourgeois*, however, put an end to this quarrel. Shortly afterwards La Fontaine had a share in a still more famous affair, the celebrated ancient-and-modern squabble in which Boileau and Perrault were the chiefs, and in which La Fontaine (though he had been specially singled out by Perrault for favorable comparison with Æsop and Phædrus) took the ancient side. About the same time (1685-87) he made the acquaintance of the last of his many hosts and protectors, Monsieur and Madame d'Hervart, and fell in love with a certain Madame Ulrich, a lady of some position but of doubtful character. This acquaintance was accompanied by a great familiarity with Vendôme, Chaulieu, and the rest of the libertine coterie of the Temple; but, though Madame de la Sablière had long given herself up almost entirely to good works and religious exercises, La Fontaine continued an inmate of her house until her death in 1693. What followed is told in one of the best known of the many stories bearing on his childlike nature. Hervart on hearing of the death, had set out at once to find La Fontaine. He met him in the street in great sorrow, and begged him to make his home at his house. "J'y allais" was La Fontaine's answer. He had already undergone the process of conversion during a severe illness which befell him the year before. An energetic young priest, M. Poucet, had brought him, not indeed to understand, but to acknowledge the impropriety of the *Contes*, and it is said that the destruction of a new play of some merit was demanded and submitted to as a proof of repentance. A pleasant story is told of the young duke of Burgundy, Fénelon's pupil, who was then only eleven years old, sending 50 louis to La Fontaine as a present of his own motion. But though La Fontaine recovered for the time he was quite broken by age and infirmity, and his new hosts had to nurse rather than to entertain him, which they did very carefully and kindly. He did a little more work, completing his *Fables* among

other things, but he did not survive Madame de la Sablière much more than two years, dying on the 13th of April 1695, at the age of seventy-three. He was buried in the cemetery of the Holy Innocents. His wife survived him nearly fifteen years, and his posterity lasted until the present century.

The curious personal character of La Fontaine, like that of some other men of letters, has been enshrined in a kind of myth or legend by literary tradition. At an early age his absence of mind and indifference to business gave a subject to Tallemant des Réaux, the most indefatigable and least scrupulous (at best the least critical) of gossipers. His later contemporaries helped to swell the tale, and the 18th century finally accepted it. We have neither space nor desire to recount the anecdotes of his meeting his son, being told who he was, and remarking, "Ah, yes, I thought I had seen him somewhere!" of his insisting on fighting a duel with a supposed admirer of his wife, and then imploring him to visit at his house just as before; of his going into company with his stockings wrong side out, &c. It may be taken for granted that much of this is apocryphal, and the companion anecdotes of his awkwardness and silence, if not positive rudeness, in company are still more doubtful. It ought to be remembered, as a comment on the unfavourable description which La Bruyère gives or is supposed to give of his social abilities, that La Fontaine was a special friend and ally of Benserade, La Bruyère's chief literary enemy, who long prevented the author of the *Caractères* from entering the Academy. But after all deductions much will remain, especially when it is remembered that one of the chief authorities for such anecdotes is Louis Racine, a man who possessed intelligence and moral worth, and who received them from his father, La Fontaine's attached friend for more than thirty years. Perhaps the best worth recording of all these stories is one of the Vieux Colombar quartette, which tells how Molière, while Racine and Boileau were exercising their wits upon "le bonhomme" or "le bon" (by both which titles La Fontaine was familiarly known), remarked to a bystander "nos bonnx esprits ont beau faire, ils s'effacent pas le bonhomme." They have not effaced him and will not do so, and the half contemptuous term "nos beaux esprits" marks well enough the sound judgment of the greatest of the four as to the merits of his companions.

The works of La Fontaine, the total bulk of which is considerable, fall no less naturally than tradition into three divisions, the *Fables*, the *Contes*, and the miscellaneous works. Of these the first may be said to be known universally, the second to be known to all lovers of French literature, the third to be with a few exceptions practically forgotten. This distribution of the judgment of posterity is as usual just in the main, but not wholly. There are excellent things in the *Œuvres Diverses*, but their excellence is only occasional, and it is not at the best equal to that of the *Fables* or the *Contes*. It was thought by contemporary judges who were both competent and friendly that La Fontaine attempted too many styles, and there is something in the criticism. His dramatic efforts are especially weak, and indeed it is evident that his forte lay neither in the dramatic delineation of character nor in the arrangement of dramatic action. The best pieces usually published under his name—*Ruybls*, *Le Florentin*, *Le Copeau*, *Les Femmes*, were not originally authored by him but by Champmeslé, the husband of the famous actress who captivated Racine and Charles de Sévigné. His avowed work was chiefly in the form of opera, a form of no great value at its best. *Psyché* has all the advantages of its charming story and of La Fontaine's style, but it is perhaps principally interesting nowadays because of the framework of personal conversation already alluded to. The mingled prose and verse of the *Songe de Paris* is not uninteresting, but its best thing, such as the description of night—

"Laissez tomber les fleurs et ne les semant pas,"

which has enchanted French critics, are little more than conceits, though as in this case sometimes very beautiful conceits. The elegies, the epistles, the epigrams, the ballades, contain many things which would be very creditable to a minor poet or a writer of *vers de société*, but even if they be taken according to the wise

Collection des Oisillons Français of M. Lemerle, and L. Moland in that of M. Girard supply in different forms all that can be wished. The second is the handiest, the third, which is complete, perhaps the most generally useful. Editions, selections, translations, &c., of the *Fables*, especially for school use, are innumerable, but an illustrated edition published by the *Laboratoire des Bibliothèques* (1874) deserves to be mentioned as not unworthy of its 19th century predecessors (G. S. A.)

LAFOSSÉ, CHARLES DE, (1640-1716), French painter, was one of the most noted and least servile pupils of Lebrun, under whose direction he shared in the chief of the great decorative works undertaken in the reign of Louis XIV. He was born at Paris in 1640, and left France for Italy in 1662. He then spent two years in Rome and three in Venice, and the influence of his prolonged studies of Veronese is evident in his *Finding of Moses* (Louvre), and in his *Rape of Proserpine* (Louvre), which he presented to the Academy as his diploma picture in 1673. He was at once named assistant professor, and in 1674 the full responsibilities of the office devolved on him, but his engagements did not prevent his accepting in 1689 the invitation of Lord Montagu to decorate Montagu House. He visited London twice, remaining on the second occasion—together with Rousseau and Monnoyer—more than two years. William III. vainly strove to detain him in England by the proposal that he should decorate Hampton Court, for Lebrun was dead, and Mansart pressed Lafosse to return to Paris to take in hand the cupola of the Invalides. The decorations of Montagu House are destroyed, those of Versailles are restored, and the dome of the Invalides (engraved, Picart and Cochon)—for to his vexation the rest of the surface fell into other hands—is now the only work existing which gives a full measure of his talent. During his latter years Lafosse executed many other important decorations in public buildings and private houses, notably in that of Crozat, under whose roof he died on 13th December 1716.

LAGO MAGGIORE. See MAGGIORE.

LAGOS, a town in the district of Faro, which is coextensive with the province of Algarve, in Portugal, is situated on the south coast of the kingdom, on a bay which forms its harbour. The town is fairly well built; but beyond one or two churches, the batteries that defend the port, and an aqueduct 800 yards long, it has no special features of interest. It holds the formal rank of city, and enjoys a respectable historical position from its connexion with Prince Henry the Navigator, whose caravels generally sailed from its harbour. The material prosperity of the town was injured by an earthquake that laid it in ruins in 1756. The inhabitants are engaged in the sunny fishery and in wine raising. The population in 1878 was 7881. Lagos is held to be situated on or near the site of the Roman colony Iacobriga.

LAGOS, a British settlement on the west coast of Africa, united since 1876 with the Gold Coast colony, and by the terms of the charter comprising all British possessions between the second and fifth degrees of east longitude. The actual settlement is situated on a low island within the mouth of the so-called Lagos river, which is really a lagoon of considerable extent, into which the Ogun and several other rivers discharge. The seaward entrance is about 3 miles wide, but it requires skilful pilotage to take a vessel across the bar into the smooth and deep water. Lagos was formerly the chief seat of the slave trade in the Bight of Benin. In 1851 it was captured by the British, and in 1861 the "king" Dooemo was practically constrained to give up his territorial jurisdiction, and accept a pension of 1200 bags of cowries, or about £1030. There is now a flourishing settlement. The mangrove swamp has been cleared away from a large part of the island; a well-kept road runs for a mile along the shore in front of the European quarter; wooden wharves have been built; marshy spots

have been turned into gardens, and among the houses are a number of bright stucco-fronted villas.

Immediately after the proclamation of the British annexation, a steady current of immigration from the mainland set in, and in 1871 the population of Lagos proper was 18,680 males and 14,968 females. Within the Lagos district are Badagry (1148 males, 1248 females), Palma (814), and Loko (165), making a total for the settlement of 31,998. Besides the local tribes the population contains Sierra-Leonians, Kionos, and Fanti, as well as from 4000 to 6000 Brazilian emancipates. The trade of Lagos consists mainly in the exportation of palm oil and palm kernels, and the importation of liquors, tobacco, and cotton goods. Most of the business is in the hands of German and French houses. The average value of imports for 1876-1879 was £515,857, and of exports £220,044. In 1879 the Church of England had 18 churches in the settlement, the Wesleyans 7, the Roman Catholics (who are largely recruited by the Brazilian immigrants) 2, and the Baptists 1. The schools numbered 28, several being subsidized by the Government. The 8000 Mohammedans have 27 mosques and about 37 small Koran schools. During the five years from 1875 to 1879 the aggregate revenue of the settlement was £253,446, the aggregate expenditure £227,523.

LAGRANGE, JOSEPH LOUIS (1736-1813), a mathematician of the highest rank, was born at Turin, January 26, 1736. He was of French extraction, his great grandfather, a cavalry captain, having passed from the service of France to that of Sardinia, and settled in Turin under Emmanuel II. His father, Joseph Louis Lagrange, married Maria Theresa Gros, only daughter of a rich physician at Cambiano, and had by her eleven children, of whom only the eldest (the subject of this notice) and the youngest survived infancy. From his post as treasurer at war, as well as through his wife, he derived ample means, which he, however, lost by rash speculations, a circumstance regarded by his son as the prelude to his own good fortune; for had he been rich, he used to say, he might never have known mathematics.

The genius of Lagrange did not at once take its true bent. His earliest tastes were literary rather than scientific, and he learned the rudiments of geometry during his first year at the college of Turin, without difficulty, but without distinction. The perusal of a tract by Halley (*Phil. Trans.*, vol. xviii. p. 980) roused his enthusiasm for the analytical method, of which he was destined to develop the utmost capabilities. He now entered, without aid or guidance save those afforded by his own unerring tact and vivid apprehension, upon a course of study which, in two years, placed him on a level with the greatest of his contemporaries. At the age of nineteen he communicated to the celebrated Euler his idea of a general method of dealing with "isoperimetrical" problems, known later as the Calculus of Variations. It was eagerly welcomed by the Berlin mathematician, who had the generosity to withhold from publication his own further researches on the subject, until his youthful correspondent should have had time to complete and opportunity to claim the invention. This prosperous opening gave the key-note to Lagrange's career. Appointed, in 1764, professor of geometry in the royal school of artillery, he formed with some of his pupils—for the most part his seniors—friendships based on community of scientific ardour. With the aid of the Marquis de Saluces and the eminent anatomist Cigna, he founded in 1768 a society which rose later to the dignity of the Turin Academy of Sciences. The first volume of his memoirs, published in the following year, contained a paper by Lagrange entitled *Recherches sur la nature et la propagation du son*, in which the power of his analysis and his address in its application were equally conspicuous. Without assumption, but without hesitation, he made his first appearance in public as the critic of Newton, and the arbiter between D'Alembert and Euler. By considering only the particles of air found in a right line, he reduced the problem of the propagation of sound to the solution of the same partial differential equations that include the

motions of vibrating strings, and demonstrated the insufficiency of the methods employed by both his great contemporaries in dealing with the latter subject. He further treated in a masterly manner of echoes and the mixture of sounds, and explained the phenomenon of grave harmonics as due to the occurrence of beats so rapid as to generate a musical note. This was followed, in the second volume of the *Miscellanea Taurinensia* (1763) by his "Essai d'une nouvelle méthode pour déterminer les maxima et les minima des formules intégrales indéfinies," together with the application of this important development of analysis to the solution of several dynamical problems, as well as to the demonstration of the mechanical principle of "least action." The essential point in his advance on Euler's mode of investigating curves of maximum or minimum consisted in his purely analytical conception of the subject. He not only freed it from all trammels of geometrical construction, but by the introduction of the symbol δ gave it the efficacy of a new calculus. He is thus justly regarded as the inventor of the "method of variations"—a name supplied by Euler in 1766.

By these performances Lagrange found himself, at the age of twenty-six, on the summit of European fame. But such a height had not been reached without cost. Intense application during early youth had checked his growth, and weakened a constitution never robust. Accesses of feverish exaltation culminated, in the spring of 1761, in an attack of bilious hypochondria, which permanently lowered the tone of his nervous system, and rendered him liable, throughout his life, to recurrences of the same complaint at the same time of year. Rest and exercise, however, temporarily restored his health, and his grave proof of the undiminished vigour of his powers by carrying off, in 1764, the prize offered by the Paris Academy of Sciences for the best essay on the libration of the moon. His treatise was remarkable, not only as offering a satisfactory explanation of the coincidence between the lunar periods of rotation and revolution, but as containing the first employment of his radical formula of mechanics, obtained by combining with the principle of D'Alembert that of virtual velocities. His success encouraged the Academy to propose, in 1766, as a theme for competition, the hitherto unattempted theory of the Jovian system. The prize was again awarded to Lagrange; and he subsequently earned the same distinction with essays on the problem of three bodies in 1772, on the secular equation of the moon in 1774, and in 1778 on the theory of cometary perturbations.

He had in the meantime gratified a long felt desire by a visit to Paris, where he enjoyed the keen and stimulating delight of conversing with such mathematicians as Clairaut, D'Alembert, Condorcet, and the Abbé Marie. An attack of illness frustrated his design of extending his journey to London, and he returned, though not for long, to the comparative isolation of the Piedmontese capital. The post of director of the mathematical department of the Berlin Academy (of which he had been a member since 1760) becoming vacant by the removal of Euler to St Petersburg, both he and D'Alembert united, by unpremeditated concert, to recommend Lagrange as his successor. Euler's eulogium was enhanced by his desire to quit Berlin, D'Alembert's by his dread of a royal command to repair thither; and the result was that an invitation, conveying the wish of the "greatest king in Europe" to have the "greatest mathematician" at his court, was sent to Turin. On November 6, 1766, Lagrange was installed in his new position, with a salary of 6000 francs, ample leisure for scientific research, and an amount of royal favour sufficient to secure him respect without exciting envy. The national jealousy of foreigners, it is true, was at first a source of

annoyance to him; but such prejudices were gradually disarmed by the mild inoffensiveness of his demeanour, and by his strict adherence to a policy of non-intervention outside his own immediate domain. We are told that the universal example of his colleagues, rather than any desire for female society, impelled him to matrimony, an excess of home-sickness, however, probably directed his choice towards a lady of the Comil family (related to his own by a previous alliance), who, by his request, joined him at Berlin. The experiment was cut short by a lingering illness, during which he devoted all his time, and a considerable store of medical knowledge, to the care of the dying woman.

The long series of memoirs—some of them complete treatises of great moment in the history of science—communicated by Lagrange to the Berlin Academy between the years 1767 and 1787 were not the only fruits of his exile on the banks of the Spree. His *Mécanique Analytique*, the production in which his genius most fully and characteristically displayed itself, was due to the same period. This great work was the perfect realization of a design present to the mind of its author almost from boyhood, and of which he had given a clear though concise sketch in his first published essay.¹ Its scope may be briefly described as the reduction of the theory of mechanics to certain general formulae, from the simple development of which should be derived the equations necessary for the solution of each separate problem.² From the fundamental principle of virtual velocities, which thus acquired a new significance, Lagrange deduced, with the aid of the calculus of variations, the whole system of mechanical truths, by processes so elegant, lucid, and harmonious as to constitute, in Sir William Hamilton's words, "a kind of scientific poem." This unification of method was one of matter also. By his mode of regarding a liquid as a material system characterized by the unshakable mobility of its minutest parts, the separation between the mechanics of matter in different forms of aggregation finally disappeared, and the fundamental equation of forces was for the first time extended to hydrostatics and hydrodynamics.³ Thus a universal science of matter and motion was derived, by an unbroken sequence of deduction, from one radical principle; and analytical mechanics assumed the clear and complete form of logical perfection which it now wears.

A publisher having with some difficulty been found, the book appeared in Paris, under the supervision of Legendre, in 1788. But before that time Lagrange himself was on the spot. After the death of Frederick the Great, his presence was computed for by the courts of France, Spain, and Naples, and a residence in Berlin having ceased to possess any attraction for him, he removed to Paris in 1787. His reception was most flattering. Marie Antoinette warmly patronized him. He was lodged in the Louvre, received the grant of an income equal to that hitherto enjoyed by him, and, with the title of "veteran pensioner" in lieu of that of "foreign associate" (conferred in 1772), the right of voting at the deliberations of the Academy. In the midst of these distinctions, a profound melancholy seized upon him. His mathematical enthusiasm, hitherto the happiness of his life, was for the time completely quenched, and during two years the printed volume of his *Affecques*, which he had seen only in manuscript, lay unopened beside him. He relieved his dejection with miscellaneous studies, especially with that of chemistry, which, in the new form given to it by Lavoisier, he found "aisée comme l'algèbre." The dis-

¹ *Revue*, i. p. 16.

² *Mé. An.*, Advertisement to 1st ed.

³ *Philosoph. Kristalline Gesell. der Mechanik*, pp. 220, 267; *Lagrange, Mé. An.*, i. pp. 166-72, 84 ed.

astious crisis of the Revolution roused him once more to activity and cheerfulness. Curiosity impelled him to remain and watch the progress of such a novel phenomenon; but curiosity was changed into dismay as the terrific character of the phenomenon unfolded itself. He now bitterly regretted his temerity in braving the danger. "Tu l'as voulu" he would repeat self-reproachfully. Even from revolutionary tribunals, however, the name of Lagrange uniformly commanded respect. His pension was continued by the National Assembly, and he was partially indemnified for the depreciation of the currency by remunerative appointments. Nominated president of the Académie for the reform of weights and measures, his services were retained when its "purification" by the Jacobins removed his most distinguished colleagues. He again sat on the commission of 1799 for the actual construction of the metrical system, and by his zealous advocacy of the decimal principle of subdivision largely contributed to its adoption.

The interval had, however, been marked by some of the most considerable events in the placid life of our mathematician. On the 31st of May 1799 he married Mademoiselle Lemonnier, daughter of the astronomer of that name, a young and beautiful girl, whose devotion ignored disparity of years, and formed the one tie with life which Lagrange found it hard to break. He had no children by either marriage, and never regretted their absence. Although specially exempted from the operation of the decree of October 1793, imposing banishment on foreign residents, he took alarm at the fate of Bailly and Lavoisier, and prepared to resume his former situation in Berlin. His design was frustrated by the establishment of and his official connexion with the École Normale, and then the École Polytechnique. The former institution had an ephemeral existence, and his lectures there were consequently few and elementary; but amongst the benefits derived from the foundation of the École Polytechnique one of the greatest, it has been observed,¹ was the restoration of Lagrange to mathematics. The remembrance of his teachings was long treasured by such of his auditors—amongst whom were Delambre and Leclerc—as were capable of appreciating them. In expounding the principles of the differential calculus, he started, as it were, from the level of his pupils, and ascended with them by almost insensible gradations from elementary to abstruse conceptions. He seemed, not a professor amongst students, but a learner amongst learners; pauses for thought alternated with luminous exposition; invention accompanied demonstration; and thus originated his *Théorie des fonctions analytiques* (Paris, 1797). The leading idea of this remarkable work was contained in a paper published in the *Berlin Memoirs* for 1772.² Its object was the elimination of the to some minds unsatisfactory conception of the infinite from the metaphysics of the higher mathematics, and the substitution for the differential and integral calculus of an analogous method depending wholly on the serial development of algebraical functions. By means of this "calculus of derived functions" Lagrange hoped to give to the solution of all analytical problems the utmost "rigour" of the demonstrations of the ancients;³ but it cannot be said that the attempt was successful. The validity of his fundamental position was impaired by the absence of a well-constituted theory of series, the notation employed was inconvenient, and was abandoned by its inventor in the second edition of his *Mécanique*; while his scruples as to the admission into analytical investigations of the idea of limits or vanishing ratios have long since been laid aside. Nowhere, however, were the keenness and clear-

ness of his intellect more conspicuous than in this brilliant effort, which, if it failed in its immediate object, was highly effective in secondary results. His purely abstract mode of regarding functions, apart from any mechanical or geometrical considerations, led the way to a new and sharply characterized development of the higher analysis in the hands of Cauchy, Jacobi, and others.⁴ The *Théorie des Fonctions* is divided into three parts, of which the first explains the general doctrine of functions, the second deals with its application to geometry, and the third with its bearings on mechanics.

On the establishment of the Institute, Lagrange was placed at the head of the section of geometry; he was one of the first members of the Bureau des Longitudes; and his name appeared in 1791 on the list of foreign members of the Royal Society. On the annexation of Piedmont to France in 1796, a touching compliment was paid to him in the person of his aged father. By direction of Talleyrand, then minister for foreign affairs, the French community repaired in state to the old man's residence in Turin, to congratulate him on the merits of his son, whom they declared "to have done honour to mankind by his genius, and whom Piedmont was proud to have produced, and France to possess." Bonaparte, who styled him "le haute pyramide des sciences mathématiques," loaded him with personal favours and official distinctions. He became a senator, a count of the empire, a grand officer of the legion of honour, and just before his death received the grand cross of the order of reunion.

The preparation of a new edition of his *Mécanique*, to which he devoted himself with extraordinary zeal, exhausted his already failing powers. Frequent fainting fits gave prelude to a speedy end, and on the 8th of April 1813 he had a final interview with his friends Lacroix, Monge, and Chaptal. He spoke with the utmost calm of his approaching death: "C'est une dernière fonction," he said, "qui n'est ni pénible ni désagréable." He, however, looked forward to a future meeting, when he promised to complete the autobiographical details which weakness obliged him to interrupt. They remained untold, for he died two days later, April 10, at the age of seventy-seven, and was buried in the Pantheon, the funeral oration being pronounced by Laplace and Lacroix.

Lagrange would never allow his portrait to be painted, holding that a man's works, not his features, deserve remembrance. From a sketch, however, obtained by stealth at a meeting of the Institute, coupled with the descriptions of those who knew him, we can, in some sort, construct an image of his mild and venerable aspect. He was of the middle height, with a slight, well-proportioned figure. His head was finely formed, though not massive; his features strongly marked, with a stamp of grave and noble beauty; eyes ashly blue, habitually cast down in meditation, but when raised, clear and penetrating; complexion pale and faded. The whole physiognomy was more expressive of benignity than of strength, and his social attitude was one of deprecation rather than of self-assertion. He was timid and affable in conversation, slow to give his opinion, though frequently betraying, by his remarks even on subjects alien to his habitual studies, unexpected stores of information and depths of thought. The phrase, "Je ne sais pas" became habitual with him, serving to express his sense of failure in the search for words to fit accurately with ideas, always precise. Of music he used to say "Je l'aime, parce qu'elle m'isole"; and his most abstruse reasonings were frequently pursued under its soothing influence. The sight of suffering was intolerable to him; he abhorred controversy, tolerated—

¹ Notice by Delambre, *Œuvres de Lagrange*, i. p. xlii.

² *Œuvres*, iii. p. 441.

³ *Théorie des Fonctions*, p. 6.

⁴ *Statist. Geschichte der math. Wiss.*, ii. pp. 222-23.

perhaps unduly—what he could not approve, and was emphatically, in his own phrase, “philosophes sans criër.”

The delicacy of his health demanded precautions exaggerated, under the influence of nervous anxiety, into minute watchfulness. He observed a scrupulous regimen, living mainly on fruit and vegetables, and his temperance doubtless helped to keep his faculties unimpaired to the last. By self-imposed rules of study, he regulated his vast capability of work as strictly as if it had been a machine entrusted to his care. It was one of his maxims that the mind gains full command over its powers only by exercise and discipline. He had learned from Frederick the Great always to do the same things at the same hours, assigning the most difficult to the morning. Each day he set himself a task for the next, and from the first aimed at mastering certain points of his subject, with a view to inventing improvements. He always read with a pen in his hand, developing the methods of his author as he proceeded; and his own works were so profoundly meditated that they were usually written without erasures.

Amongst the brilliant group of mathematicians whose magnanimous rivalry contributed to accomplish the task of generalization and deduction reserved for the 18th century Lagrange occupies an eminent place. It is, however, by no means easy to distinguish and apportion the respective merits of the competitors. This is especially the case between Lagrange and Euler on the one side, and between Lagrange and Laplace on the other. The solution of variations lay under-veiled in Euler's mode of treating isoperimetric problems. The fruitful method, again, of the variation of elements was introduced by Euler, but adopted and perfected by Lagrange, who first recognized its supreme importance to the analytical investigation of the planetary movements. Finally, of the general series of researches by which the stability of solar system was ascertained the glory must be almost equally divided between Lagrange and Laplace. In analytical invention, and mastery over the calculus, the Turin mathematician was admittedly unrivalled. Laplace owned that he had despaired of effecting the integration of the differential equations relative to secular inequalities, but Lagrange showed him the way. On the other hand, Laplace unquestionably surpassed his rival in poetical sagacity, and the intuition of physical truth. Lagrange saw in the problems of nature so many occasions for analytical triumphs, Lagrange regarded analytical triumphs as the signs of the existence of nature. One mind seemed, as it were, the complement of the other, and both united in honourable rivalry formed an instrument of unexampled perfection for the investigation of the celestial machinery. What may be called Lagrange's first period of research into planetary perturbations extended from 1774 to 1784 (see *ASTRONOMY*, vol. II. p. 731). The remarkable group of treatises communicated, 1781–84, to the Berlin Academy was designed, but did not prove, to be his final contribution to the theory of the planets. After an interval of twenty-four years the subject, having been reopened by Ponsen in a paper read June 30, 1808, was once more attacked by Lagrange with all his pristine vigour and fertility of invention. Resuming the inquiry into the invariability of mean motions, Ponsen carried the approximation, with Lagrange's formulae, as far as the squares of the disturbing forces, hitherto neglected, with the same result as to the stability of the system. He had not, however, succeeded in including in his calculations the orbital variations of the disturbing bodies; but Lagrange, by the happy artifice of transferring the origin of coordinates from the centre of the sun to the centre of gravity of the sun and planets, obtained a simplification of the formulae, by which the same analysis was rendered equally applicable to each of the planets severally. It deserves to be recorded as one of the numerous coincidences of discovery that Laplace, on being made acquainted by Lagrange with his new method, produced analogous expressions, to which his independent researches had led him. The final achievement of Lagrange's career was the extension of the method of the variation of arbitrary constants, successfully used by him in the investigation of periodical as well as of secular inequalities, to any system whatever of mutually interacting bodies.¹ “Not without astonishment,” even to himself, regard being had to the great generality of the differential equations, he reached a result so wide as to include, as a particular case, the solution of the planetary problem recently obtained by him. He proposed to apply the same principles to the calculation of the disturbances produced in the rotation of the planets by external action on their equatorial protuberances, but was anticipated by Ponsen, who gave formulae for the variation of the elements of rotation strictly corresponding with those found by Lagrange for the variation of the elements of revolu-

tion. The revision of the *Mécanique Analytique* was undertaken merely for the purpose of embodying in it these new methods and final results, but was interrupted, when two-thirds completed, by the death of its author.

In the advancement of almost every branch of pure mathematics Lagrange took a conspicuous part. The calculus of variations is indissolubly associated with his name. In the theory of numbers he furnished solutions of many of Fermat's theorems, and added some of his own. In algebra he discovered the method of approximating to the real roots of an equation by means of continued fractions, and imagined a general process of solving algebraical equations of every degree. The method indeed failed for equations of an order above the fourth, because it then involves the solution of an equation of higher dimensions than the proposed. It possesses, however, the great and characteristic merit of generalizing the solutions of his predecessors, exhibiting them all as modifications of one principle. To Lagrange, perhaps more than to any other, the theory of differential equations is indebted for its position as a science, rather than a collection of ingenious artifices for the solution of particular problems. To the calculus of finite differences he contributed the beautiful formula of interpolation which bears his name; although substantially the same result seemed to have been previously obtained by Euler.

But it was in the application to mechanical questions of the instrument which thus helped to form that his singular merit lay. It was his just boast to have transformed mechanics (defined by him as a “geometry of four dimensions”) into a branch of analysis, and to have exhibited the so-called mechanical “principles” as simple results of the calculus. The method of “generalized coordinates,” as it is now called,² by which he attained this result, is the most brilliant achievement of the analytical method. Instead of following the method of each individual part of a material system, he showed that, if we determine its configuration by a sufficient number of variables, whose number is that of the degrees of freedom of movement (there being as many equations as the system has degrees of freedom), the kinetic and potential energies of the system can be expressed in terms of these, and the differential equations of motion thence deduced by simple differentiation. Besides this most important contribution to the general fabric of dynamical science, Lagrange's name is connected with minor theorems of great elegance—among which may be mentioned his theorem that the kinetic energy imparted by given impulses to a material system under given constraints is a maximum. To this entire branch of knowledge, in short, he successfully imparted that character of generality and completeness towards which his labours invariably tended.

His share in the gigantic task of verifying the Newtonian theory would also suffice to immortalize his name. His co-operation was indeed more indispensable than at first sight appears. Much as was done by him, what was done through him was still more important. Some of his brilliant rival's most conspicuous discoveries were implicitly contained in his writings, and wanted but one step for completion. But that one step, from the abstract to the concrete, was precisely that which the character of Lagrange's mind disdained him to make. As notable instances may be mentioned Laplace's discoveries relating to the velocity of sound and the secular acceleration of the moon, both of which were laid close up to by Lagrange's analytical demonstrations. In the *Œuvres Mémoires* for 1778 and 1783 Lagrange gave the first direct and theoretically perfect method of determining cometary orbits. It has not indeed proved practically available; but his system of calculating cometary perturbations by means of “generalized coordinates” has formed the starting-point of all subsequent researches on the subject. His determination³ of maximum and minimum values for the slowly varying planetary eccentricities was the earliest attempt to deal with the problem. Without a more accurate knowledge of the masses of the planets, the solution possessed a satisfactory solution was indeed impossible; but the upper limits assigned by him agreed closely with those obtained later by Leverrier.⁴ As a mathematical writer Lagrange has perhaps never been surpassed. His treatises are not only storehouses of ingenious methods, but models of elegant and forcible clearness, elegance, and originality of his mode of presentation give lucidity to what is obscure, novelty to what is familiar, and simplicity to what is abstruse. His genius was one of generalization and abstraction; and the aspirations of the time towards unity and perfection received, by his serene labours, an embodiment denied to them in the troubled world of politics.

Lagrange's numerous scattered memoirs have been collected and published in seven handsome octo volumes, under the title *Œuvres de Lagrange publiées sous les soins de M. J. A. Serret*, Paris, 1867–71. The first, second, and third volumes of this superb publication contain the *Œuvres complètes* of Lagrange by him to the Académie des Sciences de Turin, Berlin, and Paris, the fourth includes his miscellaneous contributions to other scientific collections, together with his *Œuvres de Lagrange*, and his *Œuvres de Lagrange*, and his *Œuvres de Lagrange* in 1796. Delambre's notice of his life, extracted from the *Œuvres*, de

¹ *Œuvres*, vi. p. 777.

² We use the modern terms by which the functions introduced by Lagrange are now denoted.

³ *Œuvres*, vi. p. 311 &c.

⁴ *Grav.*, *History of Physical Astronomy*, p. 117.

Plastique, 1812, is prefixed to the first volume. Besides the separate works already named, are *Résumé des Équations Numériques*, 1798 (éd. de 1803, at ed. 1825), and *Léçons sur le Calcul des Fonctions*, 1810 (éd. de 1830), designed as a commentary and supplement to the first part of the *Théorie des Fonctions*. The first volume of the enlarged edition of the *Mécanique* appeared in 1811, the second, of which the revision was completed by M. Frany and Kunt, in 1815. A third edition, in 2 vols. 4to, was issued in 1845-46, and a second of the *Théorie des Fonctions* in 1812. See also Virey and Pote, *Précis Historique*, 1819, Thomson's *Annals of Philosophy*, 1819-20, vols. 9 and 10, Güttinger, *Grundriss der Math.*, 1748, 1875, Günther, *Kritische Uebers. der allgemeinen Principien der Mechanik*, 1877 (ed. ed.), Günther, *Essai Historique sur le Problème des trois Corps*, 1817, *Grand History of Physical Astronomy*, &c. (A. M. G.)

LAGRÈRE, LOUIS JEAN FRANÇOIS (1724-1806), French painter, was a pupil of Carle Vanloo. Born at Paris 30th December 1724, in 1756 he became a member of the Academy, presenting as his diploma picture the Rape of Delianra (Louvre). He visited St Petersburg at the call of the empress Elisabeth, and on his return was named in 1781 director of the French Academy at Rome; he there painted the Indian Widow, one of his best-known works. His pictures, which have nearly all been engraved, are frequently to be met with out of France. In 1804 Napoleon conferred on him the cross of the legion of honour, and on 19th June 1805 he died in the Louvre, of which he was honorary keeper.

LAHIRE, LAURENT DE (1606-1656), French painter, was born at Paris on 27th February 1606. He became a pupil of Lallemand, studied the works of Primaticcio at Fontainebleau, but never visited Italy, and belongs wholly to that transition period which preceded the school of Simon Vouet. His picture of Nicolas V. opening the crypt in which he discovers the corpse of St Francis of Assisi standing (Louvre) was executed in 1630 for the Capuchins of the Marais; it shows a gravity and sobriety of character which marked Lahire's best work, and seems not to have been without influence on Le Sueur. The Louvre contains eight other works, and paintings by Lahire may also be found in the museums of Strasbourg, Rouen and Mans. His drawings, of which the British Museum possesses a fine example, Presentation of the Virgin in the Temple, are treated as seriously as his paintings, and sometimes show simplicity and dignity of effect. The example of the Capuchins, for whom he executed several other works in Paris, Rouen, and Écamp, was followed by the goldsmiths' company, for whom he produced in 1635 St Peter healing the Sick (Louvre) and the Conversion of St Paul in 1637. In 1646 he shared with eleven other artists the honour of founding the French Royal Academy of Painting and Sculpture. Richelieu called Lahire to the Palais Royal; Chancellor Séguier, Tallemant de Réaux, and many others entrusted him with important works of decoration; for the Gobelins he designed a series of large compositions. Lahire painted also a great number of portraits, and in 1654 united in one work for the town-hall of Paris those of the principal dignitaries of the municipality. Two years later, 28th December 1656, he died. His works have been frequently engraved by his own pupil Chauveau, and by Lesne, Boulanger, De la Court, Rousselet, and Faithorne.

LAHORE, or LARHÖR, capital of the Punjab, India, gives its name to a civil division of the British territory in that province, and to the headquarters district of the division.

LAHORE DIVISION.—This division, the most central of the ten into which British Punjab is divided, is fourth in order of size, 8961 square miles, and fifth in respect of population, 1,899,496 (by the census of 1868), averaging 211 to the square mile. The Lahore division has three districts—Lahore, Ferozepur, Gujranwala. The whole area is alluvial plain, for the most part devoid of trees, except such as have been planted since British occupation. It is intersected by the rivers Ravi and Sutlej, and the Bari Doab canal drawn from the Ravi at the foot of the hills; also by the old bed of the Bias river deserted about the

middle of last century. The Chenab river is the boundary on the north-west, between the Lahore and the Rawal Pind divisions. Of the towns in the division there are five which have over 10,000 inhabitants, namely, Lahore, Kasur, Gujranwala, Wazirabad, Ferozepur. The common language of the rural population and of artisans is Punjabi. Urdu (Hindustani) is the language of the better educated classes, and is everywhere becoming more generally understood and used. In Government schools Punjabi is not taught.

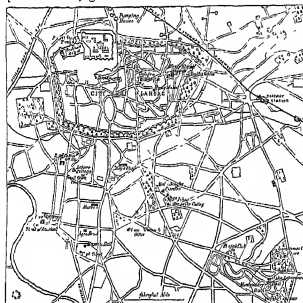
So far from the seaboard, the range between extremes of winter and summer temperature is great. The mean temperature in the shade in June is about 92°, in January about 50°. In midsummer the thermometer sometimes rises to 115° in the shade, and remains (on rare occasions) as high as 105° throughout the night. In winter the morning temperature has sometimes been as low as 20°. The rainfall is uncertain as well as scanty: the annual average is about 15 inches; it is sometimes as low as 8°; a total of 28° is exceptionally high. The harvests are greatly dependent on irrigation. The prevailing winds are westerly (N.W. and S.W.) in the hot weather, and easterly (E. and N.E.) in the cold season. The Lahore division became British territory in March 1849, on the annexation of the part of the Punjab west of the Bias river, at the close of the second Sikh war.

LAHORE DISTRICT has an area of 8648 square miles, with a population of 789,666 (438,836 males and 351,831 females;—Sikhs, 119,268, Hindus, 116,287; Mohammedans, 470,216; others, 88,896). Of this number about 3000 are Europeans and Eurasians, residing chiefly at Lahore and its cantonment of Mian Mir. The district contains 1455 villages, with an agricultural population of 364,012. The gross revenue is £110,518—£74,353 being derived from the land. Of the area 1,165,440 acres are under cultivation, 811,520 uncultivated, and 387,750 uncultivable. Of the uncultivated area nearly 287,000 acres are unappropriated cultivable waste land, the property of the Government. Irrigation is supplied to upwards of 180,000 acres by the Bari Doab canal and three inundation canals from the Sutlej (filled for a certain time each year by the rise of the river), which are Government works, and about 267,000 acres are watered by private wells.

The chief crops are—wheat, about 488,000 acres; grain (chick-pea, for cattle), 230,000; barley, 58,000; maize, 25,000; rice, 18,000; various food grains, 25,000; sugar cane, 2600; vegetables, 7000; opium, 1500; tobacco, 6000; poppy, 1000; cotton, 40,000; oil seeds, 16,000. Indigo, now only grown on a small scale in this part of India, was formerly one of the important products of the country round Lahore, which had the reputation of great fertility. The traders on the part of the East India Company in the 17th century paid much attention to the indigo of Lahore. The court minutes of the Company, July 19, 1614, notice the proposal of Captain Newport at Surat for "a voyage to the river Sindus, whence the Lahore indigo comes." Captain Dornon, writing to the Company in November of the same year regarding the option which the English merchants met with at Surat, expresses a wish that they had some hope of being able "to transport their goods by that fair river of Sindus to and from that goodly country round Lahore." And another trader speaks in 1615 of the great store of indigo to be had both at Ahmedabad and at Lahore. No doubt what was reckoned Lahore indigo may have been in great part indigo from elsewhere, passing through Lahore as the trade centre of that part of India,—just as, at the present day, the rock salt of the Punjab is in other provinces commonly called *Lahore*, though it comes from the salt hills west of the Jhelum. The importance of Lahore as a centre of trade at the times above referred to, is shown also in some of Sir T. Roe's letters. Lahore now receives indigo from Bengal. The rent per acre of good wheat land in the Lahore district is about 5 rupees. The selling price of wheat in ordinary years is about 25 *seers* (33 *lb*) for a rupee. The water-level in the neighbourhood of Lahore is at a depth of 30 to 35 feet from the surface of the ground. In the tract between the Ravi and the Chenab it is from 15 to 30 feet. In the south and south-west parts of the district, between the Ravi and the Sutlej, the depth is from 40 to 70 feet, except in some strips of low land.

After the opening of the Bari Doab canal, the water-level in wells of village lands on both sides of the canal was permanently raised, in some cases as much as 12 feet. The Lahore district has 107 miles of metalled roads, and 688 miles unmetalled, 97 miles of railway, and 101 miles of navigable rivers.

LAHORE CITY lies in $31^{\circ}34'N$ lat and $74^{\circ}21'E$ long, on the left bank of the river Ravi, about 900 feet above the sea level. It is a walled town, about $1\frac{1}{2}$ miles in length from west to east, and about $\frac{1}{2}$ mile in breadth from north to south. The immemorial population is 98,924, with the suburbs Anarkali, Muzang, and Ichia. The number is 128,141. The city walls, rebuilt in the time of Akbar, towards the end of the 16th century, were of great height, in some parts upwards of 36 feet, and higher at the gateways and parts adjoining Ranjit Singh added a deep ditch, with a broad *faucesbraie* (*ravins*) between the ditch and the walls, and large outworks, shielding with a massive defence each of the city gates. The fort or citadel, in which was the palace, is on high ground on the north face of the city, and has three gates, one direct to the open plain on the north, and one on each side, east and west, into the city. Only the north gate of the fort is now open. The city gate next the fort on the west, called the



Plan of Lahore

Roshnā or bright gate, leads into the small enclosure, called the Hazuri Bagh or Court Garden, from which on the one side rises the great flight of steps to the terrace of the imperial mosque, and on the other the ascent through a fine gateway (now closed) to the palace in the fort. The fort and palace, with the conspicuous *Samana Buz* (properly *minaret*, octagonal tower; it is a half octagon), present a striking appearance viewed from the open plain on the north.

The site of the present city has been occupied from early times, and much of it stands high above the level of the country outside, raised on the remains of many successive series of former habitations. Some of the old buildings, which have been preserved when changes were going on around, stand now below the surface of the ground about them. This is well seen in the mosque now called *Maqūd Musā* (or *sunken*), built 1560, the mosque of Mullah Rahmat, 7 feet below, and the *Shedda* (Hindu temple), a very old building near the revenue office, about 12 feet below the surrounding ground. The houses are of brick, irregular in construction, three and more stories in height, many of them with projecting balconies and lattice windows ornamented with varieties of carved woodwork. The

streets, narrow and winding, were, under the Sikh Government, and at the time of the first British occupation of the city in 1846, extremely unregulated and dirty. The water supply, from numerous wells throughout the city, was for the most part exceedingly impure. A cleansing and draining of the streets had to be taken in hand at once, when the city was held by British troops. The governor-general of India, Lord Hardinge, having, after the defeat of the Sikh army at Sabkarni, advanced to Lahore and concluded a treaty with the Sikh Government, a British force was left, to hold Lahore for that year (1846), the fort being reserved for the maharaja. But the occupation of Lahore was prolonged. A British resident was appointed, and barracks were built for the troops in the Anarkali suburb. After the annexation of the Punjab in 1849 the government of the country was placed in the hands of a board of administration. The fort was held by the British troops, the rest of the force assigned to Lahore being quartered outside the city in the cantonment of Anarkali. Subsequently a site for a permanent cantonment was selected at Mian Mir, about five miles south-east of the city, and all the troops, British and native, are now quartered there, except the small garrison of the fort.

In 1852 the lofty walls, which greatly impeded the free airing of the interior of the city, were reduced to a height of from 14 to 20 feet, and the whole of the massive outworks were removed. In 1863 the ditch was filled in and the *faucesbraie* levelled; and on this broad strip of new land immediately outside the city walls public gardens were laid out, and supplied with a watercourse from the Bari Doab canal. This work of improvement was carried out under the immediate direction of the native gentlemen of the Lahore municipal committee.

The municipality now includes within its limits the greater part of the civil station of Lahore, which covers, in addition to the ground occupied by the old Anarkali cantonment, a large area south and south-east of the city. All new public buildings have been erected in this civil station outside the walls. The principal of these are the deputy commissioner's court-house, the Government college, the Mayo hospital, the senate hall of the Punjab University College (the gift of the maharaja of Bahawalpur). The Lahore Industrial and Artisan Museum is in the building erected for the "Punjab Exhibition" of 1864. A building for the school of art in connexion with the museum is in progress. The medical school, at first held in a disused barrack of the Anarkali cantonment, and then in hired houses, is now about to be provided with a suitable building at the Mayo hospital. The block of buildings erected for the British consular and offices, and used for this purpose up to the time of annexation, is now occupied by the chief court, the Government secretariat offices, civil and military, and the offices of the financial commissioner of the Punjab, and of the commissioner of the Lahore division. A new building for the chief court is about to be erected. A large building for the Government telegraph department has lately been finished. The post-office occupies one of the barracks of the old cantonment, and others of them continue to be occupied by the offices of various Government departments—public works, public instruction, prisons, &c. The central jail stands on the site of the British camp of 1846, and in the large public grounds which contain the botanical and zoological gardens stand the John Lawrence Hall and the Montgomery Hall, erected in honour of the first two lieutenant-governors of the Punjab. Of native buildings applied to new purposes there are, in the palace (1680-1640) the Durbar-i-am (or hall of audience), serving as a barracks for the fort garrison; the two buildings called *Khwaib-gah* (or sleeping apartments), used as the Protestant and Roman Catholic places of worship for the troops in the fort; the vaults of the *Kala Buz* and *Lal Buz* (black and red towers) used as commissariat store-rooms; the *Shad Masud* (pearl mesquite), which Ranjit Singh made his treasury, still used for the same purpose. The *amra*, an adjoining building, contains an interesting collection of arms and armour of the Afghani and Sikh times.

In the city, the mansion of Raja Dhan Singh, Ranjit's prime minister (which was the British artillery mess house in 1846), contains the Government district school, the Oriental college, and the hall of the *Anglo-Punjab*, an active literary and educational society. The quadrangle of the *Wazir's Dargah* (a royal garden) contains the Government normal school. In the *Rang Mahal* is the large high school of the American Presbyterian mission.

Outside the city, half way between the civil and military

stations, is Government House, the official residence of the lieutenant-governor of the Punjab, formerly the house of the Jamadar Khush-din Singh, a Brahman who, with varied fortunes, held high offices under Ranjit Singh. The original building round which the present large house was erected was the tomb of Sayid Nur-ud-din, called also Nur-ul-islam, of Bakhara (1616), which is the left hand square apartment in the middle of the present building. The tomb of Nadrabi Begum was fitted up in the early days of British rule as the station church, and continues to be used for this purpose. (A large new church has been commenced, which will now be the cathedral of the lately constituted diocese of Lahore.) The tomb of Shah Ghungh (1699 A.D.) is, with large additions made from time to time, the office of the accountant-general of the province. The *bradras* or summer house (commonly called *chah-hur*), the building with four towers of Nawab Wazir Khan (1681), long occupied by the museum, is now the state library and reading room.

Educational and other institutions.—The Punjab University College, established in 1860 to give special encouragement to the cultivation of Oriental learning, and instruction in European science through the vernacular languages, is supported with much zeal by the chiefs and native gentlemen of the Punjab. It is now about to be raised to the status of a university, with power to confer degrees. The other educational institutions of Lahore are the Government college, the normal school, the Oriental college, the district Anglo-vernacular school, the high school for boys of European parentage, the Anarkali school for girls, another girls' school of the same class near the railway station, chiefly for the children of the railway employes, St. James' orphanage and free school, for poorer children, European and Russian. The large and prosperous school of the American Presbyterian mission in the city has been mentioned above. The medical school, established in 1860, gives a five years' course, in the English language, qualifying for a diploma as licentiate in medicine and skill for employment in the Government service in the grade of assistant-surgeon. A three years' course, in the Urdu language, trains a lower class of students for the grade of hospital assistant or native doctor. The number of students in the upper class is between fifty and sixty, in the lower from eighty to one hundred. The Anglo-Sikh industrial and agricultural school, in view mainly of the cultivation of the Oriental art as applied to decoration and manufactures, and, in aid of this purpose, instruction in drawing, modelling, &c. Among other works in which the trained pupils have been employed is the production of plaster casts of the Buddhist sculptures in the museum, obtained from explorations in the districts of the Punjab. St. John's Divinity College (enrolled in the Church Missionary Society) gives theological instruction, in the Urdu language, to native Christian students, ten of whom are new pastors of native congregations in different parts of northern India.

There is a Government book depot for the sale of educational and other books, and from the depository of the Punjab Religious Book Society there is a large and increasing sale of books of religious and general literature in English and in the vernacular languages. A large number of books in the native languages are issued annually from the local presses. Nine newspapers in Indian languages are published at Lahore—seven in Urdu, one in Hindi, and one in Arabic. One of the Lahore Urdu papers has the largest circulation of any native paper published out of Bengal. There is one daily English paper, and one under native editorship and management in the English language.

In the Lahore central jail, which is capable of receiving 2000 inmates, many useful manufactures are carried on by the prisoners. For the carpets made in this jail there is a large demand in the English market. Besides the two smaller jails, the district jail and the female jail, there is a *Thagpi* jail and school of industry, in which the low criminals, *Thagpi* (or Thugs—highway thieves and robbers) are taught useful work, chiefly tent making. A large lunatic asylum occupies the enclosed buildings of one of the old Sikh cantonments.

Trade.—The Lahore municipality has an annual income of nearly 170,000 rupees, the greater portion of which is the Lahore revenue, apart from other parts of the Punjab, and the hill countries beyond, tobacco, dyes, bamboos, hides, Kashmir paper, felt, and silk fabrics; from Bengal and the southern provinces, indigo, spices, English piece goods, and other foreign products and manufactures; from Bombay, metals and metal work, cutlery, &c., and drugs. The chief manufactures of Lahore—but they are none of them on a great scale—are woollen and silk fabrics for clothing, carpets (cotton and woollen), embroidery on leather, ivory carving, toys, pottery, turnery, metal work of various kinds, arms, jewellery, &c. Lahore has long been noted for the carpets. One of the travelling agents of the East India Company from Agra, reports the purchase of the purchase of various articles, including thirty Lahore carpets. Soon after he writes from the same place, "It requires a long time to get well chosen carpets. True Lahore carpets are not suddenly to be gotten." Two years later, December 1618, another, writing from Sahind about carpets, says, "Lahore is the chief place for that commodity." A little later in the same century it is observed that

from Lahore were obtained fine muslins, flowered and embroidered silks, woollen drapery, and all sorts of carpets.

Health.—The general health of Lahore is good, but the city and civil station, as well as the cantonment of Mian Mir, have suffered from occasional severe visitations of cholera and fever, as well as of small-pox. A large amount of rain within a short space of time, though the total of the year may be under the average, is usually followed by malarious fever, while a larger rainfall, more distributed, is healthy. Of much importance to the health of Lahore is the large work which the municipality has executed for the supply of water to the city and suburbs. The water is pumped from a well in the bed of the river Ravi to a covered reservoir in a high part of the city, from which it is distributed. A scheme of drainage and sewerage works, dependent on this supply of water, is about to be carried out. For the military station of Mian Mir water has been brought in by a cut from the Bari Doab canal.

Communications.—Lahore is in a railway communication with the most important places in the Punjab, and with the other provinces of India. Its distance from Delhi is 328 miles (Sind, Punjab, and Delhi Railway), from Calcutta, 1277 miles (East India Railway), from Bombay by Delhi and Allahabad (East India Railway and Great Indian Peninsula), 1558 miles, from Bombay by Delhi and Ajmer (Rajputana State Railway), 1290, from Multan (Sind, Punjab, and Delhi Railway), 207, from Karachi, the nearest point on the sea-coast (Sind, Punjab, and Delhi Railway and Indus Valley State Railway), 814, and from the Afghan frontier at Peshawar (Punjab Northern State Railway), 571 miles. This last line still wants, completely, the great branch across the Indus at Attock, now in course of construction. A narrow-gauge branch, from this line, for the salt traffic, is open to the bank of the Jhelum river, opposite Fird Dahan Khan. At Lahore there is one central railway station for all the lines, a short distance east of the Delhi gate.

History and antiquities.—To this account of Lahore under British rule will now be added a short sketch of its previous history, and the works of former days which still remain.

Lahore is said to have been founded by *Lava* or *Loh*, one of the sons of Rama, and it has borne the names *Lavapuri*, *Loh-puri*, *Loh-kid*, *Lohiana*, *Lahavna*. The city of the pre-Mughal period was the *Rajya Trivempura*, or territory of the kings of Kashmir. The Kashmir belonged for a long time the country (*Lavana* or *Lavyana*) as far south as Lahore, and beyond *Lavana*, which also means salt, may have taken its name from the salt region west of Jhelum. Captain Wilford (*As. Res.* 35) recognised Lahore in the *Adarsa* and *Lahavna* of the *Arthashastra*. Labakia, the name of the Pandits about the Jhelum, and Labakia in Kashmir territory, which in reality embraced the other. Cunningham (*Ancient Geography of India*) suggests that Labakia should be read *Labakia*—*Lava-lava* or *Lava-lak*. There appears to be no mention of Lahore by the historians of Alexander; it is not mentioned in the *Arthashastra* or *Sungala* or *Sungala*, in the country of the Oxartes, but this place is better represented by the hill still called *Sungala*, to the west of Lahore, between the Ravi and the Ghendri.

At the time of the first Mohammedan invasion of India, in the 7th century, Lahore was in the possession of a Chahdini Rajput prince of Ajmer. Towards the end of the 10th century Raja Jaisi, the ruler of the Lahore territory, was driven back after an encounter, on the frontier (978), with Salabaktagin, who had just risen to the throne of Ghazni. In 1001 Jaisi had to meet the first incursion of Salabaktagin's son Mahmud. In his third invasion of the Punjab Mahmud advanced as far as Bhera on the Jhelum, which used to be the raja's place of residence alternately with Lahore, and which had been for a time the Hindu capital. The sixth time Mahmud came (1008), a great battle was fought near the Indus with the raja of Lahore, Anangpal, the successor of Jaisi. At length, on his fourth invasion of India (1028), Mahmud took possession of Lahore, and appointed a governor, the raja, Jaisi II., having fled to Ajmir.

Under Mahmud and seven successors Lahore continued to be ruled by governors appointed by them. When the kings of Ghazni were fully occupied with the Soljids, the Soljids and Indian subjects were roused to revolt, and, with the aid of the raja of Delhi, attacked Lahore. But the city was successfully held against them, and in the reign of Masud II., the eighth from Mahmud, it was for a time made the seat of the government (1110). His successor Bahram went back to Ghazni; but his son, Masud Shah, after repeated defeats by the prince of Ghazni, was driven to take refuge in the Punjab, and again made Lahore the capital. When Ghazni-ud-din and Shahab-ud-din of Ghor were ruling jointly at Ghazni, the latter proceeded to follow up the defeat of their Ghaznavi predecessors on an invasion of the Punjab, and, capturing Ebn al-Malik, son of Khusrav Shah, the possessor of Lahore (1186). It was next seized by the *Qakars*, an ancient tribe of the hill country in the north-west of the Punjab. Shahab-ud-din succeeded in expelling them, but they murdered him on his way back to Ghazni, in 1209. Kutub-ud-din, a Turk slave originally, who had held the chief command in India during those troubled times of his late master's reign, succeeded to the sovereignty of the

Indian provinces, which ceased from this time to be dependent on Ghazni. He had then the possession of Lahore, which had been seized by a rival, and the seat of government was then transferred from Lahore to Delhi.

The buildings at Lahore of the Hindu times, and of this first Mohammedan period, are few in number. To the former probably belongs the *Shriam* or temple of Shiva in the middle of the city, now surrounded by more modern additions. It is ascribed to the time of Loh, the founder of the city. The temple of Bhairava (a form of Shiva), about a mile south of Lahore, is generally ascribed to a later period, but Lahore is said by the author of the *Baye Tarangini* to have been added in early times to the worship of Bhairava. To the Ghazni times belong the tomb of Malik Ayaz, governor of Lahore. It is in the heart of the city, and was built about 1040. Hazrat Ganj Bakshah, who also came with Mahmud to Lahore, is buried outside the Bhatti gate, and at his tomb (built 1075) a weekly fair is now held, resorted to by Hindus as well as Mohammedans. About the same time were built the tomb of Pir Ali Makhdum of Baghdad, and the tomb of Saad Ishak, near Wazir Khan's mosque in the city.

The Mughal army sent into India by Jahangir Khan in 1524 and subsequent years swept over the middle of the Punjab and in 1541 captured the old capital, Bhora, and had waste Lahore and Multan. In 1549 the king of Delhi, Ghansu-din Balban, visited Lahore, and rebuilt the fort which the Afghan invaders had destroyed. His eldest son Muhammad Sultan, the Khan of Multan, came to Lahore in 1586, to oppose another invasion under Samah, one of the Mughal governors. The fight in which the young prince fell at Lahore is further memorable from the capture of his friend Amir Khurd, the Persian poet.

After more than a hundred years, during which the history of Lahore is comparatively unimportant, though it was not untroubled, it suffered like other wealthy places in Northern India from the invasion in the end of the 14th century. On his return from the sack of Delhi, Timur sent a force to Lahore, with instructions to raise a large contribution there, to which was afterwards added an order for the plunder of the city and the country around. And then Lahore had a time of repose. In 1560, when Bahadur, the first of the Lodi dynasty, had raised to the sovereignty at Delhi, and the change of the several divisions of his territory was assigned to different officers, Lahore was reserved for himself.

The 14th and 15th centuries have left no known buildings at Lahore, though some of the following century are marked by the Pathan style belonging to the latter period.

The next change in the fortunes of Lahore was a great and important one. In 1522 it passed into the hands of Timur's descendant Baber (Babur), the first of a line of new masters who were to give it new life, though it gained little under Baber himself. Invited by the governor of Lahore, who had become weak, the Lodi king, Baber came on with an army, and, having defeated the Lodi forces, he gave up the city to plunder. On his departure for Cabul in 1524 he left Lahore in charge of his relative Abd'ul Aziz. Baber lived occasionally at Lahore, but his reign of frequent contests gave him little rest at any permanent seat of government. Humayun, who succeeded his father Baber in 1550, did not long retain Lahore undisturbed. His brother Kamran, governor of Kandahar and Cabul, who laid claim to the Indian sovereignty, came to Lahore, and by artifice succeeded in gaining the city without bloodshed. Five years later Kamran had to march to the relief of Kandahar, and during his absence an attempt was made upon Lahore, which was defeated by his rapid return. In 1560 the Afghans made another endeavour to recover power in India under Shih Shah Sur, who took possession of Lahore and of Bhira, the other old capital, which still retained some importance.

Kamran lived long enough at Lahore to make his mark there in three pieces of work which there are still remains, but altered and added to by others since, so that of his part there is not much to be seen. One of these was the *Madrasa* or summer house of the Dil-Kusha garden on the bank of the Ravi opposite Lahore, on which now stands the house built over it by Ranjit Singh. Kamran's garden of Shahzadeh is the beginning of the grander work, now styled by Shah Jahan. Of his palace at Naushah, east of the city, only the gateway now remains. Other buildings at Lahore of this earliest Mughal period are the tomb of Khujah Sa'id Khan and the Khujah Maqad, the mosque now called *Nisrin*, and the *Shirvan* or *Masjid*. In the time of Humayun's son and successor, Akbar (1565-1605), Lahore rose to a condition of prosperity unknown at any previous time. To his reign belongs the commencement of its architectural greatness, which increased in the two following reigns. He made the city the royal residence, rebuilt the fort, and began the palace buildings. He rebuilt the city walls, which, altered and added to by his successors and now reduced, still surround the city. To this time belong many of the well-known buildings now to be seen at Lahore. The mosque near the *Masjid* gate (opposite the Poor House of the present day) is said to have been built by the emperor's mother. Of the same date are the tombs of Abd'ul Ishak at Misang,

of Kasim Khan, of Manj Darya (a saint whose prayers procured Akbar's success in his attack on Chitor), and of Shahzadeh. This last, called *Sadeh Gumbaz*, is the earliest of the Lahore buildings coloured with the glazed tile-work commonly called *Adak*. The Akbari, whom he named Anarkali, was built about the end of his reign, it is the building now used as the station church. To this period belongs also the mosque of Mullah Rahmat as well as the earliest work of the Sikhs in the city. The *Adak* or masonry tank in the middle of the city was built in 1584 by Ratan Dida, the guru or spiritual leader of the Sikhs, forth in order from Nankah the founder of the sect.

A curious and special interest attaches to Lahore in the time of Akbar, in connexion with the first teaching of Christianity in northern India by the Jesuit missionaries whom the emperor had invited to Lahore from Goa, after receiving the visit of Antony Capel at Agra in 1578. They were first Rodolph Aquaviva, Antony Manservant, and Francis Henrico. Afterwards came Edward Leighton and Christopher Vega in 1589. When they, like the others, had gone away disappointed, and the emperor's invitation was repeated, two others were sent,—Jerome Xavier (archbishop of Frensch) and Emanuel Francisco. Akbar built a church for them in Lahore. He then for a time shut up the Lahore mosques. The church of the Jesuits was thronged with Mohammedans. On the day of Pentecost 1596 a number of converts walked in procession through the streets of Lahore to the church, and were publicly baptized by Fumoro. Benedict Cosen passed through Lahore in 1608, on his journey to solve the question of the identity of China and Cathay, and was kindly received and helped by Akbar. Lastly, a new missionary, Father D'Acosta, came to Lahore soon after the beginning of Jahangir's reign. The marks of Christian work and success at Lahore of this period remained on some of the buildings there when the men who had been brought under its influence passed away and no traces remained with their children. De Laet says that in 1680 (three years after Jahangir's death) he saw over one of the palace gates at Lahore figures of our Saviour and of the Virgin. They are described also by Tavernier, who visited Lahore in 1686; he says they had been put up by Jahangir to please the Fort. Remains of the Jesuit church also were to be seen when Theronot was at Lahore. Some traces of Christian art are still to be seen, which may be referred to the same period,—the winged heads on the principal gate of the fort and of the Gola *sark* (1622).

When Jahangir succeeded to the throne of Akbar, Lahore was included in only one scene of one of these family contests which so often marked the Mughal reigns. His son Khurram aimed at power, and attempted, unsuccessfully, to obtain possession of the city. Among those on whom the emperor's displeasure fell was the Sikh leader, Arjun Mal, fifth guru, the compiler of the *Adab Grahani*, who had succeeded his father Ram Das in the office of spiritual prayers for Khuram; he was imprisoned by Jahangir, and died the same year, 1606. His little tomb stands just outside the fort.

The buildings at Lahore of Jahangir's time are numerous. The most important and the best preserved are—the *Sumra* Dargah, and some other parts of the palace in the fort, built during several successive years (1605, &c.); the *sark* at Shahdara (1612); the tomb of Saad Nur-ud-din, Nur ul Alam, Bukhari (1616), now Government House, the tomb of Shah Abd'ul Masali, and the mosque beside it (1616), the *masjid* of Didi Bakhsh-bai (1621); the tomb, near Shahzadeh, of Meliha Lali Hussain, a converted Hindu (1621); the little tomb covered with many coloured tiles, the tomb of Farid Fakhrawa, a pupil of Manj Darya (1621); and the Gola *sark* (1622), which retains some fine specimens of the same kind of ornamentation.

Shah Jahan's reign was, at Lahore as elsewhere, the greatest and most vigorous period of Mughal architecture. Lahore as well as Delhi testifies to this in a minor degree, to the power and taste to which seem to have inspired others besides the emperor to raise the many monuments that still remain of the grandeur of his time. The first place is due to the splendid tomb of Jahangir, erected by his widow Nur Jahan, at Shahdara, on the bank of the Ravi opposite Lahore (1606), near which was afterwards built (1633) the tomb of his younger son Aurangzeb, Jahangir's commander-in-chief, and then (1650) that of the widowed queen herself. Before these, in order of time, were the gate and ascent called *Adak pahn* to the fort (1629), and then, in 1680 and following years, the series of fine palace buildings within the fort, which have since been altered and added to by the successive Mughal successors and by Ranjit Singh.

Two of Shah Jahan's principal officers of state were his chief supporters and followers in the construction of the great works of his time at Lahore. One of these was Ali Mardan Khan, a Persian, formerly governor of Kandahar, then successively governor of Kashmir and of the Punjab, who was also an eminent engineer and architect. The other was the court physician and afterwards prime minister, Hakim Alam-ud-din, better known as the Nawab Wazir Khan. Ali Mardan Khan built, under Shah Jahan's orders, the finest of the great *sarais* for travellers on the imperial road from Delhi to Lahore and Lahore to Kashmir. He proposed and carried out (1686) the canal from the Ravi at the foot

LAING, ALEXANDER GORDON (1793-1836), an African explorer, was born at Edinburgh 27th December 1793. At first it seemed that he would follow his father's profession, that of a teacher of the classics; but, his fancy being fired with the military ardour of the time, he set out for Barbados, where his maternal uncle Colonel Gordon was then stationed. Here he met with Sir George Beckwith, who procured him a commission in the York Light Infantry. His career as a traveller began in 1822, when he was sent on a mission to the country of the Salimas and advanced as far as the sources of the Rokelle. By ascertaining that the source of the Quorra or Niger was not more than 1600 feet above the sea, he dispelled the idea that it was connected with the Nile. The further elucidation of the other questions that were then connected with this great river formed the principal object of his next journey, undertaken in 1825 under the auspices of Lord Bathurst. From a letter sent May 10, 1826, from Blad Sid Mohammed to Consul Warrington at Tripoli we know that he had barely escaped with his life from an attack in which he had received twenty-four wounds. He managed to reach Timbuctoo by August 18th, but shortly afterwards fell a victim to the treachery of his servant. The history of the vain attempt to recover the traveller's journals will be found in the *Quarterly Review*, vol. xlii. (1830). The narrative of his first journey was published in 1826.

LAING, DAVID (1793-1878), a distinguished Scottish antiquary, especially eminent for his bibliographical knowledge, was the son of William Laing, a bookseller in Edinburgh, and was born in that city in 1793. He was brought up to his father's business, and continued for many years in partnership with him. Shortly after the death of the latter, however, a vacancy having occurred in the librarianship of the Signet Library, Laing was elected to that office in 1837, and continued to hold it till the time of his death. In addition to, it is believed, an almost unexampled knowledge of the titles and value of books, Laing possessed an intimate acquaintance with the early literary history of Scotland. His knowledge of Scottish art was also very extensive; and the ecclesiastical history of his native country, particularly during the 16th and 17th centuries, had long been the subject of his profound investigation. It is perhaps to be regretted that with all this knowledge he never produced any large independent work, but confined himself to the editing of the works of others. Of these, the chief are—*Dunbar's Works*, 3 vols., 1834, with a supplement added in 1865; *Robert Baillie's Letters and Journals*, 3 vols., 1841-42; *John Knox's Works*, 6 vols., 1843-64; *Poems and Fables of Robert Henryson*, 1865; *Andrew of Wyntoun's Orygynale Cronykil of Scotland*, 3 vols., 1873-79; *Sir David Lindsay's Poetical Works*, 3 vols., 1879. Laing was for more than fifty years an active member of the Society of Antiquaries of Scotland, and during that period he contributed upwards of a hundred separate papers to their *Proceedings*. He was also for more than forty years secretary to the Bannatyne Club, many of the publications of which were carefully edited by him, and few of them we believe failed to benefit by his assistance. A complete list of his productions would occupy many pages. His literary activity ended only with his life. He was struck with paralysis when attending to his duties in the Signet Library, and it is touchingly recorded of him that, on awakening out of the fit, he looked about him and asked if a proof of Wyntoun had been sent up from the printers. He died a few days afterwards, on October 18, 1878, at the age of eighty-six years. Perhaps few men who ever lived possessed so much recondite knowledge on subjects connected with Scottish history and literature, and no one could be more ready to communicate whatever he knew to

those who were engaged in investigations similar to his own. In 1864 the university of Edinburgh conferred on him the degree of LL.D. In the course of his long life Laing had collected an immense library, a large portion of the books being illustrative of the literature or history of Scotland, and many of them being of extraordinary rarity. It was dispersed by auction in London soon after his death, and the enormous price obtained for many of the books were such as had hardly ever been known even in the most celebrated of previous book sales. A valuable collection of MSS., chiefly relating to Scotland, was bequeathed by him to the library of Edinburgh university.

LAING, MALCOLM (1762-1818), a Scottish historian, was born at his paternal estate on the Mainland of Orkney in 1762. Having studied at the grammar school of Kirkwall and the university of Edinburgh, he was called to the bar in 1785, but never obtained an extensive practice as advocate. In 1793 he completed the last volume of Henry's *History of Great Britain*, the portion which he wrote being, in its strongly liberal tone, at signal variance with the preceding tenor of the work. In 1800 he published a *History of Scotland from the Accession of James VI. to the Reign of Queen Anne*, a work of considerable research. In a dissertation prefixed to an edition of his *History* published in 1804 he endeavoured to prove the participation of Queen Mary in the murder of Darnley. In the same year he published an edition of the *Historie and Life of King James the Sixth*. His only other publication is an edition of the *Poems of Ossian*. For a short period in 1807 Laing represented his native county in parliament. He died in November 1818.

LAI-YANG, a city in the Chinese province of Shan-tung, situated in 37° N. lat. and 120° 55' E. long., about the middle of the eastern peninsula, on the highway running south from Che-foo to Kin-Kea or Teng-tai harbour. It is surrounded by well-kept walls of great antiquity, and its main streets are spanned by large paillois or monumental arches, some of which date from the time of the emperor Tai-ting-tse of the Yuen dynasty (1394). There are extensive suburbs both in the north and south, and the total population is estimated at 50,000. The so-called Ailanthus silk produced by *Saturnia cyathus* is woven at Lai-yang into a strong fabric; and the manufacture of the peculiar kind of wax obtained from the la-tion or wax tree insect is largely carried on in the vicinity.

LAKE. When a stream in its course meets with a depression in the land it flows into it and tends to fill it up to the lip of its lowest exit. Whether it succeeds in doing this or not depends on the climate. In the British Islands, and in most temperate and equatorial regions, the stream would fill the depression and run over, and the surplus water would flow on towards the sea. Such a depression, with its contents of practically stagnant water, constitutes a lake, and its water would be fresh. In warm dry regions, however, such as are frequently met with in tropical latitudes, it might easily happen that the evaporation from the surface of the depression, supposed filled with water, might be greater than the supply from the feeding stream and from rain falling on its surface. The level of the waters in the depression would then stand at such a height that the evaporation from its surface would exactly balance the supply from streams and rain. We should have as the result a lake whose waters would be salt. Lakes of the first kind may be considered as enlargements of rivers, those of the second kind as isolated portions of the ocean; indeed, salt lakes are very frequently called seas, as the Caspian Sea and the Dead Sea. The occurrence of freshwater lakes and salt lakes in the same drainage system is not uncommon. In this case the salt lake forms the termination. Well-known examples of this

are Lake Titicaca and the Desaguadero in South America, and Lake Tiberias and the Dead Sea on the Jordan.

Distribution of Lakes.—Although there are few countries where lakes are entirely absent, still it requires little study to see that they are much more thickly grouped in some places than in others. Of the larger lakes, for instance, we have the remarkable group in North America, which together form the greatest extent of fresh water in the world. A similar group of immense lakes is found in Central Africa.—Lakes Victoria Nyanza and Albert Nyanza, whose overflow waters go to form the Nile, Lake Tanganyika, at the source of the Congo; and Lake Nyassa, on a tributary to the Zambesi. In Asia the largest freshwater lake is Lake Baikal, on the upper waters of the Lena. All these freshwater lakes of great size are at the sources of large and important rivers; the salt lakes in which Asia also abounds are at the mouths of large rivers, as the Caspian at the mouth of the Volga, and Aral Sea at the mouth of the Oxus.

Passing from the consideration of these larger lakes, which from their size may be considered inland oceans, and which therefore necessarily occur in small number, we find large numbers of lakes of comparatively small dimensions, and when we consider them attentively we find that they are reducible to a small number of species, and, as in the case of plants and animals, the distribution of these species is regulated chiefly by climate, but also by geological conditions. Perhaps the most important and remarkable species of lakes is that to which the Scottish lakes belong. They are generally characterized by occupying long narrow depressions in the valleys of a mountainous country in the neighbourhood of the sea, and in a temperate climate. On the sea-coast, lakes of this character are found in Norway, Scotland, Newfoundland, Canada, the southern extremity of South America, and the south end of the middle island of New Zealand; somewhat removed from the sea we have the Alpine lakes of Switzerland and Tyrol, and the great Italian lakes, all of which display the same features as those of Scotland or of Norway. In many flat countries lakes are extraordinarily abundant, as for instance in the north part of Russia and Finland, in the southern part of Sweden, in the northern parts of Canada, and on a small scale in the Hebrides.

Lagoons, found on all low sandy coasts, owe their origin to the shifting of the sand under the influence of the wind and tide. They are found at the mouths of large rivers, as on the Baltic and at the mouth of the Garonne.

In volcanic regions lakes are not uncommon, generally of a more or less circular form, and either occupying the site of extinct craters or due to subsidences consequent on volcanic eruptions; such are the Maars of the Eifel in Germany, and many lakes in Italy and in the Azores.

Lakes are not only widely distributed in latitude and longitude, they also occur at all elevations. Indeed, as a certain elevation above the sea produces an effect as regards climate equivalent to a certain increase of latitude, we find lakes existing in the centre of continents, and on high plateaus and mountain ranges, in latitudes where they would be speedily dried up if at the level of the sea. Many of the lakes in Scotland (as Lochs Lomond, Morar, Coruisk), of Norway, of British Columbia, and of southern Chili are raised only by a few feet above the level of the sea, and are separated from it often by only a few hundred yards of land, while in the Cordilleras of South America we have Lake Titicaca 12,500 feet, and in Asia Lake Kokonor 10,500 feet above the sea. Many lakes whose surface is raised high above the level of the sea are so deep that their bottom reaches considerably below that level.

Dimensions of Lakes.—The principal measurements con-

ducted with a number of lakes in different parts of the world, presented in the following table, will give a more precise idea of the size of the lakes than could be given by description alone.—

Name of Lake	Mean Lat. and Lon.	Length	Breadth (Max.)	Depth (Max.)	Height in Feet above the Sea of		Temperature of Water at Bottom
					Surface	Bottom	
Superior	47° 45' N 94° 00' W	360 Miles	160	678	560	-303	78°
Michigan	44° 45' N 83° 30' W	230	80	840	568	-340	78°
St Clair	42° 30' N 82° 30' W	18	22	30	570	+550	78°
Erie	42° 30' N 82° 30' W	200	48	504	564	+500	78°
Titicaca	16° 30' S 69° 30' W	30	30	924	12,500	+11,676	84°
Kokonor	37° 30' N 83° 30' E	21	42	504	10,500	-	84°
Baikal	56° 30' N 103° 30' E	40	4,080	1,200	-	-3,750	84°
Hal-Kah	46° 30' N 280° 30' E	28	288	72	-	+186	84°
Caspian	42° 30' N 60° 30' E	60	1,200	-	-	-1,600	41°
Dead Sea	31° 30' N 35° 30' E	45	10	1,200	-	-1,272	30°
Tanganyika	6° 30' S 33° 30' E	380	40	1,000	2,700	-	84°
Congo	4° 30' S 15° 30' E	48	8	1,200	670	-	84°
Geneva	46° 30' N 4° 30' E	45	87	1,024	1,218	+125	41° to 44°
Constance	47° 40' N 8° 30' E	8	804	1,300	+1006	108	84°
Lemond	57° 40' N 4° 30' E	4	800	102	1056	108	84°
Morar	57° 40' N 4° 30' E	11	1,120	30	-	-990	40° to 41°
Yoa	57° 40' N 4° 30' E	28	1,374	40	-	-124	41° to 42°
Lochy	57° 40' N 4° 30' E	10	1,400	80	-	-99	41° to 42°
Keppin	57° 40' N 4° 30' E	7	8	400	306	-118	41°
Key	57° 40' N 4° 30' E	10	1	400	306	-118	41°
Rumoch	57° 40' N 4° 30' E	94	1	878	688	+390	41°
Bright	57° 40' N 4° 30' E	148	8	580	1,153	+825	44°
Tumach	57° 40' N 4° 30' E	22	8	120	480	+300	42°
Gerry	57° 40' N 4° 30' E	22	8	108	1,880	+1,238	53°

From this table it will be seen that by far the largest continuous sheet of fresh water is the group of North American lakes, and of these Lake Superior is more than double the size of any of the others, this is principally due to its great breadth, as it is very little longer than Lake Michigan. Lake Superior communicates with Lakes Michigan and Huron, which are really branches of one and the same lake, by the St Mary's river, the fall being 40 feet from Superior to Huron. Huron empties itself into Erie by the St Clair river, Lake St Clair, and finally the Detroit river. Lake Erie overflows by the Niagara river and falls into Lake Ontario, whence the water finally is conveyed to the sea by the St Lawrence. The area of the lakes together is in round numbers 100,000 square miles, and, if that of the St Lawrence and its estuary be added, the water area will be about 180,000 square miles, while the whole drainage area is only 537,000 square miles. Hence of the water conveyed by the St Lawrence to the sea, rather more than one-fourth falls on the surface of the water itself. Looking to their great extent, we should have expected them to be much deeper than is found to be the case. The deepest, Lake Superior, is no deeper than Loch Morar in Inverness-shire. Comparatively shallow, however, as they are, the bottoms of them all, with the exception of Erie, are several hundred feet below the level of the sea. It has been supposed that in former times this chain of lakes formed an arm of the sea similar to the Baltic in Europe, and in support of this view we have the fact of the discovery of marine forms in Lake Michigan.

In Asia Lake Baikal is in every way comparable to the great Canadian lakes as regards size. Its area of over 9000 square miles makes it about equal to Erie in superficial extent, while its enormous depth of over 4000 feet makes the volume of its waters almost equal to that of Lake Superior. Although its surface is 1860 feet above the sea-level, its bottom is 3720 feet below it. A former connexion with the ocean has been claimed for this lake, owing to the fact that seals inhabit its waters. Other large lakes in Asia are mostly salt, and some lie wholly below the level of the sea. Thus the Caspian lies 86 feet below the Black Sea, and the bottom at its greatest depth is 3600 feet deeper. The Dead Sea is over 1300 feet deep, and its surface is 1272 feet below the Mediterranean, so that its bottom is 3580 feet below the level of the sea. In the Caspian seals are found. A former connexion with the Red Sea has been claimed for the Dead Sea, but this

is disallowed by Poschell and others. The Jordan valley, with the Sea of Tiberias and the Dead Sea, lie on the line of an extensive fault, and it is claimed that this depression in the surface occurred with the production of the fault. Further evidence in support of the statement that the Dead Sea was never connected with the sea is of a negative character, and consists chiefly in the fact that marine fossils have not been found in the waters of the Jordan or of Lake Tiberias, and that silver is absent from the waters of the Dead Sea.

A former connexion with the ocean is claimed for a number of the Swiss and Italian lakes by Dr Forl and Professor Favet, and the Norwegian lakes by Loven and Sars, on the ground of the occurrence of marine forms of the crustaceans and other classes. For a summarized account of these researches see Favet, *Arch. de Genève*, 1880, iii, 1.

Temperature of Lakes.—The earliest reliable temperature observations in lakes or seas are those of Sanson, and they are to be found in his charming *Voyage dans les Alpes*. He was the first to obtain thoroughly trustworthy observations in the deeper waters of the lakes. He used for this purpose an ordinary thermometer whose bulb was covered over with several thicknesses of cloth and wax, so as to render it very slowly conducting. He was in the habit of leaving it down fourteen hours, and then bringing it up as quickly as possible and immediately reading the temperature. He did not, however, trust to his thermometer not changing its reading while being brought up, but by an elaborate series of experiments he obtained corrections, to be applied when the thermometer had to be drawn through more or less water of higher temperature. His observations are collected in the following table along with those of Jardine in some of the Scottish lakes, at the beginning of the century:—

Name of Lake.	Date	Temperatures at		Depth.	Height above Sea
		Surface	Bottom.		
		° F	° F	Feet.	Feet.
Geneva	February	42.5	41.8	1,018	1,380
Nouchet	17th July	72.7	41.4	516	1,304
Bourges	October 1784	64.0	49.1	750	
Annecy	14th May 1790	67.9	49.1	174	1,426
Joux	...	54.6	51.8	81	350
Blanc	...	50.8	44.4	281	1,410
Ostervanne	...	64.8	38.8	394	1,260
Lucerne	21th July 1784	65.4	40.8	640	1,380
Thun	7th July 1788	60.9	41.0	518	1,806
Brans	8th July 1788	60.0	40.0	330	
Magdalen	18th July 1788	76.1	44.1	827	
Lomond	8th Sept. 1812	40.6	41.8	600	35
	7th Sept. 1812	47.3	41.9	480	364
Katrine	8d Sept. 1814	50.4	41.3		

An exceedingly important and valuable series of observations was made by Fischer and Brunner¹ in the Lake of Thun throughout the course of a whole year (March 1846 to February 1849). They used, after Saussure's method, thermometers protected by non-conducting envelopes, which were pulled up as quickly as possible. The depth of the water where they observed was 640 feet, and they made a series of observations of the temperature at that depth, at the surface, and at eleven intermediate depths, and repeated the series of observations at eight different dates over the year. From these series, which afford the first information of the yearly march of temperature at different depths, we learn that the lake as a whole gains heat till the end of September, then loses it until the month of February, when it begins to warm again, though slowly. The maximum temperature occurs in October at depths from the surface to 70 feet, in November at depths from 70 to 120 feet, in December from 120 to 900 feet, and in February at 500 feet. As the whole yearly variation of the temperature at 200 feet

is less than a degree, the epoch at which the greater depths attain their maximum and minimum temperatures cannot be certainly deduced from one year's observations. The minimum temperature of depths from the surface to 80 feet is attained in the month of February, at greater depths in the month of March. During the course of the whole year the temperature at the bottom varied between 40°-7 and 40°-9 Fahr., and in the month of February the whole of the water from the surface to the bottom was between 40°-7 and 41° Fahr.

These and other observations showed that, from depths of 400 feet, the variation of temperature with increasing depth is quite insignificant, so that even though the lake might be 1000 feet deep the temperature at 400 feet is only one or two tenths of a degree different from that of the bottom; further, on many of the thermometers recently used, it is impossible to distinguish with certainty temperatures differing by less than half a degree, consequently it was not difficult to believe that in all deep lakes there is a considerable stratum of water which remains constantly at the same temperature, all the year and every year, and that in winter this stratum thickens so as often to fill the lake, and gets thinner again in summer. By the improvement of the instruments both of these suppositions have been shown to be erroneous. In summer and in temperate latitudes, however deep the lake may be, its temperature falls as the depth increases, first rapidly and then very slowly, and the bottom temperature observed in any summer depends on the nature of the winter which preceded it, and may vary from year to year by one to two degrees. It was also believed that the deep water of a lake preserved constantly the mean winter temperature or the mean temperature of the six coldest months of the year in the locality. This was deduced from some observations by Sir Robert Christison in Loch Lomond, who found the bottom temperature at Tarbet to be 41°-4 Fahr., agreeing with the mean of the six winter months as observed at Balloch Castle, which, however, is about 15 miles distant. Although the theorem may be accidentally true for Loch Lomond, it has been proved not to hold for other lakes. Thus Simony (*Nyen Sitt. Ber.*, 1875, lxi, p. 435) gives the following table, comparing the temperature of the bottom water in the Gmundner See with the winter (October to March) air temperature:²—

Winter Period.				Summer Period.		Bottom Temp. of Gmundner See.	Date of Observation of Bottom Temperature.
Mean Temperature				Mean Temp.			
Oct.-Mar.	Dec.-Feb.						
	° F.	° F.		° F.	° F.		
1867-68	37.5	23.9	1898	61.4	49.5		6th Oct. 1868.
1868-69	40.1	26.6	1897	62.1	49.5		1st Oct. 1869.
1869-70	38.0	26.0	1876	60.6	49.3		26th Sept. 1870.
1871-72	38.3	27.8	1879	62.9	49.0		3d Oct. 1872.
1872-73	41.0	30.0	1878	60.3	49.5		25th Oct. 1873.
1873-74	39.0	22.7	1874	61.9	49.4		26th Sept. 1874.
1874-75	38.8	26.2		...	39.2		10th April 1875.

It will be seen that, with the exception of the end of 1873, the mean winter temperature is below that of the bottom water, and generally very markedly so.

During 1877-81 observations have been made by the present writer on the distribution of temperature in lakes forming part of the Caledonian Canal. The monthly mean temperatures at Culloden and at Corran Ferry lighthouse, which cannot differ much in climate from Loch Ness and Loch Lochy respectively, have been supplied by Mr Buchanan of the Scottish Meteorological Society. The bottom temperatures are those observed in the deepest part of the lakes, namely, 120 fathoms in Loch Ness, and 80 fathoms in Loch Lochy. The connexion between bottom tempera-

¹ *Mém. Soc. Phys. Genève*, xii, p. 255

² These air temperatures are those of the observatory at Vienna, corrected for difference of level.

ture (as observed in the second week of August) and winter temperature can be judged of from the following table, where the mean temperatures of October to March, and also of November to April, are given.—

	Loch Ness		Culloden		Loch Lomond		Corran	
	Surface	Bottom	Oct. to March.	Nov. to April.	Surface	Bottom	Oct. to March.	Nov. to April.
1877	58.0	42.4	40.2	40.0	55.0	44.0	42.8	40.3
1878	57.0	42.3	43.1	40.8	61.0	45.7	43.7	40.6
1879	61.4	41.2	37.2	36.3	64.0	43.0	38.9	37.5
1880	57.0	42.4	41.0	40.8	57.8	43.8	43.0	41.0
1881	58.1	41.45	38.1	36.2	54.0	42.95	38.6	36.7

From this tablet it is apparent that the bottom temperature, even of lakes as deep as Loch Ness, is subject to considerable variation from year to year, that it depends on the temperature of the previous winter, and that it is usually higher than that temperature. The difference between the bottom temperature and the mean winter temperature is greater the lower the winter temperature is. It is further interesting to notice that the mean winter temperature of 1878-79 was about one degree higher than that of 1880-81, yet the bottom temperatures were 0°·25 lower in 1879 than in 1881, and this is no doubt due to the fact that the cold of 1878-79 was more continuous than that of 1880-81, when the actual temperatures observed were much lower. The temperature of the bottom water depends not only on the temperature of the previous winter, and on the depth of the lake; it also depends on the nature of the country where it lies, and especially on its exposure to winds. Winds drive the surface water before them, and if there were no return current it would be heaped up at the further end. The effect is to accumulate surface water at one end, and to draw on deeper water to make up the deficiency at the other end. Hence the prevailing direction of the wind impresses itself on the distribution of temperature in the water; and this is well shown in the distribution of temperature as determined from observations at five stations on the same day in Loch Ness in a summer after a warm winter, and in one after a cold winter. In Scotland, warm weather is associated with southerly and westerly winds, and cold weather with northerly and easterly winds. In the warm years we have accumulation of surface water at the north-eastern end, and of bottom water at the south-western end, producing in summer a higher mean temperature of water at the north-east, and a lower mean temperature of water at the south-west end. In cold years the reverse is observed. Thus in 1879, after a cold winter, the mean temperature of the first 300 feet of water at the south-west end of Loch Ness was 48°·8, and at the north-east end 44°·96, a difference of nearly four degrees. In 1880, after a comparatively mild winter, it was 48°·13 at the south-west end, and 47°·05 at the north-east end, or nearly identical temperatures. Even at stations a few hundred yards from each other, great differences are often observed in the temperatures observed at the same depth, and it is evident that the difference of density so produced must cause a certain amount of circulation. There can be but little doubt that, under the influence of the varying temperature of the seasons, and of the winds, the water of a lake is thoroughly mixed once a year. In lakes which do not consist of a single long trough like Loch Ness, but of several basins as Loch Lomond, the bottom temperature is different in the different basins, even when the depth is the same. Loch Lomond consists of three principal basins of very unequal depth:—the large expanse of water studded with islands at the lower end, the Balloch basin; the middle or Luss basin; and the upper and deepest or Tarbet basin. In the last we have 600 feet of water, in the Luss basin 200 feet, and in the Balloch basin a maximum of

72 feet of water. On 23d September 1876 the bottom temperature in the Tarbet basin was 41°·4, and in the Luss basin 46°·4. Loch Tummel, a much smaller lake consists of three basins, each of them being from 100 to 120 feet deep, and in them we have bottom temperatures of 46°·3, 46°·9, and 45°·2, the lowest temperature being nearest the outlet.

It might have been expected that the bottom temperature in lakes similar as regards size and depth would be lower at greater elevations and higher nearer the sea-level. This does not, however, hold universally; thus Lochs Tummel and Garry are very similar in size and depth; they are only 12 miles from each other, but Loch Tummel is 480 feet and Loch Garry 1330 feet above the sea; yet at 102 feet in Loch Garry the temperature on the 18th August 1876 was 53°·9, and in Loch Tummel at the same depth on the 16th August 1876 it was 45°·4. The difference of elevation is nearly 900 feet, and, instead of the higher lake holding the colder water, its water is 8°·5 warmer than that of the lower one. Similarly in Loch Ercht, 1153 feet above the sea, the bottom temperature at 324 feet was 44°·7, and in Loch Rannoch, 668 feet above sea, at the same depth it was 44°·0. These examples will suffice to show that many circumstances concur in determining the temperatures of the waters of lakes. There is one factor which is often neglected, namely, the amount of change of water. This depends on the drainage area of its tributary streams, and necessarily varies greatly.

In comparing the bottom temperature in lakes with the mean temperatures of the coldest half of the year, we find that the two approach each other more nearly the higher these temperatures are. When the temperature of the air falls for a lengthened period below the temperature of maximum density of water (38°·2 Fahr.), then the mechanical effect produced is much the same as if the temperature had been raised. For, in virtue of the cooling, above, the water will have no tendency to sink; it will rather tend to float as a cold layer on the surface of the warmer and denser water below. Were a lake comparable with a glass of water, that is, were its depth equal to or greater than its length or breadth, it would be possible to realize this ideal condition of things, which, until recently, was supposed to represent what really takes place when a lake is covered with ice, namely, that after the water has all been cooled to a uniform temperature of 38°·2 Fahr further cooling affects only a small surface layer, which consequently rapidly freezes. If this were the case, we should expect to find the temperature of the water below the ice of a frozen lake increasing rapidly from 32° where it is in contact with the ice to 39°·2 at a short distance from it, and we should expect to find the remainder of the water down to the bottom at the same temperature. In fact, however, the depth of even the deepest lakes bears an insignificant proportion to their superficial dimensions and temperature observations in summer show that the effective climate, that is, the climate in so far as it is effective for the purpose under consideration, varies much over the surface of even very small lakes. The variations in distribution of temperature produce variations in density which of themselves are sufficient to produce convection currents. Then, as a factor of climate, there are the winds, which are the main mixing agents, and also the movement in the waters caused by the inflow of water at different points and the removal of the excess at one point. The effect of these mechanical agents, winds and currents, is to propagate the air temperature at the surface to a greater depth than would otherwise be the case. At the same time it must be remembered that in seasons of great cold there is rarely much wind. If we reflect, however, on what must take place when there is a large expanse of

open water in the middle of a country covered with snow, and exposed to the rigours of a winter night, we see that the air in contact with the surface of the water must get warmed and form an ascending current, its place being taken by fresh air drafted from the cold land surface, which not only cools the water but forces it out towards the middle, thus establishing a circulation consisting in broad lines of a surface movement from the sides to the middle of the lake, and a movement in the opposite direction below the surface. Even if the current of air were not sufficient of itself to produce a surface current in the water, it would do it indirectly. For, as it first strikes the water at the edges, the water there would get cooled most rapidly, and under suitable circumstances would form a fringe of ice; the water so cooled would be lighter than the warmer water farther out, and would have a tendency to flow off towards the middle, or with the current of air. Now, although, when compared with other seasons, there is in a hard frosty winter not much wind, still, even in the calmest weather there is almost always sufficient motion in the atmosphere to enable the meteorologist to state that the wind is from a particular quarter; this will assist the circulation which has just been described as taking place in a calm lake, though it will somewhat distort its effects. It will produce excessive cooling at the side nearest the wind, and, when the lake freezes, it will have a tendency to begin at the windward side.

The extent to which this circulation affects the deeper waters of a lake depends on local circumstances, and generally we may say that the more confined a lake is the more easily will it freeze, and the higher will be the mean temperature of its waters. In the very cold winter 1878-79 the writer was able to make observations on the temperature of the water under the ice in Linlithgow Loch and in Loch Lomond. In the following winter, which, though mild in Scotland, was excessively severe in Switzerland, Dr Forel made observations in the Lakes of Morat and Zurich, confirming the writer's observations of the unexpectedly low temperatures of the water. The freezing of so deep a lake as that of Zurich was a fortunate circumstance, because in it the bottom is actually at the temperature of maximum density. The majority of the lakes which freeze are so shallow as to admit of the whole of their water being cooled considerably below the temperature of maximum density.

The distribution of temperature in frozen lakes will be apparent from the table given below. Of the Lakes of Zurich and Morat and Loch Lomond the mean temperatures are in the order of their depth. Linlithgow is altogether peculiar. Its high temperature, which increased steadily all the time it was covered with ice, was due to chemical action amongst the fish which has been allowed to accumulate at its bottom. When the ice broke up the dead fish were taken away in carts.

Dr Forel gives the following particulars about the frozen Swiss lakes. "The Lake of Morat has a surface of 27.4 square kilometres and a maximum depth of 45 metres (147 feet); it is 1426 feet above the sea, and its mean latitude is $46^{\circ} 50' N$. The ice overrode its whole surface suddenly in the night of the 17th to the 18th December, and it remained frozen till the 8th March. The Lake of Zurich has a superficies of 87.8 square kilometres, a maximum depth of 468 feet and altitude of 1388 feet, and a mean latitude of $47^{\circ} 10' N$. Its congelation was gradual, and not sudden like that of the Lake of Morat. First the upper part of the lake was covered with ice between Männdorf and Wädenswil. At the end of December, the 28th, the ice covered it entirely, but only for a single day. On the 29th it thawed, and the lake remained partially free of ice until the middle of January. It froze over completely on the 22d January, and on the 26th the ice was 4 inches thick in the centre of the lake." Of the larger Swiss lakes, Morat, Zurich, Zug, Neuchâtel, Constance, and Annecy were frozen in 1880; Thun is known to have been frozen four times, namely, in 1869, 1865, 1866, and 1895; Bière was only once been frozen, in 1868; Lucerne freezes partially in very severe winters, and Geneva in its western and shallower part, while Wallenstadt and Bourget are not known to have ever been frozen.

Table of Temperatures in Frozen Lakes

Depth (in feet)	Temperature in Degrees Fahr				
	Zürich, 24th Jan. 1880	Morat, 26th Dec. 1879	Lomond, 25th Jan. 1879	Linlithgow 11th Jan. 1879	26th Jan. 1879
3	...	...	33.90	35.90	36.00
6	...	...	33.90	35.90	36.00
18	...	35.06	33.90	35.90	37.00
(Bottom) 48	36.06	36.14	33.90	35.90	37.00
(Bottom) 68	37.35	36.30	36.30	35.90	43.00
100	37.70	36.68	...	...	...
(Bottom) 160	38.80	37.04	...	...	...
200	38.60	...	...	...	...
800	38.84	...	...	...	...
(Bottom) 465	39.20	...	...	...	...
Mean ...	38.40	36.00	34.40	37.72	38.28

For further information on the temperature of frozen lakes, see Buchanan, *Nature*, March 6, 1879; Foral, *Arch. de Genève*, 1880, iv. 1; Nichols, *Proc. Boston Soc. of Nat. Hist.*, 1881, xxi. p. 53.

Changes of Level.—As the water supply of lakes depends on the rainfall, and as this varies much with the season, and from year to year, we should expect, and indeed we find, fluctuation of level in all lakes. There are, however, other changes of level which are independent of the water supply, and which resemble tides in their rhythmic periods. They have long been known and observed in Switzerland, and especially on the Lake of Geneva, where they are known by the name of "seiches." The level of the lake is observed to rise slowly during twenty or thirty minutes to a height which varies from a few centimetres to as many decimetres; it then falls again slowly to a corresponding depth, and rises again slowly, and so on. These movements were observed and much studied at the end of last century by Jallabert, Bertrand, and Sansure, and at the beginning of this century they formed the subject of an instructive memoir by Vaucher, who enunciated the following law connecting the seiches with the movements of the barometer. "The amplitude of seiches is small when the atmosphere is at rest; the seiches are greater the more variable is the atmosphere's pressure; they are the greatest when the barometer is falling." Vaucher recognized the existence of seiches in the Lakes of Geneva, Neuchâtel, Zürich, Constance, Annecy, and Lugano, and Dr Forel of Morges, from whose papers, published principally in the *Bibliothèque Universelle et Revue Suisse* during the last five years, the facts regarding the seiches have been taken, has observed them in every lake where he had looked for them. It is in every way likely that they are to be found in all lakes of notable extent and depth. They have been studied principally on the Lake of Geneva, where Dr Forel, at Morges, about the middle of the lake on the north shore, and M. Plantamour, at Sécheron, about a mile from Geneva on the north shore, have had self-registering tide gauges in operation for a number of years. In the writings of the Swiss observers the seiche is the complete movement of rise above and fall below the mean level, the amplitude is the extreme difference of level so produced, and the duration of the seiche is the time in seconds measured from the moment when the water is at the mean level until it is again at the mean level, after having risen to the crest and sunk to the trough of the wave. The amplitude of the seiches is very variable. At the same station and on the same day successive seiches are similar. When the seiches are small they are all small, when they are large they are all large. At the same station and on different days the amplitudes of the seiches may vary enormously. For instance, at Geneva, where the highest seiches have been observed, they are usually of such a size as to be imperceptible without special instruments; yet on the 3d August 1783 Sansure measured seiches of 1.48 metres, and on the 2d and 3d October 1841 the seiches observed by Vénizé were as much as 2.15 metres.

They are greater at the extremities than at the middle of lakes, at the head of long gulfs whose sides converge gently than at stations in the middle of a long straight coast, and in shallow as compared with deep lakes or parts of a lake. They also appear to increase with the size of the lake. The duration of the seiches is found to vary considerably, but the mean deduced from a sufficient number of observations is fairly constant at the same locality. Thus, for Morges, Dr Forel has found it to be for the half seiche 316 ± 9 seconds. At different stations, however, on the same lake and on different lakes it varies considerably. Thus on the Lake of Geneva it is, for the complete seiche, 630 seconds at Morges, and 1783 seconds at Veytaux; on Lake Neuchâtel it is 2840 seconds at Yverdon, and 264 at Saint Aubin.

The curves traced by the gauge at Geneva have been subjected to a preliminary harmonic analysis by Professor Soré, and he has decomposed them into two undulations, the one with a period, from crest to crest, of seventy-two minutes, and the other with a period of thirty-five minutes, or a little less than half the larger period. As the amplitudes of the composing curves vary much, there is great variety in the resultant curves. Besides these two principal components, there are others which have not yet been investigated.

With regard to the cause of the phenomenon, Dr Forel attributes the ordinary seiches to local variations of atmospheric pressure, giving an impulse the effect of which would be apparent for a long time as a series of oscillations. The greater seiches, such as those of 1·5 metres, he attributed to earthquake shocks; but, as a very sensible earthquake passed over Switzerland quite recently without leaving the slightest trace on the gauge, he has abandoned this explanation, and is inclined to attribute them to pulsation set going by violent downward gusts of wind, especially at the upper end of the lake. M. Plantamour, who has devoted much attention to the same subject, assured the writer, in the summer of 1881, that he was completely at a loss for a satisfactory explanation of them.

Seiches have not been observed on the Scottish lakes, though there is little doubt that they would be found if sought for. There are, however, records of disturbances of some of the lakes, especially in Perthshire, of which the following may be cited as an instance.

A violent disturbance of the level of Loch Tay is reported in the *Statistical Account of Scotland* (1798), xvi. p. 458, to have occurred at Kenmore on 12th September 1784, continuing in a modified degree for four days, and again on 18th July 1784. Kenmore lies at the north-eastern end of the lake, where the river Tay issues from it. It lies at the end of a shallow bay. "At the extremity of this bay the water was observed to retire about 5 yards within its ordinary boundary, and in four or five minutes to flow out again. In this manner it ebbed and flowed successively three or four times during the space of a quarter of an hour, when all at once the water rushed from the east and west in opposite currents, . . . rose in the form of a great wave, to the height of 5 feet above the ordinary level, leaving the bottom of the bay dry to the distance of between 90 and 100 yards from its natural boundary. When the opposite currents met they made a clashing noise and foam; and, the stronger impulse being from the east, the wave after rising to its greatest height, rolled westward, but slowly diminishing as it went, for the space of five minutes, when it wholly disappeared. As the wave subsided it flowed back with some force, and exceeded its original boundary 4 or 5 yards; then it ebbed again about 10 yards, and again returned, and continued to ebb and flow in this manner for the space of two hours, the ebbs succeeding each other, at the distance of about seven minutes, and gradually lessening, till the water settled into its ordinary level. During the whole time that this phenomenon was observed the weather was calm. On the next and four succeeding days an ebbing and flowing was observed nearly about the same time and for the same length of time, but not at all in the same degree as on the first day."

The above is the account given by the Rev. Thomas Fleming, at the time minister of Kenmore, who was an eye witness. It resembles in all essential particulars the descriptions of waves which accompany actual earthquakes, yet in his account he goes on to say—"I have

not heard (although I have made particular inquiry) that any motion of the earth was felt in the neighbourhood, or that the agitation of the wave was observed anywhere but about the village of Kenmore." It is well known that there were great seismic movements observed in Perthshire at the time of the Lisbon earthquake, and there is a tradition in the neighbourhood that Loch Lubnaig near Callander was largely increased in extent by the dislocations which took place.

In all lakes there are changes of level corresponding with periods of rain and of drought. They are the more considerable the greater the extent of country draining into them, and the more constrained the outflow. In the great American lakes, which occupy nearly one-third of their drainage area, the fluctuations of level are quite insignificant; in Lake Michigan the U.S. surveyors give as the maximum and minimum yearly range 1·64 and 0·68 feet. In the Lake of Geneva the mean annual oscillation is 5 feet, and the difference between the highest and the lowest waters of this century is 9·3 feet. The most rapid rise has been 3·23 inches (82 mm.) in twenty-four hours. A very remarkable exception to the rule that large freshwater lakes are subject to small variations of level is furnished by Lake Tanganyika in Central Africa. Since its discovery travellers have been much perplexed by the evidence and reports of considerable oscillations of level of uncertain period, and also by the apparent absence of visible outlet, while the freshness of its waters was of itself convincing evidence of the existence of an outlet. By the careful observations of successive explorers the nature of this phenomenon has been fully explained, and is very instructive. It has recently been visited by Captain Hore of the London Missionary Society, and it appears from his reports that the peculiar phenomena observed depend on the fact that the area of country draining into the lake is very limited, so that in the dry seasons the streams running into it dry up altogether, and its outlet gets choked by the rapid growth of vegetation in an equatorial climate. A dam or dyke is thus formed which is not broken down until the waters of the lake have risen to a considerable height. A catastrophe of this kind happened whilst Captain Hore was in the neighbourhood, and he noted the height of the water at different times near his station at Ujiji, and observed it fall 2 feet in two months. It continued to fall until in seventeen months it had fallen over 10 feet. Taking the length of the lake at 330 miles, and the mean breadth at 30 miles, its surface is 9900 square nautical miles. If this surface be reduced 2 feet in sixty days, the water will have to escape at the rate of 187,500 cubic feet per second. The mean rate of discharge of the Danube is 207,000 cubic feet per second. Hence, without taking into account water which would be brought into the lake by tributaries during the two months, we require for outlet a river at least two-thirds of the size of the Danube, and in the Lukuga such a river is found. When Stanley visited it the Lukuga was quite stopped up with dense growth, and no water was issuing; the lake was then rising; when Captain Hore visited it the lake was falling rapidly, and the Lukuga was a rapid river of great volume. One of the chief affluents to the lake was found to be discharging at the rate of 18,750 cubic feet of water per second; a few months later it was dry and the mouth closed with vegetation. During the dry season too the lake, with its 10,000 square miles of surface, is exposed to the evaporating action of the south-east trade wind, and when the supply is so insignificant this must be sufficient of itself to sensibly lower the level. Ordinarily then we might expect the lake to be subject to a yearly ebb and flow corresponding to the periods of drought and rains; and, from what we learn of the great fluctuations of rainfall one year with another, we should expect that during a series of dry years the obstructions to the outflow would gain such a head

that the rains of several wet seasons would have to accumulate before forcing a passage. The result would be a tide of a period corresponding to the recurrence of series of wet or dry years. Were the lake situated at or near the level of the ocean, its equatorial position would give it such a preponderance of rain over the whole year as to keep its outlet constantly open; but its actual position, 2700 feet above the sea, produces an alternation in climate, equivalent to an increase of latitude, which would place it in the trade wind region rather than in that of equatorial calms and rains. That such is actually the effect is shown by the range of temperature, which is moderate (59° to 83° Fahr.), and the rainfall (37 to 30 inches), which is almost exactly that of London. The Central African lakes, from their immense size and from their equatorial position, possess a peculiar interest for the physical geographer, and

it is to be hoped that before long we shall have sufficient soundings to give a general idea of the size of their basins, and also temperature observations to show the effect of a vertical sun on large bodies of water at a moderate elevation, and removed from the disturbing influence of oceanic circulation.

As might be expected, in salt lakes which have no overflow, the yearly rise and fall is often considerable. In the Great Salt Lake in Utah, the greatest depth of which is 56 feet, changes of level are accompanied by great changes in water surface, and also in saltness of water. In the rainy season the Dead Sea stands 10 or 12 feet higher than in the dry season. The following table shows the chemical composition of the waters of various salt lakes, that of the sea-water in the Suez Canal being added for comparison. —

	Kokonor Sea.	Aral Sea.	Caspian Sea		Urumchi Sea.	Dead Sea.	Van Sea.	Suez Canal, Isthmia.
			Open.	Karabag.				
Specific gravity	1.0507	1.09	1.0196	1.2537	1.1700	22.28	1.0190	1.0088
Percentage of salt	1.11		1.90	38.5	22.28		1.79	0.1
Grammes Salt in 1000 Grammes Water								
<i>Names of Salt</i>								
Bicarbonate of lime	0.8904	0.2186	0.1132	..	..	..	..	0.0079
..	0.0008	..	0.0014	..	..	..	..	0.0059
..	0.0008	..	..	..	..	..	0.4031	..
Carbonate of soda . . . . .	..	..	..	..	..	..	..	0.5871
Phosphate of lime . . . . .	..	..	0.0021	..	..	..	..	0.0039
Sulphate of lime	0.0224	1.8490	0.0004	..	0.6600	..	0.5028	1.8068
.. .. .. .. ..	..	..	0.0025	61.8530	21.5400	..	0.5078	0.2021
..	1.7241	..	..	..	..	..	0.0085	..
Chloride of sodium	0.0008	0.2346	0.1162	88.7840	109.4100	79.5000	0.0000	40.3556
..	0.2209	0.1245	0.1320	0.9560	..	25.3000	..	0.0221
..	0.0045	..	0.0024	0.2618	..	..	..	0.0265
.. .. .. .. ..	..	0.0003	0.0115	129.5779	15.4410	95.0000	..	4.7083
.. .. .. .. ..	..	..	0.0000	0.9900	..	..	..	..
Bromide of magnesium	0.0015	..	0.0081	0.1080	..	..	..	0.0770
..	0.0015	..	0.0024	..	0.2400	..	0.0701	0.0097
Silica . . . . .	..	..	..	..	..	..	..	..
Total solid matter	11.1463	10.8987	15.9773	261.0000	222.7710	221.2000	17.2800	81.0264

This table embraces examples of several types of salt lake. In the Kokonor, Aral, and open Caspian seas we have examples of the moderately salt, non-saturated waters. In the K Karabag, a branch of the Caspian, the Urumchi, and the Dead Sea we have examples of saturated waters containing principally chlorides. The Van Sea is an example of the alkaline seas which also occur in Egypt, Hungary, and other countries. Their peculiarity consists in the quantity of carbonate of soda dissolved in their waters, which is collected by the inhabitants for domestic and for commercial purposes. The chemical reader will be struck by the quantity of magnesium salt dissolved in water which contains so much carbonate of soda. The analysis in the table is by Abbel, quoted by Schmidt in his interesting "Études Hydrologiques," published in the *Bulletin de l'Académie de St Pétersbourg*. Another analysis by De Chancourt, quoted by Bischof, omits all mention of sulphate of magnesium, but inserts the carbonate.

The limits of this article do not admit of the discussion of the many interesting phenomena connected with salt lakes. With regard, however, to a former connection of the Caspian with the Black Sea, which has been, so often suggested, it seems improbable, both on chemical and on physical grounds, that they were ever connected as seas, that is, in the same way as the Black Sea is connected with the Mediterranean, but, if we consider the topography of the Caucasus district, we see that the lowest summit level of the land between the two seas is in the Manych valley, 56 feet above the Black Sea. Were the climate of the Caspian to change only very slightly for the moment, its waters might easily rise the 196 feet which would enable it to overflow towards the Mediterranean, while a rupture towards dryness would be followed by the retreat of the waters, which would be then confined as they are now to the basin of the sea. It is important, therefore, to bear in mind that no terrestrial dislocations are required to produce enormous changes in the level of salt lakes; we require only changes of climate, and these very slight. There can be little doubt that, if the climate of the Black Sea extended across the isthmus to the Caspian, the latter would now stand 200 feet higher, would be fresh, and would overflow into the Sea of Azoff.

For other aspects of the subject see *Geology*. (J. Y. B.)

LAKE DWELLINGS, as their name implies, are habitations constructed, not on the dry land, but within the margins of lakes or creeks at some distance from the shore. The villages of the Guajiro in the Gulf of Maracaibo are

described by Goering as composed of houses with low sloping roofs perched on lofty piles and connected with each other by bridges of planks. Each house consisted of two apartments; the floor was formed of split stems of trees set close together and covered with mats; they were reached from the shore by dug-out canoes poled over the shallow waters; a notched tree trunk served as a ladder; and the piles were so firmly driven that no shakiness was perceptible even when the houses were crowded with people. In such a climate the advantages of dwelling in houses so situated are obvious. The custom is common both in the Gulf of Maracaibo and in the estuaries of the Orinoco and Amazon; indeed the name of the province of Venezuela was given to it from the prevalence of these pile-dwellings along its shores. A similar system prevails in New Guinea. D'Urville describes four such villages in the Bay of Dorei, containing from eight to fifteen blocks or clusters of houses, each block separately built on piles, and consisting of a row of distinct dwellings accommodating a number of families. Cameron describes three villages thus built on piles in Lake Mohrya in Central Africa, the motive here being to prevent surprise by bands of slave-catchers. Similar constructions have been described by travellers, among the Dyaks of Borneo, in Celebes, in the Caroline Islands, on the Gold Coast of Africa, and in other places. Historians have referred to the former existence of the custom in Europe and Asia. Hippocrates, writing in the 5th century B.C., says of the people of the Phæas that their country is hot and marshy and subject to frequent inundations, and that they live in houses of timber and reeds constructed in the midst of the waters, and use boats of a single tree trunk. Herodotus, writing also in the 5th century B.C., describes the people of Lake Prasias as living in houses constructed on platforms supported on piles in the middle of the lake, which are approached from the land by a single narrow

bridge. Abulfeda the geographer, writing in the 13th century, notices the fact that part of the Apameau Lake was then called the Lake of the Christians, because it was inhabited by Christian fishermen who lived on the lake in wooden huts built on piles. Fishermen's huts roughly constructed of branches of trees and supported on piles placed salure-wise existed in the shallows of the bays on the European side of the Bosphorus not many years ago, and Sir John Lubbock mentions that the Roumelian fishermen on Lake Prasias "still inhabit wooden cottages built over the water, as in the time of Herodotus." The records of the wars in Ireland in the 16th century show that the petty chieftains of that time had their defensive strongholds constructed in the "freshwater lochs" of the country, and there is record evidence of a similar system in the western parts of Scotland. The archaeological researches of the past few years have shown that such artificial constructions in lakes were used as defensive dwellings by the Celtic people of post-Roman and mediæval times (see CRANNOGH). Similar researches on the Continent have also established the fact that in pre-historic times nearly all the shallow lakes of Switzerland, and many in the adjoining countries—in Savoy and the north of Italy, in Austria and Hungary, and in Mecklenburg and Pomerania—were peopled, so to speak, by lake-dwelling communities, living in villages constructed on platforms supported by piles, at varying distances from the shores. The principal groups are those in the Lakes of Bourget, Geneva, Neuchâtel, Bienna, Zurich, and Constance lying to the north of the Alps, and in the Lakes Maggiore, Varese, Isèo, and Garda lying to the south of that mountain range. Many smaller lakes, however, contain them, and they are also found in peat moors on the sites of ancient lakes now drained or silted up. In some of the larger lakes the number of settlements has been very great. Fifty are enumerated in the Lake of Neuchâtel, thirty-two in the Lake of Constance, twenty-four in the Lake of Geneva, and twenty in the Lake of Bienna. Some of these settlements have been of considerable size. The site of the lake dwelling of Wangen, in the Untere See, Lake of Constance, forms a parallelogram more than 700 paces in length by about 120 paces in breadth. The settlement at Morges, which is one of the largest in the Lake of Geneva, is 1200 feet long by 160 feet in breadth. The settlement of Satz, one of the largest in the Lake of Bienna, extends over an area of 6 English acres, and was connected with the shore by a gangway nearly 100 yards long and about 40 feet wide. The substructure which supported the platforms on which the dwellings were placed was most frequently of piles driven into the bottom of the lake. Less frequently it consisted of a stack of brushwood or fascines built up from the bottom and strengthened by stakes penetrating the mass so as to keep it from spreading. When piles were used they were simply the rough stems of trees of a length proportioned to the depth of the water, sharpened sometimes by fire and at other times chopped to a point by hatchets. On their level tops the beams supporting the platforms were laid and fastened by wooden pins, or inserted in mortises cut in the heads of the piles. In some cases the whole construction was further steadied and strengthened by cross beams, notched into the piles below the supports of the platform. The platform itself was usually composed of rough layers of unbarked stems, but occasionally it was formed more regularly of boards split from larger stems. When the mud was too soft to afford foothold for the piles they were mortised into a framework of tree trunks placed horizontally on the bottom of the lake. On the other hand, when the bottom was rocky so that the piles could not be driven, they were steadied at their bases by being enveloped in a mound of loose stones, deposited

around and among them, exactly in the manner in which the foundations of piers and breakwaters are now constructed. In cases where piles have not been used, as at Niederwyl and Wauwil, the substructure is a mass of fascines or faggots laid parallel and crosswise upon one another with layers of brushwood or of clay and gravel separating the beds of the wooden material, which is steadied and kept in position by upright stakes not driven into the lake bottom,—a few piles here and there being occasionally fixed throughout the mass to serve as guides or stays. At Niederwyl the platform was formed of split boards, many of which were 2 feet broad and 2 or 3 inches in thickness. On these substructures were placed the groups of huts composing the settlement; for the peculiarity of these lake dwellings is that they were pile villages, or clusters of huts occupying a common platform. The huts themselves were quadrilateral in form. The size of each separate dwelling is in some cases marked by boards resting edgewise on the platform, like the skirting boards over the flooring of the rooms in a modern house. The walls, which were supported by posts, or by piles of greater length, were formed of wattle-work, coated with clay. The floors were of clay, and in each floor there was a hearth constructed of flat slabs of stone. The roofs were thatched with bark, straw, reeds, or rushes. As the superstructures are in all cases gone, there is no evidence as to the position and form of the doorways, or the size, number, and position of the windows, if there were any. In some cases the remains of the gangways or bridges connecting the settlements with the shore have been discovered, but in others the village appears to have been practically insular and accessible only by canoes. Several of these single-tree canoes have been found, one of which is 43 feet in length and 4 feet 4 inches in its greatest width. It is impossible to estimate with any degree of certainty the number of separate dwellings of which any of these villages may have consisted, but at Niederwyl they stood almost contiguously on the platform, the space between them not exceeding 3 feet in width. The size of the huts also varied considerably. At Niederwyl they were 20 feet long and 12 feet wide, while at Robenhäusen they were about 27 feet long by about 22 feet wide. The character of the relics associated with the sites of the various settlements discloses the fact that in some cases they have been the dwellings of a people using no materials but stone, bone, and wood for their implements, ornaments, and weapons; in others, of a people using bronze as well as stone and bone; and in others again iron and bronze were used. But, though the character of the associated relics is thus changed, there is no corresponding change in the construction and arrangements of the dwellings. The settlement in the Lake of Moosseedorf, near Bern, affords the most perfect example of a lake dwelling of the Stone age. It was a parallelogram 70 feet long by 50 feet wide, supported on piles, and having a gangway built on faggots connecting it with the land. The superstructure had been destroyed by fire. The implements found in the relic bed under it were celts or axe-heads of stone, with their haftings of stag's horn and wood; a flint saw, set in a handle of fir wood and fastened with asphalt; flint flakes and arrow-heads; harpoons of stag's horn with barbs; awls, needles, chisels, fish-hooks, and other implements of bone; a comb of yew wood 5 inches long; and a skate made out of the leg bone of a horse. The pottery consisted chiefly of roughly-made vessels, some of which were of large size, others had holes under the rims for suspension, and many were covered with an encrustation of soot, the result of their use as culinary vessels. Burnt wheat, barley, and linseed, with many varieties of seeds and fruits, were plentifully mingled with the bones of the stag, the ox, the swine, the sheep, and

the goat, representing the ordinary food of the inhabitants, while remains of the beaver, the fox, the hare, the dog, the bear, the horse, the elk, and the bison were also found. The settlement of Robenhause, in the moor which was formerly the bed of the ancient Lake of Pfäfers, seems to have continued in occupation after the introduction of bronze. The site covers an area of nearly 3 acres, and is estimated to have contained 100,000 piles. In some parts three distinct successions of inhabited platforms have been traced. The first had been destroyed by fire. It is represented at the bottom of the lake by a layer of charcoal mixed with implements of stone and bone, and other relics highly carbonized. The second is represented above the bottom by a series of piles with burnt heads, and in the bottom by a layer of charcoal mixed with corn, apples, cloth, bones, pottery, and implements of stone and bone, separated from the first layer of charcoal by 3 feet of peaty sediment intermixed with relics of the occupation of the platform. The piles of the third settlement do not reach down to the shell marl, but are fixed in the layers representing the first and second settlements. They are formed of split oak trunks, while those of the two first settlements are round stems chiefly of soft wood. The huts of this last settlement appear to have had cattle stalls placed between them, the droppings and litter forming heaps at the lake bottom. The bones of the animals consumed as food at this station were found in such numbers that 5 tons were collected in the construction of a watercourse which crossed the site. Among the wooden objects recovered from the relic beds were tubs, plates, ladles, and spoons, a flail for threshing corn, a last for stretching shoes of hide, celt handles, cinbe, long-bows of yew, floats, and implements of fishing, and a dug-out canoe 12 feet long. No spindle-whorls were found, but there were many varieties of cloth, platted and woven, bundles of yarn, and balls of string. Among the tools of bone and stag's horn were awls, needles, harpoons, scraping tools, and haftings for stone axe-heads. The implements of stone were chiefly axe-heads and arrow-heads. Of clay and earthenware there were many varieties of domestic dishes, cups and pipkins, and crucibles or melting pots made of clay and horse dung and still retaining the drossy coating of the melted metal. No bronze objects have yet been found at Robenhause, although the presence of the crucibles attests the fact of the use of that metal. The settlement of Auvernier in the Lake of Neuchâtel is the richest and most considerable station of the Bronze age. It has yielded four bronze swords, ten socketed spear-heads, forty celts or axe-heads and sickles, fifty knives, twenty socketed chisels, four hammers and an anvil, sixty rings for the arms and legs, several highly ornate torques or twisted neck rings, and upwards of two hundred hair pins of various sizes up to 16 inches in length, some having spherical heads in which plates of gold were set. Moulds for sickles, lance-heads, and bracelets were found out in stone or made in baked clay. From four to five hundred vessels of pottery finely made and elegantly shaped are indicated by the fragments recovered from the relic bed at this station. In the settlement at Marin in the Lake of Neuchâtel iron takes the place of whatever in the older lake dwellings was made either of stone, bone, or bronze. The swords are well forged, of a peculiar fibrous iron, and furnished with iron sheaths. The spear-heads are large, sometimes as much as 18½ inches in length, with blades indented by segmental curves. Shield mountings, horse trappings, and personal ornaments such as fibulae are here made of iron instead of bronze, and Roman and Gallic coins found in the relic bed bring the occupation of the settlement distinctly within the historic period. The antiquity of the earlier settlements of the Stone and Bronze ages is not capable of being deduced from existing

evidence. "We may venture to place them," says Dr Keller, "in an age when iron and bronze had been long known, but had not come into our districts in such plenty as to be used for the common purposes of household life, at a time when amber had already taken its place as an ornament and had become an object of traffic." It is now established that the people who erected the lake dwellings in Switzerland were also the people who were spread over the mainland. The forms and the ornamentation of the implements and weapons of stone and bronze which are found in the lake dwellings are the same as those of the implements and weapons in these materials which are found in the soil of the adjacent regions, and both groups of relics must therefore be ascribed to the industry of one and the same people. Whether dwelling on the land or dwelling in the lake, they have exhibited so many indications of capacity, intelligence, industry, and social organization that they cannot be considered as presenting, even in their Stone age, a low condition of culture or civilization. Their axes were made of tough stones, sawn from the block by flint, and ground to the fitting shape. They were fixed by the butt in a socket of stag's horn, mortised into a handle of wood. Their knives and saws of flint were mounted in wooden handles and fixed with asphalt. They made and used an endless variety of bone tools. Their pottery, though roughly finished, is well made, the vessels often of large size and capable of standing the fire as cooking utensils. For domestic dishes they also made wooden tubs, plates, spoons, ladles, and the like. The industries of spinning and weaving were largely practised. They made nets and fishing lines, and used canoes. They practised agriculture, cultivating several varieties of wheat and barley, besides millet and flax. They kept horses, cattle, sheep, goats, and swine. Their clothing was partly of linen and partly of woollen fabrics and the skins of their beasts. Their food was nutritious and varied, their dwellings neither unhealthy nor inconvenient. They lived in the security and comfort obtained by social organization, and were apparently intelligent, industrious, and prosperous communities.

The materials for the investigation of this singular phase of prehistoric life were first collected and systematized by the late Dr Ferdinand Keller, who died at Zurich, July 21, 1881, in the eighty-first year of his age. They were submitted in a series of seven successive reports to the Society of Antiquaries of Zurich, of which he was president, and printed in the Society's Transactions, *Mittheilungen der Antiquarischen Gesellschaft in Zurich*, vols. I.-XII., 4to, 1865-76. The substance of these reports has also been issued as a separate work in England, *The Lake Dwellings of Switzerland and other parts of Europe*, by Dr Ferdinand Keller, translated and arranged by John Edward Lee, 2d ed., 2 vols. 8vo, London, 1878. Other works on the same subject are Frédéric Troyon, *Habitations Lacustres des temps anciens et modernes*, 8vo, Lausanne, 1880; E. Desor, *Les Palafittes ou Constructions Lacustres du Lac de Neuchâtel*, 8vo, Paris, 1868; E. Desor and L. Favre, *Le Palafitte du Brette Lacustre en Suisse*, folio, Paris, 1874; A. Perny, *Revue préhistorique sur la Savoie spécialement à l'époque lacustre (Les Palafittes du Lac de Bourget)*, 4to, Paris, 1870; Ernest Chantre, *Les Palafittes ou Constructions Lacustres du Lac de Paladru*, folio, Chambéry, 1871; Bartolomeo Gastaldi, *Lake Habitations and prehistoric Remains in the Turkestan and North-west of Northern and Central Italy*, translated by O. H. Chamberlain, 8vo, London, 1885; Sir John Lubbock, *Prehistoric Times*, 4th ed., 8vo, London, 1878. (J. A. N.)

LAKHIMPUR, or **LUCKIMPOOR**, a British district in the extreme east of the province of Assam, extending from 26° 51' to 27° 54' N. lat., and from 93° 49' to 96° 4' E. long. It lies along both banks of the Brahmaputra, which belongs to the district for about 400 miles of its course; and it is bounded N. by the Daphla, Miri, Abar, and Mishmi hills, E. by the Mishmi and Singpho hills, S. by the watershed of the Patkai range and the Lohit branch of the Brahmaputra, and W. by the districts of Barrack and Sibsagar. To the north and north-east the frontier is undefined. The Brahmaputra is navigable for steamers in all seasons as far

as Dibrugarh, in the rainy season as far as Sadiya; its navigable tributaries within the district are the Subanari, Dibru, and Buri Diding. The greater part of the area (11,500 square miles) is sparsely occupied by independent hill tribes, and only 3200 square miles are directly under British administration. The elephant, rhinoceros, bear, buffalo, wild cattle, and deer are abundant; the capturing of elephants is a Government monopoly worth from £3000 to £4500 annually. Coal and petroleum (both worked for a short time about 1866), building stone, limestone, and ironclay exist in the district; and gold has been washed in the hill streams from time immemorial. Rice was grown on 39,460 acres in 1871. Tea is grown with European capital and under European supervision, and has in recent years made great progress, the plantations in 1874 covering 89,370 acres. Silk cloth is made from the cocoons of the *muga* worm (*Saturnia asanumuga*), which feeds on the *sim* tree; but the manufacture has greatly fallen off. A thousand cocoons yield 6 or 8 oz. of thread, worth 10s. to 11s. per pound. The exports of Lakhimpur are tea, muga silk, india-rubber, beeswax, ivory, and mustard seed; the imports rice, opium, tobacco, salt, oil, and cotton cloth. The annual fair established by the Government at Sadiya is less of commercial than of political importance.

The population of the settled district in 1871-72 was 121,267, residing in 125 villages, and including 28,388 aborigines, 68,388 semi-Hinduized aborigines, 19,748 caste Hindus, 8826 Mohammedans. The most numerous Hindu caste was the Kolita (3466), the former priests of the aboriginal kings of Assam; they have now taken to agriculture, and make as pure Hindus. Of the semi-Hinduized aborigines the most numerous tribe is the Ahom, the former rulers of the country (45,943). The hill tribes of the unsettled district are broadly distinguished into a Shan group (Khamti and Singpho) and an Indo-Chinese group (Miamis, Ahoms, Murs, Daphils, &c.). Most, if not all of them, have sent out little colonies who settle on the borders of the plains. There are no towns in the Lakhimpur district. Dibrugarh, on the Dibru, a few miles above its junction with the Brahmaputra, is the chief civil station, with a population of 8870 in 1874. Lakhimpur figures largely in the annals of Assam as the region where successive invaders from the east first reached the Brahmaputra. The Bam Bhuys, originally from the western provinces of India, were driven out by the Chutias (a Shan race), and these in their turn gave place to their more powerful brethren, the Ahoms, in the 18th century. The Burmese, who had ruined the native kingdom, were expelled by the British in 1825, but it was not till 1839 that the country was taken under direct British management.

LAÏLANDE, JOSEPH JÉRÔME LEFRANÇOIS DE (1732-1807), a noted astronomer, was born at Bourg (department of Ain), July 11, 1732. His parents, who were in easy circumstances, sent him to Paris to study the law; but the accident of lodging in the Hôtel Clugny, where Delisle had his observatory, determined his astronomical vocation, and he became the zealous and favoured pupil of both Delisle and Lemonnier. He, however, completed his legal studies, and was on the point of returning to Bourg to practise there as an advocate, when Lemonnier obtained permission to send him, in his own place, to Berlin, for the purpose of making observations on the lunar parallax in concert with those of Lacaille at the Cape of Good Hope. The successful execution of his task procured for him, before he was twenty-one, admission to the Academy of Berlin, and the post of adjunct astronomer to that of Paris. He now devoted himself to the improvement of the planetary theory, publishing in 1759 a corrected edition of Halley's tables, with a history of the celebrated comet whose return in that year he had aided Clairaut to calculate. In 1762, Delisle resigned in his favour the chair of astronomy in the Collège de France, the duties of which were discharged by Lalande with *selat* during forty-six years. His house became an astronomical seminary, and amongst his pupils were Delambre, Piazzi, Mochain, and his own nephew, Michel Lalande. By his publications in connexion with the transit of 1769 he won great and, in some respects,

deserved fame. But his love of notoriety fully equalled his scientific zeal, and earned for him as much ridicule as his impetuous temper drew hostility. These faults were partially outweighed by his generosity and benevolence. A strict adherence to hygienic rules long preserved his health, but eventually shortened his life. He died April 4, 1807, of consumption aggravated by systematic exposure to cold.

Although his investigations were conducted with diligence rather than genius, the career of Lalande must be regarded as of eminent service to astronomy. By his talents as a lecturer and writer he gave to the science unexampled popularity, his planetary tables into which he introduced corrections for mutual perturbations, were the best available up to the end of the last century, and the Lalande prize, instituted by him in 1802 for the chief astronomical performance of each year, still testifies to his enthusiasm for his favourite pursuit. Amongst his voluminous works are *Traité d'Astronomie*, 2 vols. 4to, 1764 (enlarged edition, 4 vols., 1771-81, 3d edition, 8 vols., 1792), *Mémoire de la Société Française*, 1801, giving the places of 50,000 stars, *Éphéméride astronomique*, 1808, with a history of astronomy from 1781 to 1808, *Astronomie des Dames*, 1786; *Abri de Navigation*, 1788; *Voyage d'un Français en Italie*, 1789, a valuable record of his travels in 1785-86. He communicated above one hundred and fifty papers to the Paris Academy of Sciences, edited the *Commeçement des Temps*, 1769-1774, and again 1794-1807, and wrote the concluding 27 vols. of the 2d edition of Montucla's *Histoire des Mathématiques*, 1802.

LALITPUR, or LULLITPOOR, a British district in the lieutenant-governorship of the North-Western Provinces, India, extending from 24° 9' to 25° 14' N. lat. and from 78° 12' to 79° 2' E. long., with an area of 1847 square miles. It is bounded N. and W. by the river Betwa, S.W. by the Narayan, S. by the Vinayachal Ghatas and the Sagar (Saugor) district of the Central Provinces, S.E. and E. by Orchhis state and the Dhasan. The district is an undulating plain about 1500 feet on an average above the sea-level, in the hill country of Bundelkhand, sloping gradually northwards from the Vinayachal range to the Betwa and Jumna. It is drained by several important tributaries of the Jumna, and an immense number of smaller streams; but their rapid and frequently swollen currents, instead of fertilising, impoverish the land and sweep away embankments and bridges. The general condition of the district is far from prosperous. A large proportion of the area is covered with jungle, and the poor-coloured villages are few and far between. Only 866 square miles were under tillage in 1872; the food stuffs (mainly wheat, grain, barley, and millet) are never produced in much greater quantity than is necessary for local consumption, and a bad year results in scarcity, if not famine. As but little is done in the way of irrigation, the spring harvest is a very poor one; and if the rainfall sink much below its average of 40 inches the autumn harvest is also scanty.

In 1836 the population was 243,146; in 1872 it was only 212,661, while the number of villages had fallen from 750 to 646. About 88 per cent. (207,788) of the inhabitants in 1872 were Hindus—the Brahmins numbering 20,057, Rajputs 20,985, Banias 11,866. The Rajput Bundelas are the most important socially, the Banias commercially. A few Gonds are found in the south, and about 10,000 Sahariyas, a degraded body of savages known to the police throughout India as professional thieves, are scattered throughout the jungle. The district is administered on the non-regulation system by a deputy-commissioner. The only municipality is Lalitpur town (population 8974 in 1872). The Gonds are the earliest known inhabitants of Lalitpur; they have left traces of their ultimate high state of civilisation in temples and reservoirs. They were succeeded by the Chandel princes of Mahoba, who in their turn gave place to a number of petty independent rulers. In the 14th century the Bundelas invaded the country, and Lalitpur finally became a part of the state of Chandpur, which continued for the most part practically independent till the beginning of the 19th century, when Sindhu, provoked by raids into Gwalior, sent Colonel Bagnall against Lalitpur, and took the government under his direct control. In 1829 two-thirds of its territory was restored to the Chandel sovereign. The remainder of the country, which was retained by Sindhu, was in 1844 made over to the British Government. The Bundela chiefs of Lalitpur were among those who most eagerly joined the mutiny, and it was only after a severe struggle that the district was again pacified.

LALLY, THOMAS ARTHUR, BARON DE TOLLENDAL, COMTE DE (1702-1766), French general, descended from an old Irish family who emigrated to France along with the Stuarts, was born in Dauphiné in January 1702. His father, colonel in an Irish-French regiment, familiarized him with active service from his boyhood, and he rose step by step in a career distinguished for bravery and conduct till in 1744 he was created a brigadier by Louis XV. on the field of Fontenoy. Previous to this he had been engaged in several plots for the restoration of the Stuarts, and in 1745 he accompanied Charles Edward to Scotland, serving as aide-de-camp at the battle of Falkirk. Escaping in disguise to France, he joined the army of Marshal Saxe in the Low Countries, and for his conduct at the capture of Maestricht in 1748 received the grade of marshal of the camp. When the French in 1756 resolved to fit out an expedition to recover their power in India, Lally was appointed to the chief command. Arriving at Pondicherry in 1758, he alarmed the English by his first successes, and even laid siege to Madras. But he was ill supported by his countrymen, his military chest was empty, and his bravery and zeal were not combined with the qualities necessary for success in Indian administration. Madras was relieved by a British fleet, and the English under Coote assumed the offensive, and inflicted a severe defeat on Lally at Wandiwash. He still made a long and stubborn resistance, but was ultimately besieged in Pondicherry and compelled to surrender in January 1761. Returning to France on parole, he was thrown into prison. Popular indignation at the collapse of French power in India demanded a victim, and the parliament of Paris sentenced him to death on a vague and frivolous accusation. The judicial murder of Lally (9th May 1766) was exposed by Voltaire, and his son Lally-Tollendal obtained in 1778 the formal reversal of the sentence.

LAMAISM is partly religious, partly political. Religiously it is the corrupt form of Buddhism prevalent in Tibet and Mongolia. It stands in a relationship to primitive Buddhism similar to that in which Roman Catholicism, so long as the temporal power of the pope was still in existence, stood to primitive Christianity. The ethical and metaphysical ideas most conspicuous in the doctrines of Lamaism are not confined to the highlands of Central Asia, they are accepted in great measure also in Japan and China. It is the union of these ideas with a hierarchical system, and with the temporal sovereignty of the head of that system in Tibet, which constitutes what is distinctively understood by the term Lamaism. Lamaism is hardly calculated to attract much attention for its own sake. Tibetan superstitions and Tibetan politics are alike repugnant to Western minds. But, as so many unfounded beliefs and curious customs have a special value of their own to the student of folklore, so Lamaism has acquired a special interest to the student of comparative history through the instructive parallel which its history presents to that of the Church of Rome.

The central point of primitive Buddhism was the doctrine of "Arَاهatship,"—a system of ethical and mental self-culture, in which deliverance was found from all the mysteries and sorrows of life in a change of heart to be reached here on earth. This doctrine seems to have been held very nearly in its original points from the time when it was propounded by Gotama in the 5th century B.C. down to the period in which northern India was invaded and conquered by the Huns at about the commencement of the Christian era. At that time there had arisen a school of Buddhist teachers who called their doctrine the "Great Vehicle." It was not in any contradiction to the older doctrine, which they contemptuously called the "Little Vehicle," but included it all, and was based upon it. The distinguishing characteristic of the

newer school was the importance which it attached to "Bodhisatship." The older school had taught that Gotama, who had propounded the doctrine of Arَاهatship, was a Buddha, that only a Buddha is capable of discovering that doctrine, and that a Buddha is a man who by self-denying efforts, continued through many hundreds of different births, has acquired the so-called *Ten Perfections* or cardinal virtues in such perfection that he is able, when sin and ignorance have gained the upper hand throughout the world, to save the human race from impending ruin.¹ But until the process of perfection has been completed, until the moment when at last the sage, sitting under the Bo tree, acquires that particular insight or wisdom which is called Enlightenment or Buddhahood, he is still only a Bodhisat. And the link of connexion between the various Bodhisats in the future Buddha's successive births is not a soul which is transferred from body to body, but the *karma*, or character, which each successive Bodhisat inherits from his predecessors in the long chain of existences. Now the older school also held, in the first place, that, when a man had, in this life, attained to Arَاهatship, his karma would not pass on to any other individual in another life,—or in other words, that after Arَاهatship there would be no rebirth; and, secondly, that four thousand years after the Buddha had proclaimed the *Dhamma* or doctrine of Arَاهatship, his teaching would have died away, wickedness and ignorance would have increased in the world, and another Buddha would be required to bring mankind once more to a knowledge of the truth. The leaders of the Great Vehicle urged their followers to seek to attain, not so much to Arَاهatship, which would involve only their own salvation, but to Bodhisatship, by the attainment of which they would be conferring the blessings of the *Dhamma* upon countless multitudes in the long ages of the future. By thus laying stress upon Bodhisatship, rather than upon Arَاهatship, the new school, though they doubtless merely thought themselves to be carrying the older orthodox doctrines to their logical conclusion, were really changing the central point of Buddhism, and were altering the direction of their mental vision. It was of no avail that they adhered in other respects to the main to the older teaching, that they professed to hold to the same ethical system, that they adhered, except in a few unimportant details, to the old regulations of the order of the Buddhist mendicant recluses. The ancient books, still preserved to us in the *Pali Pitakas*, being mainly occupied with the details of Arَاهatship, lost their exclusive value in the eyes of those whose attention was being directed to the details of Bodhisatship. And the opinion that every leader in their religious circles, every teacher distinguished among them for his sanctity of life, or for his extensive learning, was a Bodhisat, who might have and who probably had inherited the karma of some great teacher of old, opened the door to a flood of superstitious fancies.

It is worthy of note that the new school found its earliest professors and its greatest exponents in a part of India which lay outside the district to which the personal influence of Gotama himself and of his immediate followers had been confined. The home of early Buddhism was round about Kosala and Magadha; in the district, that is to say, north and south of the Ganges between where Allahabad now lies on the west, and Rajgir on the east. The home of the Great Vehicle was, at first, in the countries farther to the north and west. Buddhism arose in countries, subject indeed to Brahman influence, but where the sacred language of the Brahmins was never more than a learned tongue, and where the exclusive

¹ See, for instance, the *Buddhist Birth Stories*, pp. 19-27 and 68-69.

claims of the Brāhmins had never been universally admitted. The Great Vehicle arose in the very stronghold of Brāhmaism, and among a people to whom Sanskrit was a familiar tongue. The new literature therefore, which the new movement called forth, was written, and has been preserved, in Sanskrit,—its principal books of *Dharma*, or doctrine, being the following nine—(1) *Pratyā-parāmitā*; (2) *Gaṇḍa-vyūha*; (3) *Daśa-bhūmayāra*; (4) *Samādhi-sūtra*; (5) *Lankā-vāṭā*; (6) *Saddharma-puṇḍarīka*; (7) *Tathāgata-guṇya*; (8) *Lalitā-vistara*; (9) *Śvāra-prabhāsa*. The date of none of these works is known with any certainty, but it is highly improbable that any one of them is older than the 6th century after the death of Gotama. Copies of all of them were brought to Europe by Mr B. H. Hodgson, and other copies have been received since then; but none of them have as yet been published in Europe (the *Lalitā Vistara* has been published by Rajendra Lal Mitra in Calcutta), and only two have been translated into any European language. These are the *Lalitā Vistara*, translated into French, through the Tibetan, by M. Foucaux, and the *Saddharma Puṇḍarīka*, translated into French by M. Eugène Burnouf. The former of these two is a legendary work, partly in verse, on the life of Gotama, the historical Buddha; and the latter, also partly in verse, is devoted to proving the essential identity of the Great and the Little Vehicle and the equal authenticity of both as doctrines announced by the master himself.

Of the authors of these nine works, as indeed of all the older Buddhist works with one or two exceptions, nothing has as yet been ascertained. The founder of the system of the Great Vehicle is, however, often referred to under the name of Nāgārjuna or Nāgaseṇa, a personage celebrated even in the countries to which the Greater Vehicle has never penetrated as the contemporary and religious instructor of the Yavana king Milinda, and as the answerer of the famous *Questions of Milinda*, a work still preserved in its Pāli form.¹ As Milinda may with all probability be identified with the Greek king Menander, who was one of the followers of Alexander the Great in Bactria, this tradition would imply that the origin of the Great Vehicle must be assigned to as early a date as the 2d century B.C. But the work itself was probably composed at least some centuries afterwards; and it would be hazardous to attach too much importance to any chronological data drawn from it. We must be content at present to settle a certain historical sequence in the principal doctrines of the system, which developed into Lamāism, without pretending to fix any actual dates.

Together with Nāgaseṇa, other early teachers of the Great Vehicle whose names are known to us are Vasumitra, or Vasubandhu, Āryadeva, Dharmapāla, and Gaṇapati—all of whom were looked upon as Bodhisats. As the newer school did not venture so far as to claim as Bodhisats the disciples stated in the older books to have been the contemporaries of Gotama (they being precisely the persons known as Arhats), they attempted to give the appearance of age to the Bodhisat theory by representing the Buddha as being surrounded, not only by his human companions the Arhats, but also by fabulous beings, whom they represented as the Bodhisats existing at that time. In the opening words of each Mahāyāna treatise a list is given of such Bodhisats, who were beginning, together with the historical Bodhisat, to occupy a position in the Buddhist church of those times similar to that occupied by the saints in the corresponding period of the history of Christianity in the Church of Rome. And these lists of fabulous Bodhisats have now a distinct historical importance. For they grow

in length in the later works; and it is often possible by comparing them one with another to fix, not the date, but the comparative age of the books in which they occur. Thus it is a fair inference to draw from the shortness of the list in the opening words of the *Lalitā Vistara*, as compared with that in the first sections of the *Saddharma Puṇḍarīka*, that the latter work is much the younger of the two, a conclusion supported also by other considerations.

Among the Bodhisats mentioned in the *Saddharma Puṇḍarīka*, and not mentioned in the *Lalitā Vistara*, as attendant on the Buddha are Mañju-ari and Avalokiteśvara. That these saints were already acknowledged by the followers of the Great Vehicle at the beginning of the 5th century is clear from the fact that Fa Hian, who visited India about that time, says that "men of the Great Vehicle" were then worshipping them at Mathure, not far from Delhi (F. H., chap. xvi.). These were supposed to be celestial beings who, inspired by love of the human race, had taken the so-called Great Resolve to become future Buddhas, and who therefore, very naturally, descended from heaven when the actual Buddha was on earth, to pay reverence to him, and to learn of him. The belief in them probably arose out of the doctrine of the older school, which did not deny the existence of the various creations of Brahmanical mythology and speculation, but allowed of their actual existence as spiritual beings, and only deprived them of all power over the lives of men, and declared them to be temporary beings liable like men to sin and ignorance, and requiring like men the salvation of Arhatship. Among them the later Buddhists seem to have placed their numerous Bodhisats; and to have paid special reverence to Mañju-ari as the personification of wisdom, and to Avalokiteśvara as the personification of overruling love. The latter indeed occupies in the Mahāyāna very much the position which the old Brahmanical god Brahma, the First Cause of the Brahmanical speculation, had been allowed to retain in primitive Buddhism. The former was afterwards identified with the mythical first Buddhist missionary, who is supposed in the legend to have introduced civilization into Tibet about two hundred and fifty years after the death of the Buddha.

The way was now open to a rapid fall from the simplicity of early Buddhism, in which men's attention was directed to the various parts of the system of self-culture which men could themselves practise, to a belief in a whole pantheon of saints or angels, which appealed more strongly to the half-civilized races among whom the Great Vehicle was now professed. A theory sprang up which was supposed to explain the marvellous powers of the Buddhas by representing them as only the outward appearance, the reflexion, as it were, or emanation, of ethereal Buddhas dwelling in the skies. These were called *Dhyanai Buddhas*, and their number was supposed to be, like that of the Buddhas, innumerable. Only five of them, however, occupied any space in the speculative world in which the ideas of the later Buddhists had now begun to move. But, being Buddhas, they were supposed of course to have their Bodhisats; and thus out of the five last Buddhas of the earlier teaching there grew up five mystic trinities, each group consisting of one of these five Buddhas, his prototype in heaven the Dhyanai Buddha, and his celestial Bodhisat. Among these hypothetical beings, the creations of a sickly scholasticism, hollow abstractions without life or reality, the particular trinity in which the historical Gotama was assigned an subordinate place naturally occupied the most exalted rank. Amida, the Dhyanai-Buddha of this trinity, soon began to fill the largest place in the minds of the new school; and Avalokiteśvara, his Bodhisat, was looked upon with a reverence somewhat less than his former glory. It is needless to add that, under the overpowering

¹ Edited by Dr V. Transcander, London, 1880.

influence of these vain imaginations, the earnest moral teachings of Gotama became more and more hid from view. The imaginary saints grew and flourished. Each new creation, each new step in the theory, demanded another, until the whole sky was filled with forgeries of the brain, and the nobler and simpler lessons of the founder of the religion were hidden beneath the glittering stream of metaphysical subtleties.

Still worse results followed on the change of the earlier point of view. The acute minds of the Buddhist pandits, no longer occupied with the practical lessons of Arhatship, turned their attention, as far as it was not engaged upon their hierarchy of mythological beings, to questions of philosophical speculation, which, in the earliest Buddhism, are not only discouraged but forbidden. We find long treatises on the nature of being, idealistic dreams which have as little to do with the Bodhisatship that is concerned with the salvation of the world as with the Arhatship that is concerned with the perfect life. Only one lower step was possible, and that was not long in being taken. The animism common alike to the untutored Huns and to their Hindu conquerors, but condemned in early Buddhism, was allowed to revive. As the stronger side of Gotama's teaching was neglected, the debating belief in rites and ceremonies, and charms and incantations, which had been the especial object of his scorn, began to live again, and to grow vigorously, and to spread like the Birana weed warmed by a tropical sun in marsh and muddy soil. As in India, after the expulsion of Buddhism, the degrading worship of Siva and his dusky bride had been incorporated into Brahmanism from the wild and savage devil worship of Aryan and of non-Aryan tribes, so, as pure Buddhism died away in the north, the *Tantra* system, a mixture of magic and witchcraft and sorcery, was incorporated into the corrupted Buddhism.

The founder of this system seems to have been Asanga, an influential monk of Peshawar, in the Punjab, who lived and wrote the first text-book of the creed, the *Yogachaktra Bhūmi Śāstra*, about the 6th century of our era. Hwen Tsang, who travelled in the first half of the 7th, found the monastery where Asanga had lived in ruins, and says that he had lived one thousand years after the Buddha.¹ He managed with great dexterity to reconcile the two opposing systems by placing a number of Saivite gods or devils, both male and female, in the inferior heavens of the then prevalent Buddhism, and by representing them as worshippers and supporters of the Buddha and of Avalokitesvara. He thus made it possible for the half-converted and rude tribes to remain Buddhists while they brought offerings, and even bloody offerings, to these more congenial shrines, and while their practical belief had no relation at all to the Truths or the Noble Eightfold Path, but busied itself almost wholly with obtaining magic powers (*Siddhi*), by means of magic phrases (*Dhāraṇa*), and magic circles (*Maṇḍala*). Asanga's happy idea bore but too ample fruit. In his own country and Nepal the new rite, sweet and luscious to the taste of savages, completely disqualified them from enjoying any purer drink; and now in both countries Saivism is supreme, and Buddhism is even nominally extinct, except in some outlying districts of Nepal. But this full effect has only been worked out in the lapse of ages; the *Tantra* literature has also had its growth and its development, and some unhappy scholar of a future age may have to trace its loathsome history. The nauseous taste repelled even the self-sacrificing industry of Burnout, when he found the later *Tantra* books to be as immoral as they are absurd.

"The pen," he says, "refuses to transcribe doctrines as miserable in respect of form as they are odious and degrading in respect of meaning."²

Such had been the decline and fall of Buddhism considered as an ethical system before its introduction into Tibet. The manner in which its order of mendicant recluses, at first founded to afford better opportunities to those who wished to carry out that system in practical life, developed at last into a hierarchical monarchy will best be understood by a sketch of the history of Tibet.

In Tibet as elsewhere the beginnings of the accounts found in the old historians are merely a recapitulation of legends in which popular tradition has explained by miraculous and mythological fancies the origins of its civilization. Its real history commences with Srong Tsan Gampo, who was born a little after 600 A.D., and who is said in the Chinese chronicles to have entered, in 634 after Christ, into diplomatic relationship with Thai Tung, one of the emperors of the Thung dynasty. He was the founder of the present capital of Tibet, now known as Lhasa, and in the year 623 (the same year as that in which Mohammed fled from Mecca) he began the formal introduction of Buddhism into Tibet. For this purpose he sent the minister Thumi Sambhota, afterwards looked upon as an incarnation of Mañjuśrī, to India, there to collect the sacred books, and to learn and translate them. Thumi Sambhota accordingly invented an alphabet for the Tibetan language on the model of the Indian alphabets then in use. And, aided by the king himself, who is represented to have been an industrious student and translator, he wrote the first books by which Buddhism became known in his native land. The most famous of all the works ascribed to him is the *Mani Kambum*, "the Myriad of Precious Words,"—a treatise chiefly on religion, but which also contains an account of the introduction of Buddhism into Tibet, and of the closing part of the life of king Srong Tsan Gampo. He is also very probably the author of another very ancient standard work of Tibetan Buddhism, the *Samatog*, a short digest of Buddhist morality, on which the civil laws of Tibet have been founded. It is said in the *Mani Kambum* to have fallen down from heaven in a casket (Tibetan, *samatog*), and, like the last-mentioned work, is unfortunately only known to us in meagre abstract.

King Srong Tsan Gampo's zeal for Buddhism was shared and supported by his two queens, the one named Bribenu, a princess from Nepal, the other named Wen Ching, a princess from China. They are related in the chronicles to have brought with them sacred relics, books, and pictures, for whose better preservation and honour two large monasteries were erected, and opened and dedicated with much ceremony. These are the cloisters of La Brang and Ra Mochay, still, though much changed and enlarged, the most famous and sacred abbeys in Tibet, and the glory of Lhasa. In after times the two queens have become semi-divine personages, and are worshipped under the name of the two *Dārā-Eke*, the "glorious mothers," being regarded as incarnations of the wife of Siva, representing respectively two of the qualities which she personifies, divine vengeance and divine love. The former of the two is worshipped by the Mongolians as *Okkin Tengri*, "the Virgin Goddess;" but in Tibet and China the rôle of the divine virgin is filled by *Kwan Yin*, a personification of Avalokitesvara as the heavenly word, who is often represented with a child in her arms. Srong Tsan Gampo has also become a saint, being looked upon as an incarnation of Avalokitesvara; and the description in the ecclesiastical historians of the measures he took for the welfare of his subjects do great credit to their ideal of the perfect Buddhist king. He is

¹ Edméunt's translation, *Mémoires sur les Contrées Occidentales*, p. 270; and *La Vie de Hien Tsang*, p. 94.

² *Introduction*, &c., p. 558.

said to have spent his long reign in the building of reservoirs, bridges, and canals; in the promotion of agriculture, horticulture, and manufactures; in the establishment of schools and colleges; and in the maintenance of justice, and the encouragement of virtue. But the degree of his success must have been slight. For after the death of himself and of his wives Buddhism gradually decayed, and was subjected by succeeding kings to cruel persecutions; and it was not till more than half a century afterwards, under King Kir Song de Tsan, who reigned 740-786, that true religion is acknowledged by the ecclesiastical historians to have become firmly established in the land.

This monarch again sent to India to replace the sacred books that had been lost, and to invite Buddhist pandits to translate them. The most distinguished of those who came were Santa Rakshita, Padma Samblava, and Kamala Sila, for whom, and for their companions, the king built a splendid monastery still existing, at Samye, about three days' journey south-east of Lhasa. It was to them that the Tibetans owed the great collection of what are still regarded as their sacred books—the *Kanjur*. It consists of 100 volumes containing no less than 689 works, of which there are two or three complete sets in Europe, one of them in the India Office Library. A detailed analysis of these Scriptures has been published by the celebrated Hungarian scholar Csoma de Körös, whose authoritative work has lately been republished in French with complete indices and very useful notes by M. Léon Feé. These volumes contain about a dozen works of the oldest school of Buddhism, the Hinayāna, and about 300 works, mostly very short, belonging to the Tantra school. But the great bulk of the collection consists of Mahāyāna books, belonging to all the previously existing varieties of that widely extended Buddhist sect, and, as the Sanskrit originals of many of these writings are now lost without hope of recovery, the Tibetan translations will be of great value, not only for the history of Lamaism, but also for the history of the later forms of Indian Buddhism.

The last king's second son, Lang Darma, concluded in May 823 a treaty with the then emperor of China (the twelfth of the T'ang dynasty), a record of which was engraved on a stone put up in the above mentioned great convent of La Brang, and is still to be seen there.¹ He is described in the church chronicles as an incarnation of the evil spirit, and is said to have tried his best to overthrow religion, and to have succeeded in suppressing Buddhism throughout the greater part of the land. The period from Song Tsan Gampo down to the death of Lang Darma, who was eventually murdered about 850 A.D., in a civil war, is called in the Buddhist books "the first introduction of religion." It was followed by more than a century of civil disorder and wars, during which the exiled Buddhist monks attempted unsuccessfully again and again to return. Many are the stories of martyrs and confessors who are believed to have lived in these troublous times, and their efforts were at last crowned with success, for in the century commencing with the reign of Bilungur in 971 there took place "the second introduction of religion" into Tibet, more especially under the guidance of the Pandita Atiśa, who came to Tibet in 1041, and of his famous native pupil and follower Brom Stön. The long period of depression seems not to have been without a beneficial influence on the persecuted Buddhist Church, for these teachers are reported to have placed the Tantra system more in the background, and to have adhered more strongly to the purer forms of the Mahāyāna development of the ancient faith.

For about three hundred years the Buddhist Church of Tibet was then left in peace, subjecting the country more and more completely to its control, and growing in power and in wealth. During this time it achieved its greatest victory, and underwent the most important change in its character and organization. After the reintroduction of Buddhism into the "kingdom of snow," the ancient dynasty never recovered its power. Its representatives continued for some time to claim the sovereignty; but the country was practically very much in the condition of Germany at about the same time—chieftains of almost independent power ruled from their castles on the hill tops over the adjacent valleys, engaged in petty wars, and conducted plundering expeditions against the neighbouring tenants, whilst the great abbeys were places of refuge for the studious or religious, and their heads were the only rivals to the barons in social state, and in many respects the only protectors and friends of the people. Meanwhile Jenghis Khān had founded the Mongol empire, and his grandson Kublai Khān, who ruled over the greatest empire which has ever owned the sway of a single man, became a convert to the Buddhism of the Tibetan Lamas. He granted to the abbot of the Sakya monastery in southern Tibet the title of tributary sovereign of the country, head of the Buddhist Church, and overlord over the numerous barons and abbots, and in return was officially crowned by the abbot as ruler over the extensive domain of the Mongol empire. Thus was the foundation laid at one and the same time of the temporal sovereignty of the Lamas of Tibet, and of the supremacy over Tibet of the emperors of China. One of the first acts of the "head of the church" was the printing of a carefully revised edition of the Tibetan Scriptures,—an undertaking which occupied altogether nearly thirty years, and was not completed till 1306.

Under Kublai's successors in China the Buddhist cause flourished greatly, and the Sakya Lamas extended their power both at home and abroad. The dignity of abbot at Sakya became hereditary, the abbots breaking so far the Buddhist rule of celibacy that they remained married until they had begotten a son and heir. But rather more than half a century afterwards their power was threatened by a formidable rival at home, a Buddhist reformer.

Tsongkapa, the Luther of Tibet, was born about 1367 on the spot where the famous monastery of Kunbum now stands. He very early entered the order, and studied at Sakya, Brigung, and other monasteries. He then spent eight years as a hermit in Takpo in southern Tibet, where the comparatively pure teaching of Atiśa (referred to above) was still prevalent. About 1390 he appeared as a public teacher and reformer in Lhasa itself, and before his death in 1419 there were three huge monasteries there containing 30,000 of his disciples, besides others in other parts of the country. His voluminous works, of which the most famous are the *Sumdun* and the *Lam Nün Tserpo*, exist in printed Tibetan copies in Europe, but have not as yet been translated or analysed. But the principal lines on which his reformation proceeded are sufficiently well attested. He insisted in the first place on the complete carrying out of the ancient rules of the order as to the celibacy of its members, and as to simplicity in dress. One result of the second of these two reforms was to make it necessary for every monk openly to declare himself either in favour of or against the new views. For Tsongkapa and his followers wore the yellow or orange-coloured garments which had been the distinguishing mark of the order in the lifetime of its founder, and in support of the ancient rules Tsongkapa reinstated the fortnightly rehearsal of the *Pātimokkha* or "disburdenment" in regular assemblies of the order at Lhasa—a practice which had fallen into disuse. He also restored the custom of the

¹ Published with facsimile and translation and notes in the *Journal of the Royal Asiatic Society* for 1874-80, vol. xli.

first disciples to hold the so-called *Vassa* or yearly retirement, and the public meeting of the order at its close. In all these respects he was simply following the directions of the Vinaya, or regulations of the order, as established probably in the time of Gotama himself, and as certainly handed down from the earliest times in the *pitakas* or sacred books. Further, he set his face against the Tantra system, and against the whole crowd of animistic superstitions which had been allowed to creep into life again among the more ignorant of the monks and the people. He laid stress on the self-culture involved in the practice of the *pāramitās* or cardinal virtues, and established an annual national fast or week of prayer to be held during the first days of each year. This last institution indeed is not found in the ancient Vinaya, but was almost certainly modelled on the traditional account of the similar assemblies convoked by Asoka and other Buddhist sovereigns in India every fifth year. Laymen as well as monks take part in the proceedings, the details of which are entirely unknown to us except from the accounts of the Catholic missionaries.—Fathers Huo and Gabet, who describe the principal ceremonial as, in outward appearance, wonderfully like the high mass. In doctrine the great Tibetan teacher, who had no access to the Pāli Pitakas, adhered in the main to the purer forms of the Mahāyāna school; in questions of church government he took little part, and did not dispute the titular supremacy of the Sakya Lāmas, though in other matters he had raised the standard of revolt. But the effects of his teaching weakened their power. The "orange-hoods," as his followers were called, rapidly gained in numbers and influence, until they so overshadowed the "red-hoods," as the followers of the older sect were called, that in the middle of the 15th century the emperor of China acknowledged the two leaders of the new sect at that time as the titular overlords of the church and tributary rulers over the realm of Tibet. These two leaders were then known as the *Dalai Lāma* and the *Pantshen Lāma*, and were the abbots of the great monasteries at Gedun Dubpa, near Lhasa, and at Krasia Lünpo, in Further Tibet, respectively. Since that time the abbots of these monasteries have continued to exercise the sovereignty over Tibet,—their pretensions being supported, in the few cases in which an attempt has been made to dispute it, by the power of Mongolia and China.

As there has been no further change in the doctrine, and no further reformation in discipline, we may leave the ecclesiastical history of Lāmism since that date unnoticed, and devote our little remaining space to the consideration of some principal points in the constitution of the Lāmism of to-day. And first as to the mode of electing successors to the two Great Lāmas. It will have been noticed above that it was an old idea of the northern Buddhists to look upon distinguished members of the order as incarnations of Avalokiteśvara, of Mañjuśrī, or of Amida. These beings were supposed to possess the power, whilst they themselves continued to live in heaven, of appearing also on earth in a *Nirmāṇa-rūpa*, or apparitional body. In the same way the Pantshen Lāma is looked upon as an incarnation, the Nirmāṇa-rūpa, of Amida, who had previously appeared in that way under the outward form of Tshonkups himself; and the Dalai Lāma is looked upon as an incarnation of Avalokiteśvara. Theoretically, therefore, the former, as the spiritual successor of the great teacher and also of Amida, who occupies the higher place in the mythology of the Great Vehicle, would be superior to the latter, as the spiritual representative of Avalokiteśvara. But practically the Dalai Lāma, owing to his position in the capital, has the political supremacy, and is actually called the *Gyalpo Rinpoche*, "the glorious king,"—his companion being content with the title *Pantshen*

Rinpoche, "the glorious teacher." When either of them dies it is necessary for the other to ascertain in whose body the celestial being whose outward form has been dissolved has been pleased again to incarnate himself. For that purpose the names of all male children born just after the death of the deceased Great Lāma are laid before his survivor. He chooses three out of the whole number; their names are thrown into a golden casket provided for that purpose by a former emperor of China. The Chutaktus, or abbots of the great monasteries, then assemble, and after a week of prayer, the lots are drawn in their presence and in presence of the surviving Great Lāma and of the Chinese political resident. The child whose name is first drawn is the future Great Lāma; the other two receive each of them 500 pieces of silver. The Chutaktus just mentioned correspond in many respects to the Roman cardinals. Like the Great Lāmas, they bear the title of Rinpoche or Glorions, and are looked upon as incarnations of one or other of the celestial Bodhisattvas of the Great Vehicle mythology. Their number varies from ten to a hundred; and it is uncertain whether the honour is inherent in the abbacy of certain of the greatest cloisters, or whether the Dalai Lāma exercises the right of choosing them. Under these high officials of the Tibetan hierarchy there come the Chubbi Khāns, who fill the post of abbot to the lesser monasteries, and are also incarnations. Their number is very large; and there are but few monasteries in Tibet or in Mongolia who do not claim to possess one of these living Buddhas. Besides these mystical persons there are in the Tibetan Church a number of other ranks and degrees, corresponding to the deacon, full priest, dean, and doctor of divinity in the West. At the great yearly festival at Lhasa they make in the cathedral an imposing array, not much less magnificent than that of the clergy in Rome; for the ancient simplicity of dress has quite disappeared in the growing differences of rank, and each division of the spiritual army is distinguished in Tibet, as in the West, by a special uniform. The political authority of the Dalai Lāma is confined to Tibet itself, but he is the acknowledged head also of the Buddhist Church throughout Mongolia and China. He has no supremacy over his co-religionists in Japan, and even in China there are many Buddhists who are not practically under his control or influence.

The principal authorities for the history of Buddhism have already been given at the close of the article BUDDHISM. To these may now be added T. W. Rhys Davids's *Buddhism*, London, 1878; *Buddhist Birth Stories*, London, 1880; *Buddhist Suttas from the Pāli*, Oxford, 1881; and *Hibbert Lectures*, London, 1881; also Bushell, "The Early History of Tibet," in the *Journal of the Royal Asiatic Society*, 1878-80, vol. xii.; S. S. Seneb's *History of the East Mongols in Mongolia*, translated into German by J. Schmitz (*Geschichte der Ost-Mongolen*); "Analysis in Kanji," by M. Leon Feer, in *Annales du Musée Guimet*, 1881; Schott, *Über den Buddhismus in Hoch-Asien*; Guttschall, *Geschichte des Chinesischen Reiches*; Huo and Gabet, *Souvenirs d'un Voyage dans le Tartarie, le Tibet, et la Chine*, Paris, 1858; *Palais's Sammlung historischer Nachrichten über die Mongolischen Völkerschaften*; and Babu Saad Chunder Dutt's "Contributions to the Religion and History of Tibet," in the *Journal of the Bengal Asiatic Society*, 1881. (T. W. R. D.)

LAMA-MIAU, or DOLANOR, one of the chief cities of Inner Mongolia, is situated 160 miles north of Peking, in a barren sandy plain watered by the Urtugol, a tributary of the Shandugol. The town proper, almost exclusively occupied by Chinese, is about a mile in length by half a mile in breadth, has narrow and dirty streets, and contains a large population for its extent. Unlike the ordinary Chinese town of the same rank, it is not walled. A busy trade is carried on between the Chinese and the Mongolians, who bring in their cattle, sheep, camels, hides, and wool to barter for tea, tobacco, cotton, and silk. At some distance from the Chinese town lies the Mongolian quarter, with

two groups of lama temples and villages occupied by 2300 priests. Dr Williamson (*Journeys in North China*) describes the chief temple as a huge oblong building with an interior not unlike a Gothic church. Lama-mia is the seat of a manufactory of bronze idols and other articles of ritual, which find their way to all parts of Mongolia and Tibet. The craftsmen work in their own houses. See Prejevalsky, *Mongolia*, 1876.

LAMARCK, JEAN BAPTISTE PIERRE ANTOINE DE MONET, CHEVALIER DE (1744-1829), a celebrated French naturalist, was born 1st August 1744, at Bazentin, a village of Picardy. He was an eleventh child, and his father, lord of the manor and of old family, but of limited means, having already placed three sons in the army, destined this one for the church, and sent him to the Jesuits at Amiens, where he continued till his father's death. After this he would remain with the Jesuits no longer, and, not yet seventeen years of age, started for the seat of war at Bergen-op-Zoom, before which place one of his brothers had already been killed. Mounted on an old horse, with a boy from the village as attendant, and furnished by a lady with a letter of introduction to a colonel, he reached his destination on the evening before a battle. Next morning the colonel found that the new and very diminutive volunteer had posted himself in the front rank of a body of grenadiers, and could not be induced to quit the position. In the battle, the company which he had joined became exposed to the fire of the enemy's artillery, and in the confusion of retreat was forgotten. All the officers and subalterns were killed, and not more than fourteen men were left, when the oldest grenadier seeing there were no more French in sight proposed to the young volunteer so soon become commandant to withdraw his men. This he refused to do without orders. These at last arrived; and for his bravery he was made an officer on the spot, and soon after was named to a lieutenantcy.

After the peace, the regiment was sent to Monaco. There it happened that one of his comrades playfully lifted him by the head, and to this it was imputed that he was seized with disease of the glands of the neck, so severe as to necessitate grave surgical interference, and put a stop to his military career.

The courage of Lamarck, so early exhibited, was in future to be shown by the maintenance of his opinions in the absence of any friendly support, and by fortitude amid many adversities; while his activity was to be displayed, not only in manifold speculation, but in copious and varied scientific work. He went to Paris and began the study of medicine, supporting himself by working in a banker's office. He early became interested in meteorology and in physical and chemical speculations of a chimerical kind, but happily threw his main strength into botany, and in 1778 published his *Flore française*, a work in which by a dichotomous system of contrasting characters he enabled the student with facility to determine species. This work, which went through several editions and long kept the field, gained for its author immediate popularity as well as the honour of admission to the Academy of Sciences.

In 1781 and 1782, under the title of botanist to the king, an appointment obtained for him by Buffon, whose son accompanied him, he travelled through various countries of Europe, extending his knowledge of natural history; and on his return he began those elaborate contributions to botany on which his reputation in that science principally rests, namely, the *Dictionnaire de Botanique* and the *Illustrations de Genres*, voluminous works contributed to the *Encyclopédie Méthodique* (1786). In 1793, when he was already forty-nine years of age, in consequence of changes in the organization of the natural history department at the Jardin du Roi, where he had held a botanical appoint-

ment since 1788, Lamarck was presented to a zoological chair, and called on to lecture on the *Insecta* and *Vermes* of Linnaeus, the animals for which he introduced the term *Invertebrata*, still employed. Thus driven, comparatively late in life, to devote his principal attention to zoology instead of botany, he had the misfortune soon after to suffer from impaired vision; and the malady progressing resulted subsequently in total blindness. Yet his greatest zoological work, the *Histoire Naturelle des Animaux sans Vertèbres*, was published from 1815 to 1822, with the assistance, in the last two volumes, of his eldest daughter and of M. Latreille. A volume of plates of the fossil shells of the neighbourhood of Paris was collected in 1823 from his memoirs in the *Annales des Muséum*. The later years of his blind old age were spent in straitened circumstances and accumulating infirmities, solaced, however, by the devotion of his family, and particularly of his eldest daughter, of whom Cuvier records that she never left the house from the time that he was confined to his room. He died 18th December 1829.

The character of Lamarck as a naturalist is remarkable alike for its excellences and its defects. His excellences were width of scope, fertility of ideas, and a pre-eminent faculty of precise description, arising not only from a singularly terse style, but from a clear insight into both the distinctive features and the resemblances of forms. That part of his zoological work which still finds a large and important place in the science of the present day, and constitutes his solid claim to the highest honour as a zoologist, is to be found in his extensive and detailed labours in the departments of living and fossil *Invertebrata*. His endeavours at classification of the great groups were necessarily defective on account of the imperfect knowledge possessed in his time in regard to many of them, e.g., echinoderms, ascidians, and intestinal worms; yet they are not without interest, particularly on account of the comprehensive attempt to unite in one great division as *Articulata* all those groups that appeared to present a segmented construction. Moreover, Lamarck was the first to distinguish vertebrate from invertebrate animals by the presence of a vertebral column, and among the *Invertebrata* to found the groups *Crustacea*, *Arachnida*, and *Annelida*. In 1785 (*Hist. de l'Acad.*) he evinced his appreciation of the necessity of natural orders in botany by an attempt at the classification of plants, interesting, though crude and falling immeasurably short of the system which grew in the hands of his intimate friend Jussieu. The problem of taxonomy has never been put more philosophically than he subsequently put it in his *Animaux sans Vertèbres*:—"What arrangement must be given to the general distribution of animals to make it conformable to the order of nature in the production of these beings?"

The most prominent defect in Lamarck must be admitted, quite apart from all consideration of the famous hypothesis which bears his name, to have been want of control in speculation. Doubtless the speculative tendency furnished a powerful incentive to work, but it outran the legitimate deductions from observation, and led him into the production of volumes of worthless chemistry without experimental basis, as well as into spending much time on fruitless meteorological predictions. His *Annales Meteorologiques* were published yearly from 1800 to 1810, and were not discontinued until after an unnecessarily public and brutal tirade from Napoleon, administered on the occasion of being presented with one of his works on natural history.

To the general reader the name of Lamarck is chiefly interesting on account of his theory of the origin of life and of the diversities of animal forms. The idea, which appears to have been favoured by Buffon before him, that species were not through all time unalterable, and that the more complex might have been developed from pre-existent simpler forms, became with Lamarck a belief on which he imagined a demonstration. Spontaneous generation, he con-

ander, might be easily conceived as resulting from such agencies as heat and electricity causing in small gelatinous bodies an utricular structure, and inducing a "singular tension," a kind of "dréisme" or "ergisme"; and, having thus accounted for the first appearance of life, he explained the whole organization of animals and formation of different organs by four laws.

"1. Life by its impetus force tends continually to increase the volume of every body possessing it, and to enlarge its parts, up to a limit which it brings about."

"2. The production of a new organ in an animal body results from the superintention of a new want (*désin*) continuing to make itself felt, and a new movement which this want gives birth to and encourages."

"3. The development of organs and their force of action are constantly in ratio to the employment of those organs."

"4. All which has been acquired, laid down, or changed in the organization of individuals in the course of their life is conserved by generation and transmitted to the new individuals which proceed from those which have undergone those changes."

It is the second law which has been principally associated with Lamarck's name, and is often referred to as his hypothesis of the evolution of organs in animals by apterous or long, although Lamarck does not teach that the animal's desires affect its conformation directly, but that altered wants lead to altered habits, which result in the formation of new organs as well as in modification, growth, or diminishing of those previously existing. Thus, he suggests that, running pursued by carnivores, their legs have grown slender, and, their legs being only fit for support, while their jaws are weak, they have made attack with the crown of the head, and the determination of fluids thither has led to the growth of horns. So also the stretching of the giraffe's neck to reach the foliage he supposes have led to its elongation, and the kangaroo, sitting upright to support the young in its pouch, he imagines to have had its fore-limbs dwarfed by disuse, and its hind legs and tail exaggerated by using them in leaping. The length to which he carried such notions can be fairly estimated by the illustration which, long after the publication of his *Philosophie Zoologique*, he selected in the introduction to the *Essai des lois de la Vie*. "I conceive that a gastropod mollusc, which, as it crawls along, finds the need of touching the bodies in front of it, makes efforts to touch those bodies with some of the foremost parts of its head, and sends to those every time quantities of nervous fluids, as well as other liquids. I conceive, I say, that it must result from this reiterated afflux towards the points in question that the nerves which shut at those points will, by slow degrees, be extended. Now, as in the same circumstances other fluids of the animal flow also to the same places, and especially nourishing fluids, it must follow that two or more parts of the mollusc will appear and develop incessantly in those circumstances on the points referred to."

However absurd this may seem, it must be admitted that, unlimited thus having been once granted for organs to be developed in series of generations, the objections to their being formed in the way here imagined are only such as equally apply to the theory of their origin by natural selection. Thus, for example, neither theory considers that it has to deal, not with crude heaps of mere functional organs, but with exquisitely orderly forms, nor accounts for the symmetrical first appearance of parts or for sex; nor, though Lamarck tried hard, did he or any other laborer reduced to physical law the rise of consciousness in association with structures which in their physical relations are mere mechanisms capable of reflex actions.

In judging the reasonableness of the second law of Lamarck as compared with more modern and now widely received theories, it must be observed that it is only an extension of his third law, and that third law is more sound. The strengthening of the blacksmith's arm by use is proverbially notorious. It is, therefore, only the sufficiency of the Lamarckian hypothesis to explain the first commencement of new organs which is in question, if evolution by the mere operation of forces acting in the inorganic world be granted; and surely the Darwinian theory is equally helpless to account for the beginnings of a new organ, while it demands as indispensable that every stage in the assumed hereditary development of an organ must have been useful.

Furthermore, to no writer more recent than Lamarck can be attributed the credit of first pointing attention to the repetition of acquired variations in the progeny, or the view of wearing that fact into a theory of the origin of species. His words are,—"Everything which nature has caused individuals to acquire or lose by the influence of the circumstances to which their race is long exposed, and consequently by the influence of the predominant employment of each organ, or of each faculty, is preserved by generation to the new individuals proceeding from them, provided that the changes are common to the two sexes, or to those which have produced these new individuals" (*Phil. Zool.*, i. 285). It is interesting to note in this passage that he hesitated to believe that peculiarities could become permanent in the progeny by both parents.

Notwithstanding his attempt to evolve all vital action from the forces at work in the inorganic world, Lamarck made a broad dis-

tinction between the "power of life," to which he attributed the production of "a real progression in the composition of the organization of animals," and the modifying effects of external circumstances. The existence of such a progression cannot now be doubted, and constitutes evolution in the only sense in which it is universally admitted. Lamarck, equally with Darwin, teaches the more speculative doctrine that the complex forms are descended from simpler ancestors. In the *modus operandi* by which they hold this to have been accomplished both have admitted the action of a variety of modifying circumstances. Lamarck gave great importance to the influence of new wants acting indirectly by stimulating growth and use. Darwin has given less importance to the effects of accidental variations acting indirectly by giving advantage to the struggle for existence. The speculative writings of Darwin have, however, been interwoven with a vast number of beautiful experiments and observations bearing on his speculations, though by no means proving his theory of evolution, while the speculations of Lamarck lie apart from his wonderful descriptive labours, untroubled by intermixture with other matters capable of attracting the numerous class who, provided they have new facts set before them, are not careful to hunt themselves to the conclusions strictly deducible therefrom. But those who read the *Philosophie Zoologique* will find how many truths often supposed to be far more modern are stated with abundant clearness in its pages. (J. CL.)

LAMARTINE, ALPHONSE MARIE LOUIS DE PRAT DE (1790-1866), poet, historian, and statesman, was born at Mâcon on the 21st of October 1790, and died at Passy on the 1st of March 1866. The family of Lamartine was good, and the title of Prat was taken from an estate in Franche Comté. His father was imprisoned during the Terror, and only released owing to the events of the 9th Thermidor. Subsequently the family returned to the country. Lamartine's early education was received from his mother. He was sent to school at Lyons in 1806, but not being happy there was transferred to the care of the Pères de la Foi at Balley, where he remained until 1809. For some time afterwards he lived at home, reading romantic and poetical literature, but in 1811, being then twenty years old, he set out on his travels for Italy, where he seems to have sojourned for nearly two years. His family having been steady royalists, he entered the Gardes du corps at the return of the Bourbons, and during the Hundred Days he sought refuge first in Switzerland and then at Aix en Savoie, where he fell in love, with abundant results of the poetical kind. After Waterloo he returned to Paris, and mixed a good deal in society. In 1818-19 he revisited Switzerland, Savoy, and Italy, the death of his beloved affording him new subjects for verse. He had now got together a considerable body of poetry, and after some difficulties he got his first book, the *Méditations*, published (1820). It was exceedingly popular, and helped him to make a position. He had left the army for some time, and he now entered the diplomatic service and was appointed secretary to the embassy at Naples. On his way to his post he married at Geneva a young English lady, Marianna Birch, who had both money and beauty (1823), and in the same year his *Nouvelles Méditations* appeared. In 1824 he was transferred from Naples to Florence, where he remained for five years. His *Last Canto of Childe Harold* appeared in 1825, and he had to fight a duel with an Italian officer, Colonel Pepe, in consequence of a phrase in it. The *Harmonies Politiques et Religieuses* appeared in 1829, when he had left Florence. Having refused an appointment at Paris under the Polignac ministry (destined to be fatal to legitimism), he went on a special mission to Prince Leopold of Saxe-Coburg, who was not yet king of the Belgians, but was talked of as king of Greece. The next year he was elected to the Academy. Lamartine was in Switzerland, not in Paris, at the time of the Revolution of July, and, though he put forth a pamphlet on *Rational Policy*, he did not take any active part in politics. In 1833 he set out with his wife and daughter for Palestine, having been unsuccessful in his candidature for a seat in the chamber. His daughter Julia died at Beyrout, and

before long he received the news of his election by a constituency (Bergues) in the department of the Nord. He returned through Turkey and Germany, and made his first speech shortly after the beginning of 1834. Thereafter he spoke constantly, and acquired considerable reputation as an orator,—bringing out, moreover, many books in prose and verse. His Eastern travels (*Souvenirs d'Orient*) appeared in 1835, his *Recollections* in 1836, his *Chateaubriand* in 1838, and his *Revelations*, the last remarkable volume of his poetry, in 1839. As the reign of Louis Philippe went on, Lamartine, who had previously been a liberal royalist, became more and more democratic in his opinions. He set about his greatest prose work, the *Histoire des Girondins*, which at first appeared periodically, and was published as a whole in 1847. Like many other French histories, it was a pamphlet as well as a chronicle, and the subjects of Lamartine's pen became his models in politics. At the revolution of February Lamartine at once became one of the most important personages in France. He was one of the first to declare for a provisional government, and became a member of it himself, with the post of minister for foreign affairs. He was elected for the new constituent assembly in ten different departments, and was chosen one of the five members of the Executive Committee. For a few months indeed Lamartine, who for nearly sixty years had been a distinguished man of letters, an official of inferior rank in diplomacy, and an eloquent but unpractical speaker in parliament, became one of the foremost men in Europe. His own experience in the routine work of government, the utterly impractical nature of his colleagues and of the constitution which they endeavoured to carry out, and the turbulence of the Parisian mob proved fatal to his chances. During his brief tenure of office Lamartine gave some proofs of statesmanlike ability, notably in his reply to the deputies of United Irishmen, who visited him in the hope that the new French democracy would take up the old hatred of the rebellion against England, and his eloquence was repeatedly called into requisition to pacify the Parisians. But no one can permanently carry on the government of a great country by speeches from the balcony of a house in the capital, and Lamartine found himself in a dilemma. So long as he held aloof from Ledru-Rollin and the more radical of his colleagues, the danger resulting weakened the Government, as soon as he effected an approximation to them, the middle classes, who more in France than any where else were and are the arbiters of Governments, fell off from him. The quelling of the insurrection of the 16th May was his last successful act. A month later the renewal of active disturbances brought on the fighting of June, and Lamartine's influence was extinguished in favour of Cavaignac. There is hardly another instance on record of so sudden an elevation and so rapid a fall. Before February in 1848 Lamartine was, as has been said, a private person of talent and reputation; after June in the same year he was once more the same, except that his chance of political pre-eminence was gone. He had been tried and found wanting, having neither the virtues nor the vices of his situation. In January 1849, though he was nominated for the presidency, only a few thousand votes were given to him, and three months later he was not even elected to the legislative assembly.

The remaining story of Lamartine's life is somewhat melancholy. He had never been a rich man, nor had he been a saving one, and during his period of popularity and office he had incurred great expenses. He now set to work to repair his fortune by unremitting literary labour. He brought out in the *Presse* a series of *Confidences*, and somewhat later a kind of autobiography, entitled *Raphaël*, which treated his own experiences in romantic fashion.

He began and finished several historical works of more or less importance, the *History of the Revolution of 1848*, *The History of the Restoration*, *The History of Turkey*, *The History of Russia*, besides a very large number of small biographical and miscellaneous works. In 1858 a subscription was opened for his benefit. Two years afterwards, following the example of Chateaubriand, he superintended an elaborate edition of his own works in forty-one volumes. This occupied five years, and while he was engaged on it his wife died (1865). He was now a man of more than seventy years old; his powers had deserted him, and even if they had not the public taste had entirely changed, and was no longer disposed to welcome or enjoy his sentimental fashion of handling prose and poetry. His efforts had not succeeded in placing him in a position of comfort and independence, and at last, in 1867, the Government of the empire (from which he had perforce stood aloof, though he never considered it necessary to adopt the active protesting attitude of Quinet and Victor Hugo) came forward to his assistance, a vote of twenty thousand pounds being proposed in April of that year for his benefit by M. Émile Ollivier. In no other country than France would this have been anything but creditable to both parties, for Lamartine, both as a distinguished man of letters and as a past servant of the state, had every claim to the bounty of his country. But the bitter party feeling which animated the later years of the reign of Napoleon III. made the grant something of a party matter, and Lamartine was reproached for accepting it by the extreme republicans and irreligious. He did not enjoy it long, dying, as has been said, on the 1st of March 1869, two years before the collapse of the empire.

As a statesman Lamartine was placed during his brief tenure of office in a position from which it would have been almost impossible for any man who was not prepared and able to play the dictator to emerge with credit. At no time in history, not even in the great revolution of sixty years earlier, were impractical orators so fit in the heads of men as in 1848, and as a result there such an abundance of what may be called backbones in a nation as then in France. But Lamartine could hardly have guided the ship of state safely even in much calmer weather. Personally he was amiable and even estimable, the chief fault of his character being vanity and an insensible tendency towards theatrical effect, which makes his travels, memoirs, and other personal records as well as his historical works radically untrustworthy. Nor does it appear that he had any settled political ideas. He was first an ardent legitimist, then a liberal royalist, then a constitutionalist of an indefinite type, then a republican, and it does not appear that any of these phases was the result of reasoned conviction, but rather of a vague kind of sentiment and of the contagion of popular and prevalent ideas. In regard to money he was entirely disinterested, never obtaining or seeking any lucrative office. That he was quite so disinterested in the matter of personal vanity and ambition cannot perhaps be safely affirmed. He did good by moderating the revolutionary and destructive ardour of the Parisian populace in 1848; but he had been perhaps more responsible than any other single person for bringing about the events of that year by the vague and frothy republican denunciation of his political career in 1847. Altogether little more can be said of his political career than that he was the most striking if not the most successful instance of the French system, which has prevailed since the downfall of the first empire, of making literary success a direct road to political eminence.

More must be said of his literary position. Lamartine had the advantages of coming at a time when the literary field, at least in the departments of belles lettres, was almost empty. The feeble school of descriptive writers, epic poets of the extreme decadence, fabulists, and miscellaneous verse-makers which the empire had nourished could satisfy no one, though its members still continued with unmeaning fidelity to copy themselves and their models. Madame de Staël was dead, Chateaubriand, though alive, was something of a classic, and had not effected a full revolution. Lamartine did not himself go the complete length of the romantic revival, but he went far in that direction. He availed himself of the growing interest in legitimism and Catholicism which was represented by Bonald and Joseph de Maistre, of the nature worship of Rousseau and Bernardin de St Pierre, of the sentimentalism of Madame de Staël, of the medievalism and the romance of Chateaubriand and Scott, of the *maladie du siècle* of Chateaubriand and Byron. Perhaps if his

matter be very closely analysed it will be found that he added hardly anything of his own. But if the parts of the mixture were like other things the mixture itself was not. It seemed indeed to the immolator *gnumothos* so original that tradition has it that the *Meditations* were refused by a publisher because they were in none of the accepted styles. They appeared, as has been said, in 1890, that is to say, when Lamartine was nearly thirty years old. The best of them and the best thing that Lamartine ever did is the famous *Lac*, describing his return to the little mountain town of Le Bourget after the death of his mistress, with whom he had visited it in other days. The verse is occasionally harmonious, the sentiments conventional but refined and collected, the imagery well chosen and gracefully expressed. There is indeed an unquestionable want of vigour, but to readers of that day the want of vigour was entirely compensated by the presence of freshness and grace. Lamartine's chief misfortune in poetry was that not only was his note a somewhat weak one, but that he could strike but once. The four volumes of the *Meditations*, the *Harmonies*, and the *Recollections*, which contained the prime of his verse, are perhaps the most monotonous reading to be found anywhere in work of equal bulk by a poet of equal talent. They contain nothing but meditative lyrical pieces, almost any one of which is typical of the whole, though there are, of course, considerable variations of merit. The two narrative poems which succeeded the early lyrics, *Jocelyn* and the *Chute d'un Ange*, were, according to Lamartine's original plan, parts of a vast "Epic of the Ages," some further fragments of which survive, especially one of not a little merit which was published four years after the author's death in company with some youthful attempts at the classical tragedy and a few miscellanies. *Jocelyn* had at one time more popularity in England than most French verse. *Le Chute d'un Ange*, in which the Byronic influence is more obvious than in any other of Lamartine's works, is more ambitious in theme and less regulated by scrupulous conditions of decorum in handling than most of its author's poetry. It does, however, little more than prove that such anticlimaxes were not for him.

As a prose writer Lamartine was, as may be soon from what has been said (and many of his works have not been mentioned), very fertile. His characteristics in his prose fiction and descriptive work are not very different from those of his poetry. He is always and everywhere sentimental, though very frequently, as in his shorter prose tales (*The Stone Mason of St. Pointe*, *Gratella*, &c.), he is graceful as well as sentimental. In his histories, the style being one for which he was radically untrained, the effect is worse. It is as if he had imitated that Lamartine of the romantic narratives and had confidently trustworthily, indeed with regard to his Eastern travels some of the episodes were exaggerated as more inventions by persons who had every reason to be well informed and none to bear false witness. In his histories proper the special motive for embellishment—falsification—would be for good enough a word. The most serious defect, but the least of many, is that of unnecessary romances. Lamartine as an historian belongs exclusively to the rhetorical school as distinguished from the philosophical on the one hand and the documentary on the other.

It is not surprising when these characteristics of Lamartine's work are appreciated to find that his fame has declined with singular rapidity in France. As a poet indeed he had lost his reputation many years before he died. He was entirely eclipsed by the brilliant and vigorous school who succeeded him with Victor Hugo at their head. It is possible that the *Chute d'un Ange* was an effort to compete with them on their own ground; if so, it was an entire failure. Lamartine's power of initiative in poetry was very small, and the mugs of poetic ground which he could cover strictly limited. He did not attempt the great task of the day, the freeing of the Alexandrine from the restraints imposed upon it, and the devising or reviving of new lyrics means to refresh and invigorate French poetic style. He did only carry the picturesque sentimentalism of Rousseau, Bernardin de St. Pierre, and Chateaubriand a little further, and cloths it in language and verse a little less antiquated than that of Chénedollé and Millevoye. He has been said to be a French Corneille, and the parallel holds good in respect of veneration and of his relative position to the more largely dominating school of the followers, though not in respect of individual peculiarities. Lamartine in short occupied a kind of half-way house between the 18th century and the Romantic movement, and he never got any further. When a living English critic questioned his importance in conversation with Sainte-Beuve, the answer was, "He is important to us," and it was a true answer; but his importance is now chiefly literary, even to Frenchmen.

The already mentioned edition is the most complete one of Lamartine, but there are many issues of his separate works. Since his death, besides the poems already mentioned, some *Almanachs* of his youth have been published, and also two volumes of correspondence.

LAMB, CHARLES (1775-1834), an original and delightful English essayist and critic, was born in Crown Office Row, Inner Temple, London, February 10, 1775. His father, John Lamb, a Lincolnshire man, who filled the

situation of clerk and servant companion to Mr Salt, one of the benchers of the Inner Temple, was successful in obtaining for Charles, the youngest of three children, a presentation to Christ's Hospital, where the boy remained from his eighth to his fifteenth year (1782-1789). Here he was fortunate enough to have for a schoolfellow the afterwards famous Samuel Taylor Coleridge, his senior by rather more than two years, and a close and tender life-long friendship began which had a singularly great influence on the whole of his after career. When the time came for leaving school, where he had learned some Greek and acquired considerable facility in Latin composition, Lamb, after a brief stay at home (spent, as his school holidays had often been, over old English authors in the library of Mr Salt), was condemned to the labours of the desk,—an "unconquerable impediment" in his speech disqualifying him for a school exhibition, and thus depriving him of the only means by which he could have obtained a university education. For a short time he held a clerkship in the South Sea House under his elder brother John, and in 1792 he entered the accountant's office in the East India House, where during the next three and thirty years the hundred folios of what he used to call his true "works" were produced. A dreadful calamity soon came upon him, which seemed to blight all his prospects in the very morning of life. There was insanity in the family, which in his twenty-first year had led to his own confinement for some weeks in a lunatic asylum; and, a few months afterwards, on the 22d of September 1798, his sister Mary, "worn down to a state of extreme nervous misery by attention to needlework by day and to her mother by night," was suddenly seized with acute mania, in which she stabbed her mother to the heart. The calm self-mastery and loving self-renunciation which Charles Lamb, by constitution excitable, nervous, and timid, displayed at this crisis in his own history and in that of those nearest him, will ever give him an imperishable claim to the reverence and affection of all who are capable of appreciating the heroisms of common life. His sister was of course immediately placed in confinement, and with the speedy return of comparative health came the knowledge of her fatal deed; himself calm and collected, he knew how to speak the words of soothing and comfort. With the help of friends he succeeded in obtaining her release from the life-long restraint to which she would otherwise have been doomed, on the express condition that he himself should undertake the responsibility for her safe keeping. It proved no light charge; for, though no one was capable of affording a more intelligent or affectionate companionship than Mary Lamb during her long periods of health, there was ever present the apprehension of the recurrence of her malady; and, when from time to time the premonitory symptoms had become unmistakable, there was no alternative but her removal, which took place in quietness and tears. How deeply the whole course of Lamb's domestic life must have been affected by his singular loyalty as a brother need not be pointed out; for one thing, it rendered impossible his union with Alice Winterton, whom he appears to have truly loved, and to whom such touching reference was made long afterwards in *Dream Children, a Reverie*.

Lamb's first appearance as an author was made in the year of the great tragedy of his life (1796), when there were published in the volume of *Poems on Various Subjects* by Coleridge four sonnets by "Mr Charles Lamb of the India House." In the following year he also contributed along with Charles Lloyd some pieces in blank verse to Coleridge's new volume of *Poems*. In 1798 he published a short and pathetic prose tale entitled *Reverend Gray*, and in 1799 he was associated with Coleridge and Southey in the publication of the *Annual Anthology*, to which he had

contributed a short religious poem in blank verse entitled "Living without God in the World"; the company in which he was thus found brought upon him the irrelevant and pointless ridicule of Canning and Gifford. His next public appearance was not more fortunate. His *John Woodvil* (1801), a slight dramatic piece written in the style of the earlier Elizabethan period, and containing some genuine poetry and happy delineation of the gentler emotions, but as a whole deficient in plot, vigour, and character, was held up to ridicule by the *Edinburgh Review* as a specimen of the rudest condition of the drama, a work by "a man of the age of Theophrastus." The dramatic spirit, however, was not thus easily quenched in Lamb. His next effort (1806) was a farce, named *Mr. II.*, the point of which lay in the hero's anxiety to conceal his name, "Hogshead"; it has recently been put upon the boards with success in America, but in London it did not survive the first night of its appearance. Its author bore the failure with rare equanimity and good humour, and soon struck into new and more successful fields of literary exertion. In 1807 appeared *Tales founded on the Plays of Shakespeare*, written by Charles and Mary Lamb; and in 1808 *Specimens of English Dramatic Poets who lived about the time of Shakespeare*, with short but felicitous critical notes. In the same year Mary Lamb, assisted by her brother, also published *Poetry for Children* and a collection of short school-girl tales under the title *Mrs. Leicester's School*; and to the same date belongs the *Adventures of Ulysses*, designed by Lamb as a companion to the *Adventures of Telemachus*. In 1810 began to appear Leigh Hunt's quarterly periodical, *The Reflector*, in which Lamb published much (including the essays on the tragedies of Shakespeare and on Hogarth) that subsequently appeared in the first collective edition of his *Works* (3 vols. 12mo), which appeared in 1818. The establishment of the *London Magazine* in 1820 stimulated him to the production of a series of new essays which rose into instant popularity, and may be said to form the chief corner-stone in the small but classic temple of his fame. The first of these, as it fell out, was a description of the old South Sea House, with which Lamb happened to have associated the name of a "gay light-hearted foreigner" called Elin, who had frequented it in the days of his service there. The pseudonym adopted on this occasion was retained for the subsequent contributions which appeared collectively in a post 8vo volume of *Essays* in 1823. After a brief career of five years the *London Magazine* came to an end; and about the same period Lamb's long connexion with the India House terminated, a pension of about £450 having been assigned to him. The increased leisure, however, for which he had long sighed, did not prove favourable to literary production, which henceforth was limited to a few trifling contributions to the *New Monthly* and other serials. The malady of his sister, which continued to increase with ever shortening intervals of relief, broke in painfully on his lettered ease and comfort; and it is unfortunately impossible to ignore the deteriorating effects of an over-free indulgence in the use of tobacco and alcohol on a temperament such as his. His removal on account of his sister to the quiet of the country, by tending to withdraw him from the stimulating society of the large circle of literary friends who had helped to make his Wednesday evening "at home" so remarkable, doubtless also tended to intensify his listlessness and helplessness. One of the brightest elements in the closing years of his life was the friendship and companionship of Emma Isola, whom he and his sister had adopted, and whose marriage in 1833 to Mr. Moxon, though a source of useless joy to Lamb, left him more than ever alone. While living at Edmonton, he was overtaken by an attack of erysipelas brought on by an accidental fall as he was walking on the London road;

after a few days' illness he painlessly passed away on December 27, 1834. The sudden death of one so widely known, admired, and beloved as Charles Lamb fell on the public, as well as on his own attached circle, with all the poignancy of a personal calamity and a private grief. His memory wanted no tribute that affection could bestow, and Wordsworth has commemorated in simple and solemn verse the genius, virtues, and fraternal devotion of his early friend.

In depth of thought and splendour of genius Charles Lamb was surpassed by not a few of his contemporaries, but as an essayist he is entitled to a place beside Montaigne, Sir Thomas Browne, Steele, and Addison. He unites many of the characteristics of each of these writers,—refined wit, exquisite humour, a genuine and cordial vein of pleasantry, and heart touching pathos. His fancy as an essayist is distinguished by great delicacy and tenderness, and even his conceits are imbued with human feeling and passion. He had an extreme and almost exclusive partiality for our earlier prose writers, particularly for Fuller, Browne, and Burton, as well as for the dramatists of Shakespeare's time; and the cars with which he studied them is apparent in all he ever wrote. It shines out conspicuously in his style, which has an antique air, and is redolent of its peculiarities of the 17th century. Its quaintness has subjected the author to the charge of affectation, but there is nothing really affected in his writings. His style is not so much an imitation as a reflexion of the older writers, for in spirit he made himself their contemporary. A confirmed habit of studying them in preference to modern literature had made something of their style natural to him; and long experience had rendered it not only easy and familiar but habitual. It was not a masquerade dress he wore, but the costume which showed the man to most advantage. With thought and meaning, often profound, though clothed in simple language, every sentence of his essays is pregnant, and in this respect he bears a strong resemblance to the writers already named. If he had their manner, he possessed their spirit likewise. To some of his essays and specimens we are considerably indebted for the revival of the dramatic writers of the Shakespearean age; for he preceded Gifford and others in wiping the dust of ages from the works of these authors. In his brief comments on each specimen he displays exquisite powers of discrimination; his discernment of the true meaning of his author is almost infallible. As a poet Lamb is not entitled to so high a place as that which can be claimed for the essayist and critic. His dependence on Elizabethan models is here also manifest, but in such a way as to bring into all the greater prominence his native deficiency in "the accomplishment of verse." Yet it is impossible, once having read, ever to forget the tenderness and grace of such verses as those to Heester Savory and on "The Old Familiar Faces," or the quaint humour of "A Farewell to Tobacco." As a letter writer also Lamb is entitled to rank very high.

The *Letters of Charles Lamb*, with a sketch of his life by one of his executors, Sir Thomas Noon Talford, appeared in 2 vols. in 1837, and *Final Memorials of Charles Lamb*, by the same hand, were published in 1843. Supplementary to these is the *History* by another personal friend B. W. Procter (Barry Cornwall) published in 1865. See also Fitzgerald's *Charles Lamb*, *his Friends*, *his House*, and *his Books*, 1860; *Onlooker's Charles Lamb*, 1867; and *Carole Hazlett's Mary and Charles Lamb: Poems, Letters, and Reminiscences*, 1874. There have been several complete editions of the *Works* of Lamb; of these the fullest as well as most recent is that of Fitzgerald (*Life, Letters, and Writings of Charles Lamb*, 8 vols., 1870-78).

LAMBALLE, MARIE THÉRÈSE LOUISE DE SAVOIE-CARIGNAN, PRINCESS DE (1749-1793), daughter of Louis Victor of Carignan, was born at Turin, 5th September 1749. In 1767 she was married to Stanislaus, prince of Lamballe, and son of the duke of Penthièvre. After his death in

the following year an unsuccessful attempt was made to arrange a marriage between her and Louis XV. She then retired from the court, but, having accidentally made the acquaintance of Marie-Antoinette, she was after the accession of Louis XVI appointed by the queen superintendent of the royal household, and enjoyed her closest intimacy and friendship. In 1792 she shared for a week her imprisonment in the Temple, but on the 19th August she was transferred to La Force, and, having refused the oath against the monarchy, she was on September 3d delivered over to the fury of the populace, after which her head was placed on a pike and carried before the windows of the imprisoned queen.

See Lescaur, *La Princesse de Lamballe*, 1869, and Fanny, *Louise de Savoie-Carignan, Princesse de Lamballe, et la Prison de La Force*, 1868.

LAMBERT, JOHANN HEINRICH (1728-1777), physicist and mathematician, was born at Mulhausen, Alsace, August 28, 1728. He was the son of a tailor; and the slight elementary instruction he obtained at the small free school of his native town was supplemented altogether by his own private reading. Having cultivated a good style of penmanship, he became book-keeper at Montbéliard ironworks, and subsequently (1745) secretary to Professor Iella, the editor of a newspaper at Basel, who three years later recommended him as private tutor to the family of President A. von Salis de Coire. Coming thus into virtual possession of a good library, Lambert had peculiar opportunities for improving himself in his literary and scientific studies. In 1759, after completing with his pupils a lengthened tour of two years' duration through Göttingen, Utrecht, Paris, Marseilles, and Turin, he resigned his tutorship and settled at Augsburg. Munich, Erlangen, Coire, and Leipzig became for brief successive intervals his home. Finally in 1764 he removed to Berlin, where he received many favours at the hand of Frederick, was elected a member of the Royal Academy of Sciences, and ultimately (1774) undertook the editing of the astronomical almanac. On September 26, 1777, he died of consumption, the natural result of a life spent in excessive application to all kinds of mental labour. Seventeen hours daily were devoted by him to reading and writing; and, as might have been expected in the case of one who wrote so much, many of his numerous publications are of little permanent interest. Not a few, however, are very valuable, and show him to have been a man of original and active mind with a singular facility in applying mathematics to practical questions.

Lambert's most important work, *Pyrometrie* (Berlin, 1779), is a systematic treatise on heat, containing the records and full discussion of many of his own experiments. Worthy of special notice also are *Photometrie*, Augsburg, 1760; *Asymptotische criticae Observationum proprietates*, Augsburg, 1761; and *Beiträge zum Gebrauche der Mathematik und deren Anwendung*, 4 vols., Berlin, 1768-72.

The *Memoirs* of the Berlin Academy from 1761 to 1764 contain many of his papers, which treat of such subjects as resistance of fluids, magnetism, comets, probabilities, the problem of three bodies, meteorology, &c. In the *Acta Helvetica* (1758-60) and in the *Nova Acta Beroliana* (1763-69) several of his contributions appear. In Bodé's *Jahrbuch* (1776-83) he discusses nutrition, aberration of light, Saturn's rings, and comets; in the *Nova Acta Helvetica* (1767) he has a long paper "Sur le Bon des Corps Elastiques"; in Bernoulli and Hindenburg's *Magazin* (1767-68) he treats of the roots of equations and of parallel lines; and in Hindenburg's *Archives* (1768-69) he writes on optics and perspective. Many of these pieces were found among his effects after his death, and published posthumously. Recognized as among the first mathematicians of his day, he was also widely known for the universality and depth of his philological and philosophical knowledge. The most valuable of his logical and philosophical memoirs were published collectively in 2 vols., 1762. See Huber's *Lambert nach seinem Leben und Werken*.

LAMBERT, JOHN (1619-1694), was born in 1619 at Clifton Hall in the parish of Kirby Malham, in the West Riding of Yorkshire. His family was of ancient lineage,

and long settled in the county. He studied at the Inns of Court, but without making the law his profession. In 1640 he married Frances, daughter of Sir William Lister. He was present at the great meeting of the Yorkshire gentry on Heyworth Moor (3d June 1642), and in September was appointed a captain of horse under Lieutenant-Colonel Fairfax. He did good service at the siege of Hull (11th October 1642), at Bradford (31st March 1644), and at the important engagement at Selby (10th April 1644). At Marston Moor (2d July 1644) he commanded part of Sir Thomas Fairfax's cavalry on the right wing. He was sent into York to arrange terms for the surrender of the city, which took place July 16, 1644. When the "New Model" army was formed in the beginning of 1645, Colonel Lambert was appointed commissary-general of the army in the north. He beat the royalists at Kedgeley and Ferrybridge, and took several strong places. He followed Fairfax's campaign in the west of England in 1646, and was a commissioner with Cromwell and others for the surrender of Oxford in the same year.

When the quarrel between the army and the parliament began, Lambert threw himself warmly into the army's cause. He is said by Clarendon to have assisted Ireton in drawing up the several addresses and remonstrances issued by the army, both men having had some experience in the law, and being "of a subtle and working brain." In August 1647 Lambert was sent as major-general by Fairfax to take charge of the forces in the northern counties. His wise and just management of affairs in those parts is commended by Whitelocke. He displayed personal courage in suppressing a mutiny among his troops, kept strict discipline, and showed much diligence in hunting down the moss-troopers who infested the moorland country.

When the Scotch army under the marquis of Hamilton invaded England in the summer of 1648, Lambert was obliged to retreat till Cromwell came up from Wales, and joining him destroyed the Scotch army in three days' fighting from Preston to Warrington. Lambert pressed Hamilton with the cavalry, and took him prisoner at Uttoxeter, a few days after the battle. He then marched back into Scotland, where he was left in charge of the troops. In December 1648 he sat down before Pontefract Castle, which held out till March 1649. Lambert was thus absent from London at the time of the violence put upon the parliament by Colonel Pride, and the other measures which led to the king's death.

Cromwell, when appointed to the command of the war in Scotland (26th July 1650), took Lambert with him as major-general. He was wounded at Musselburgh, but was with Cromwell at Dunbar on the 2d of September, when the soldiers begged that Lambert might lead them the next day, and Cromwell willingly gave his consent. He defeated the "Protesters" or "Western Whigs" at Hamilton, on the 1st of December 1650. In the following July he was sent over into Fife to get a position in the rear and flank of the Scotch army near Falkirk, and force them to decisive action by cutting off their supplies from Perth. A battle fought at Inverkeithing, with heavy loss to the Scots, in which Lambert behaved with great gallantry, gave him the position he required, and he improved it by taking Inchgarra and Burntisland. Charles now (as Lambert had foreseen) made for England. Lambert with the cavalry was ordered to harass his march down the western shires, while Cromwell followed through Yorkshire and the Midlands. In the action at Warrington Bridge Lambert again distinguished himself by his personal courage, and at Worcester also (3d September 1651), where he commanded the forces on the eastern bank of the Severn, and had his horse shot under him. Parliament now conferred on him a grant of lands in Scotland worth £1000 per annum.

In November 1651 he was made a commissioner to settle the affairs of Scotland, and on the death of Ireton he was appointed lord deputy of Ireland in February 1653. He accepted the office with pleasure; but his magnificent preparations offended the Commons, who limited his office to the term of six months. Lambert hereupon resigned the deputyship without entering on his duties.

Notwithstanding this affront Lambert took part with Cromwell in the expulsion of the Rump (30th April 1653) and its council of state. He was joined to the lord-general and two others as additional members of the little parliament of nominees, making up the number to one hundred and forty-four. He presented the act of resignation of that assembly, and was principally concerned in drawing up the address requesting Cromwell to assume the protectorate, and the Instrument of Government, which was the constitution of the Protectoral rule. At the installation of Cromwell he bore a prominent part. In the parliament of 1654, and again in 1656, Lambert (or Lord Lambert as he is now generally called) sat as member for the West Riding of Yorkshire. When the proposal to declare Oliver king was started in parliament (February 1657) he at once declared strongly against it. A hundred officers headed by Fleetwood and Lambert waited on the Protector, and begged him to put a stop to the proceedings. Lambert was not convinced by Cromwell's arguments, and Cromwell and he henceforward never spoke to each other as friends. On his refusal to take the official oath of allegiance to the Protector, Cromwell deprived him of his commissions, giving him, however, a pension of £2000 a year. He retired to his house and garden at Wimbledon, and appeared no more in public during Oliver Cromwell's lifetime.

On the accession of Richard he seems to have expected the first place in the army, but was not unwilling to be second to Fleetwood. The Protector was between two parties—the court party, who wished to hold to the "Petition and Advice," and the army party or Wallingford House party, who, whilst supporting Richard as Protector, wished to put the control of the army into stronger hands. Richard saw that to deliver up the power of the sword was to abdicate, and refused to make Fleetwood general. Lambert was elected for Pontefract in Richard's parliament, and took part with the republican malcontents who soon combined with Wallingford House. Councils of officers were held, which Lambert, though holding no commission, was invited to attend. They determined to stand by the "good old cause" and to demand the dissolution of the parliament as being too full of monarchical and Presbyterian notions—in fact, to put the civil power aside and set up a military government in its stead. The Protector dissolved parliament (23d April 1659). The officers, unable to rule without a parliament, restored the Rump as representing the Commonwealth (7th May 1659). Richard's Protectorate had practically ended with his parliament, and he now laid down the show of royalty. Sir George Booth and Sir Thomas Middleton headed a royalist rising in Cheshire, which Lambert put down after a sharp encounter near Chester. He promoted a petition from his army that Fleetwood might be made lord-general and himself major-general. The republican party in the house took offence. The Commons (12th October 1659) cashiered Lambert, Desborough, and other officers, and retained Fleetwood's commission as chief of a military council of seven, republicans of the old sort. Lenthall, the speaker, was to give his orders to the army. On the next day (13th October) Lambert caused the doors of the House to be shut and the members kept out. On the 26th a "committee of safety" was appointed, of which Lambert was a member. He was also appointed major-general of all

the forces in England and Scotland, Fleetwood being general. Lambert was now sent with a large force to meet Monk, who was in command of the English forces in Scotland, and either negotiate with him or force him to terms. Monk, however, declared for the liberty and authority of parliament, and set his army in motion southward. The committee of safety was obeyed no more than the Rump had been. The soldiers themselves cried out for the restoration of parliament, and on the 26th of December the Rump was recalled to restore some appearance of lawful authority.

Meanwhile the bulk of Lambert's army was dissolved by the mere appearance of Lord Fairfax in arms on Marston Moor, and he was kept in suspense by Monk's deceptions and delays, till his whole army fell from him, and he came back to town almost alone. Monk marched unopposed to London, and declared for a "free parliament." The "excluded" Presbyterian members were recalled. Lambert was sent to the Tower (3d March 1660), from which he escaped a month later (9th April 1660). He tried to rekindle the civil war in favour of the Commonwealth, but was speedily recaptured, and sent back to the Tower (24th April). On the Restoration he, along with Vane, was exempted from danger of life by an address of both Houses to the king. The next parliament (1662) brought a charge of high treason against them. Vane was beheaded, but Lambert was spared, and remained in custody in the island of Guernsey for the remainder of his life. He died at the age of seventy-five, in 1684.

Lambert would have left a better name in history if he had been a Cavalier. His genial, ardent, and excitable nature, easily raised and easily depressed, was more akin to the royalist than the puritan spirit. Vain and sometimes overbearing, as well as ambitious, he believed that Cromwell could not stand without him, and, when Cromwell was dead, he imagined himself equal to succeed him, and thought that the first place must be his by right. Yet his ambition was less selfish than that of Monk. Lambert is accused of no ill faith, no want of generosity, no cold and calculating policy. Lambert was not merely a soldier. He was an able writer and speaker, and an accomplished negotiator, and took pleasure in quiet and domestic pursuits. He learnt his love of gardening from Lord Fairfax, who was also his master in the art of war. He painted flowers, besides cultivating them, and incurred the blame of Mrs Hutchinson by "dressing his flowers in his garden and working at the needle with his wife and his maids." He made no special profession of religion; but no imputation is cast upon his moral character by his detractors. It has been said that he became a Roman Catholic before his death. (F. W. A. *)

LAMBESE, or **LAMBESSA**, the ancient *Lambæsa* and the *Tazart* or *Tesrilet* of the natives, is situated in the French province of Constantine in Algeria, about 6 miles east of Batna. The modern village is well known for its great convict establishment (founded about 1850); and the remains of the Roman town, and more especially of the Roman camp, in spite of the wanton vandalism to which they have been more than once subjected since their discovery, are among the most interesting in northern Africa. The ruins of the town are situated on the lower terraces of the Jebel Aurès, and consist of triumphal arches, temples, aqueducts, and an immense quantity of ordinary masonry evidently belonging to private houses. To the north and east lie extensive cemeteries with the stones still standing in their original alignments; to the west is a similar area from which, however, the stones have been largely removed for building the modern village. Of the temples the most noteworthy are those to *Æsculapius* and *Hædjh* (Salus), and to *Isis* and *Serapis*. About two-thirds

of a mile from the town on the level ground of the plain of Batna stands the camp. It measures 1640 feet from north to south by 1476 feet from east to west, and in the middle rise the ruins of a pretorium. This noble building is 92 feet long by 60 feet broad and 49 feet high; its southern façade has a splendid peristyle half the height of the wall, consisting of a front row of massive Ionic columns and an engaged row of Corinthian pilasters. The ruins of both city and camp have yielded a rich harvest of inscriptions (Renier edited 1800, and there are 4185 in the *Corpus Inscr. Lat.*, vol. viii.); and, though a very large proportion are epitaphs of the barest kind, the more important pieces supply a fair outline of the history of the place.

Lamech was originally a military foundation. The camp of the third legion (Legio III. Augusta), to which it owes its origin, appears to have been established between 129 and 130 A.D., in the time of Hadrian, whose address to his soldiers was found inscribed on a pillar in a second camp to the west of the great camp still extant. By 106 mention is made of the decrements of a *vicus*, 10 curio of which are known by name, and the *vici* became a municipality probably at the time when it was made the capital of the newly founded province of Numidia. The legion was removed by Gordianus, but restored by Valerianus and Gallienus; and its final departure did not take place till after 302. The town soon afterwards declined. It never became the seat of a bishop, and no Christian inscriptions have been found among the ruins.

See Bruns; Perrenon, *L. Renier, Inscriptions romaines de l'Algérie*, Paris, 1866; Quatremère, *Die Hien Lagerstätten in Africa*, in *Commentationes phil. et histor. 29*, Bonn, 1877; Thaly, *Travels in the Pontifical States of Rome*, London, 1877. A ground plan of the ruins is given in *Ann. des dépt. de France*, torn. xix.

LAMBETH. See LONDON.

LAMECH, נֶמֶךְ, is a name which appears in each of the antediluvian genealogies, Gen. iv. 16-24 and Gen. v. In the first he is a descendant of Cain, and through his three sons father of the several avocations of early civilization, in the latter he is father of Noah. In each case, though in different senses, he marks the close of the first epoch of the world's history. Since the publication of Büttmann's *Mythologie* it has come to be generally recognized that the two genealogies terminating in Lamech are divergent forms of a single list. The parallelism of the two is not confined to the identical names, Lamech and Enoch. Methuselah (מֶתוּשֶׁלַח) not Methusael is the true reading of the LXX. in Gen. iv. 18, and there are some textual grounds for thinking that in the same verse Methusael has displaced an older reading Mahlahel. Kainan again is closely akin to Cain, and there is also a less close resemblance between Jared and Irad, while Enos (Enosh) and Adam both mean *man*. Thus the two series beginning with Enosh and Adam and ending in Lamech do not vary more than is often the case with different recensions of ancient name lists. See especially Lagarde, *Orientalia*, ii. 33 sq. Again it has been pointed out, especially by Wellhausen, *Jahrb. f. d. Theol.*, 1876, p. 400 sq., that Gen. iv. 16-24 is in its original conception quite distinct from the history of the curse of Cain (Gen. iv. 1-15), and offers the history of the beginnings of existing civilization (verse 20 sq.), not of a civilization extinguished by the flood; and the continuation of this narrative is plausibly sought in the history of the tower of Babel, according to which the human race entered Babylon from the east (comp. iv. 16 with xi. 2), whereas the movements of the sons of Noah start from Ararat. On this view we are to suppose that the oldest literary source of the Hebrew history of the origins of our race ignored the flood, and traced the beginnings of city life to a land east of Eden (Nod), which has no place in later geography, and of which Cain was the first settler. Lamech is a descendant of Cain, under whose sons the different special avocations of a very primitive civilization differentiate themselves. The mass of the people are tent dwellers and shepherds, their "father" or the patron of their occupation being Jubal; but the arts are also developed in two branches, the "father" of minstrelsy

being Jubal, while the art of metallurgy is traced back to Tubal Cain (LXX. simply Θούλα). The etymologies of the proper names throw little light on this interesting conception; that of Lamech is quite obscure,¹ and the names of the sons, if they are Semitic, may be all derived from the root נָמַךְ, expressing the notion of "offspring." It is indeed conceivable that some of the names are of non-Semitic origin; *kāpāl* in Persian and Turkish means bronze, and the nation of Tubal was known to the Hebrews for bronze-work (Ezek. xxvii. 15), which would go well enough with the fact that *Kayn* in Arabic means a smith. But on the other hand the wives and daughters of Lamech, as well as the other two sons, have names that point naturally to Hebrew roots, so that it is very doubtful how far one is entitled to press these foreign analogies in explaining what is certainly one of the oldest Hebrew traditions.

What we read in Genesis of Lamech and his race seems to be a mere fragment of an older and more copious tradition. He has two wives—Adah (נָדָה, "ornament" ♀), a name which reappears in Gen. xxvii. in the genealogy of the Edomites, and Zillah (צִלְחָה, "shadow" ♀). Ewald gives to these names a mythological colour by making Adah mean "aurora" (Arabic *ghadit*) in contrast to Zillah, "shadow"; but in that case we should expect the LXX. to transcribe the word by Ταῖα Ἀῤῥῆ, as Irad is rendered Ταῖαδ. At the same time the unquestionable occurrence of names of gods in the Edomite genealogy where Adah recurs favours the view that something of the same sort may be found in Gen. iv. 16 sq. On the other hand it is certainly important that the sons of Lamech form two brotherhoods (verse 21) divided by their maternal descent. The fathers of pastoral life and minstrelsy stand apart from the father of metallurgy and his sister Naamah. Handicraft especially in metals is generally practised by foreigners among the Semitic nomads, so that Tubal Cain may very well represent another race, such as the non-Semitic people which introduced metallurgy in Chaldea according to Assyriologists. The name Naamah ("gracious") is so plainly akin to the divine name Naaman (No'man, Adonia) that we can scarcely refuse to compare what is said of her brother with the Phœnician legend in Philo Byblius (Euseb., *Pr. Ev.*, i. x. 9) of two brothers, inventors of iron and iron-working, of whom one named Chrysos was skilled in sayings, incantations, and divination, and was worshipped as a sort of Phœnician Hephestus. The details of Phœnician legend, however, in this as in other cases, are widely divergent from the Bible story.

The savage "sword song" of Lamech is unique in the Bible, and breathes the true spirit of the desert:—

Adah and Zillah, hear my voice,
Ye wives of Lamech, give ear unto my speech.
I slay a man for a wound,
A young man for a stroke;
For Cain's vengeance is sevenfold,
But Lamech's seventyfold and seven.

In the other form of the genealogy the line of Lamech is dissociated from the guilty Cain and leads up to Noah. This form of the tradition is much more recent, belonging to the Levitical or priestly narrator. Its chief importance is that it shows how inseparably Lamech and his genealogy were connected with the ancestry of the Hebrew race.

LAMEGO, a town in the district of Vizeu in the province of Beira, Portugal, is situated 6 miles south of the Douro, and about 50 miles east of Oporto. As the seat of a bishop, it contains a Gothic cathedral, a part of which is referred to the 14th century. One of the churches was

¹ The conjectures and supposed parallels offered by Ewald (*Geschichte*, i. 882, 891; *Jahrb.* vi. 2) and Meyers (*l. 478 sq.*) offer no safe basis for speculation. G. Smith (*Chaldean Genesis*, ch. xvi.) proposes to identify the name with the Accadian Damsar and Lamgar, "moon."

formerly a Moorish mosque, and, though intrinsically commonplace, enjoyed for a long time an undeserved fame as the meeting place of the cortes said to have been convened in 1143 or 1144 by Alphonso Henriquez, the first king of Portugal, to settle the royal succession and to determine the laws of the country. But within the last forty years it has been pretty clearly demonstrated that no such cortes ever met. To archaeologists the ancient bath preserved at Lamego will afford more interest than the old Moorish castle, which crowns the hill on which the city stands. Numbers of swine are reared in the neighbourhood, which furnish the well-known Lisbon hams. The old name of Lamego was Lama or Lamacum. Under the Moors, who were driven out in 1038 by Ferdinand of Castile, it was a leading city. The population in 1876 was 8383.

LAMENNAIS, HUGUES FÉLIX-ROBERT DE (1782-1854), French theologian, philosopher, and political writer, was born at St Malo in Brittany. His father, Pierre Louis Robert, merchant and shipowner, had been ennobled by Louis XVI. because of aid to royal naval armaments and for importing and selling corn at easy prices in a time of public distress. His property of La Mennais, with the feudal prefix De, gave him a new surname. His wife was so noted for her saintly temper as her humane husband for scepticism. The death of his mother and his father's bankruptcy deprived young Lamennais early of regular education. An eccentric uncle got charge of him, and for years the freedom of this uncle's library was all his training. His elder brother Jean, priest, educationist, and author, had taught him the elements of Latin, and by his own further efforts he comprehended Latin at ten. Well read in Rousseau at twelve, he criticized religion so adroitly with the parish priest that he could not be admitted to communion. In 1796 he sent a discourse combating modern philosophy to a provincial academy. He visited Paris with his father next year, where he wrote democratic letters to the newspapers. On his return he joined his brother for study at a house near Dinan called La Chesnaie, built by their maternal grandfather. Greek, Latin, Hebrew, modern languages, the church fathers, the controversialists, and historians occupied him. Religious struggle, and an intense melancholy, aided it may be by the *malheureuse passion* which he is said to have suffered from, account for the fact that he was twenty-two before taking his first communion, though in direct preparation for the clerical life.

In 1808 his hand found its proper work. His *Reflections on the State of the Church during the 18th Century and on the Actual Situation*, published anonymously at Paris, was the first important theological stand made against the materialistic philosophy which had its apothecosis in imperialism. Napoleon's police seized the book as dangerously ideological, with its eager recommendation of religious revival and active clerical organization. It awoke the ultramontane spirit which has played so great a part since in the politics of churches and states. But Lamennais was not yet ready for the contest. Pious exaltation of spirit was his prevailing mood, as is shown by his translation next year of the *Spiritual Guide* of the ascetic Blotius. Indeed, to the end of his life there is recurrence to what may be called poetic religious feeling, one of his latest reliefs from the storms of political struggle being a translation of the Gospels. In 1811 he took the tonsure, but shortly after became teacher of mathematics in the seminary founded by his brother at St Malo. Theological politics had large discussion after the concordat of 1802, by which the Gallican Church was re-established; and the brothers' joint work, *Tradition upon the Institution of Bishops*, which was published a few days after the restoration, condemns the Gallican principle which allowed bishops to be created irrespective of the pope's sanction.

The revival of the Bourbon monarchy drew Lamennais to Paris, and the Hundred Days sent him to exile. The abbé Caron gave him work in his school for French exiles in London; and he also became tutor at the house of Lady Jerningham, whose first impression of him as an imbecile changed into friendship. In 1815 he returned with the abbé to Paris, where his seeming fatuity cost him much misery as a seminarian of St Sulpice; but with Caron's aid, whom he called his spiritual father, he took full sacerdotal ordination next year, though with reluctance, as a letter to his sister shows. He enjoyed much peace with his friend at the Maison des Feuillantes, and finished there the first volume of his great work, the *Essay on Indifference in the Matter of Religion*. Published in 1817, it affected Europe like a spell. Since Bossuet no clergyman wielded such power as he gained at a blow. He denounced toleration, and advocated a Catholic restoration to belief. The right of private judgment, introduced by Descartes and Leibnitz into philosophy and science, by Luther into religion, and by Rousseau and the Encyclopedists into politics and society, had, he contended, terminated in practical atheism and spiritual death. Ecclesiastical authority, founded on the absolute revelation delivered to the Jewish people, but supported by the universal tradition of all nations, he proclaimed to be the sole hope of regenerating the European communities. In 1824 the fourth volume completed the work, and the *Defence* of the same date indicates the violent opposition he met with, not only from his natural enemies, the lovers of personal freedom in thought, science, and politics, sacred or civil, but from the Gallican bishops and monarchists, because he argued that all authority rests in the Holy See, and from his ultramontane friends, because he dared to support the Christian revelation by an analysis of human, or, as they considered, profane tradition.

Meanwhile Lamennais had become journalist on the *Conservateur*, with Chateaubriand, De Bonald, and De Villèle for his fellows in essentially political work. When in 1820 De Villèle became the chief of the ultras, or friends of absolute monarchy, Lamennais, who was not the monarchist they thought him, left the *Conservateur* with other contributors, named "the incorruptibles," and in the *Drapeau Blanc* and in the *Mémorial Catholique* he opposed his previous comrade. His principles compelled him to draw a firm line as to the divine right of even legitimate kings, especially in connexion with church supremacies. In 1823 he was before the tribunals for an article in the *Drapeau Blanc*. He went to Rome in 1824, and Pope Leo XII., his admirer, offered him the cardinal's hat, which he refused. On his return he published *Religion in its Relations to Civil and Political Order*, the first volume of which was a picture of the religious state of France, and the second an attack on the competence of the assembly of the clergy in 1682 to decree the liberties of the Gallican Church. The law accepting these liberties, Lamennais was summoned before the state courts, and with all France keenly interested was condemned to pay a fine. From this time he broke with the legitimists and the liberals, and Rome became to him the only seat of the social problem. His ideal was a pure theocracy.

But in the *Progress of the Revolution and War against the Church* the element of popular political liberty began to appear, modifying such infallibility of the head of the church as depositing of princes and dispensing with oaths of allegiance taken by their subjects implied. The revolution of 1830 increased his popular leanings, and in the journal *L'Avenir*, which he founded in September with the mottoes "God and Liberty," "The Pope and the People," theories strange to ultramontanism were broached. With Lacordaire, Montalembert, Gerbet, and other disciples, he deposed rights of local administration, enlarged suffrage,

universal and equal freedom of conscience, of instruction, of meeting, and of the press. Methods of worship were to be criticized, improved, or abolished, and all in absolute submission to papal spiritual but not temporal authority. The Jesuits and the prelates grew alarmed, and "the modern Savonarola" was denounced to Gregory XVI. For their spiritual obedience the writers of *L'Avenir* were ordered to suspend the journal, which they did (1831), and Lamennais, Lacordaire, and Montalembert set out for Rome to get the papal pardon and blessing. They were not received, and "Cathline departed," to be overtaken by a bitter encyclical letter at Munich from the pope condemning the new doctrines. So interested was Gregory in the questions raised that under an assumed name he published a work of refutation. To his demand of submission Lamennais signed obedience, with a saving clause as to his country and humanity. The iron had entered his soul, and deeply wounded he retired to Le Chénais, the scene of his youthful inquiries and memories. His genius had turned the entire Christian church against him, and those whom he fought for so long, the ultramontanes, were the fiercest of all his opponents. The famous *Words of a Believer* appeared in 1834, and his final rupture with the church took place. "Small in size but immense in his perversity," was the pope's criticism in a new encyclical letter. A treatise of aphorisms, it has the vigour and sacred breathing of a Hebrew prophet.

Henceforth Lamennais is the apostle of the people alone. The *Affairs of Rome and the Ills of the Church and Society* came from old habit of religious discussions rather than from his real mind of 1837, or at most it was but a last word. *Modern Slavery, The Book of the People, Politics for the People*, two volumes of articles from the journal of the extreme democracy, *Le Monde*, are titles of works which show that he has arrived among the missionaries of liberty, equality, and fraternity, and he soon gets a share of their martyrdom. *The Country and the Government* caused him a year's imprisonment in Ste Pelagie. He struggled through difficulties of lost friendships, limited means, and personal illnesses, faithful to the last to his hardly won dogma of the sovereignty of the people, and to judge by his contribution to Louis Bland's *Review of Political Progress*, was ready for something like communism. He was named president of the "Société de la Solidarité républicaine," which counted half a million adherents in fifteen days. The Revolution of 1848 had his sympathies, and he started *Le Peuple Constituant*, but was compelled to stop it on 10th July, complaining that silence was for the poor; but again he was at the head of *La Révolution Démocratique et Sociale*, which also succumbed. He managed his own publications; and pamphlets without number, and at intervals volumes of *Mélanges*, kept his influence fresh and his republican aims to the front as much as possible. In the constituent assembly he sat on the left till the *coup d'état* of Napoleon III. in 1851 put an end to all hopes of popular freedom. While deputy he drew up a constitution, but it was rejected as too radical. A translation of Dante chiefly occupied him till his death in the fourth year of the second empire. He refused to be reconciled to the church, and was buried at Père La Chaise without funeral rites, according to his own directions, mourned for by a countless concourse of democratic and other admirers.

During the most difficult time of his republican period he had one resource by which to find solace for his intellect from the noise of daily politics. From 1841 till 1846 he was engaged on the work which will remain longest as evidence of his thinking power and of his clear brilliant style, his *Sketch of a Philosophy*. Of the four volumes, the third, which is an exposition of art as development

from the necessities and aspirations of the temple, stands pre-eminent. The rest of the work somewhat answers to the modest title of the book. Some papers which he wished to be published intact after his death were kept back by the religious zeal of his brother and sister, but in 1865 and afterwards till 1869 six volumes appeared under the care of Émile Faguerre. Blaise, the nephew of Lamennais, disputed various rights with Faguerre, and in his biography of his uncle he questions facts in the account of the life prefixed by the editor to the *Posthumous Works*. But the whole matter is of private rather than public interest, affecting the position of Lamennais in little degree.

The complete works have been published twice at Paris, in 12 volumes, 1868-57, and in 11 volumes by Faguerre, 1844 *et*. Neither edition is anything like complete, but that of Faguerre is the more so. Besides the biographical matter given by Faguerre and Blaise as preface—the former to the *Posthumous Works*, the latter to the *Unedited Works*, Sainte-Beuve has Lamennais as one of his skilful *Portraits Contemporains*, Castille has him among the *Portraits posthumes ou des nouveaux nés*, and George Sand's thoughts of "the Breton" can be read in *French Authors at Rome*. Robinet, Gerbet, and Regnaud may be selected from many others who give personal details. Quérard's *Les Suppléments Littéraires Devotés*, article "La Monnaie," will give ample introduction to all that is known of the author's works, and of the works connected with him. (T. 81.)

LAMENTATIONS, Book of. The Old Testament book of Lamentations bears in Hebrew Bibles the subscription קִינָה, "Ah how!" the opening word of the first chapter, and also of chaps i and iv. The Talmud, however, and Jewish writers in general call it the book of חִיבָה, "elegies" or "dirges,"¹ of which the Septuagint title *Θρῆνοι* and the Latin *Lamentationes* or *Lamenta* are translations. The fuller title *Lamentationes Jeremie Propheeta*, *Lamentations of Jeremiah*, expresses the ancient tradition as to the authorship of the book. It is found in the Syriac and in some MSS. of the LXX., e.g., in K, but not in A and B, and the shorter anonymous form is undoubtedly older.

The dirges which make up the book are five in number, and the first four are alphabetical acrostics—successive verses in chaps. i, ii, iv, or successive sets of three verses in the case of chap. iii, beginning with successive letters of the alphabet. The last chapter has twenty-two verses, like chaps. i, ii, and iv, but is not an acrostic.

It is noteworthy that in chaps. ii, iii, and iv, the letter *Pe* (p) precedes *Yim* (y), contrary to the ancient and established order common to the Hebrew alphabet with the Greek and Latin derivatives, in which *O* stands for *P*. The sense shows that this irregularity is not due to a transposition of the original order of the verses, while the fact that the same transposition occurs three times makes it plain that the deviation from the common order is not due to want of skill to make the acrostic perfect, but rests on a variation in the order of the alphabet as used by the author. Thus it has not unreasonably been argued by Thomsen that chap. i, which takes the alphabet in the common order, must have a different author from chaps. ii-iv; but it is quite as probable that in chap. i, as Ewald suggests in the 2d ed. of his *Diebeler*, p. 826, ver. 16 originally followed ver. 17, and was transposed to reduce the acrostic to the usual form. In the other chapters the sense forbids such transposition.

The subject of the five dirges is not the death of an individual; they refer to a national calamity—the widowhood of Jerusalem and the overthrow of the Judean state by the Chaldeans. But the examples of Amos v. 1, 2, Jer. ix. 19 [18], Ezek. xix., show that they are not less properly called dirges on that account; the lamentations of Israel over the desolation of Zion, the agonies of the last desperate struggle and the extinction of national existence, appropriately took a form modelled on the death-wail sung by "cunning women" (Jerem. ix. 17) and poets "skilful of lamentation" (Amos v. 16) at the wake (זִמְנָה) of the illustrious dead. Among the Hebrews, as among other primitive peoples, this type of poetry was much cultivated,

¹ This name, as will appear below, is perhaps as old as the book of Chronicles, and is the Hebrew title known to Jerome (*Prolog. Gal.*).

and reached great artistic perfection at an early date, as appears from David's elegy on Saul and Jonathan; and as it was practiced by persons of special skill, whose services were engaged by the relatives of the dead, it naturally assumed a certain formal and even artificial character. This accounts for the use in our book of the elaborate acrostic form, which to our minds seems little suited for such composition. We are not to think of these dirges as an unattended effusion of natural feeling, but as carefully elaborated poems in which every element of pity and tender art to stir the minds of the hearers. It is far from improbable that the Lamentations were originally composed, as Ewald suggests, for a solemn act of mourning in which the captive or fugitive Israelites united, and we know that they ultimately took their place in the ritual of the great day of mourning, the 9th of Ab, when the synagogue still celebrates the fall of the temple.¹ The or weeping of the fifth month (Ab) was already an old usage in the time of Zechariah (vii 3), and it is quite possible that the ritual use of the book of Lamentations goes back to the early days of this ancient custom. Such considerations meet the difficulty which has sometimes been felt in supposing a single author to have written a whole series of elegies on the fall of Jerusalem. In a solemn and formal ceremony of mourning the repetition of the same theme in successive songs of lamentation is only natural. These observations do not of course prove the unity of the book, but they add force to the arguments for unity derived from the plan and language of the whole, and urged by critics, like Ewald and Nagelsbach, who are not influenced by the tradition which makes Jeremiah the author. The evidence for unity of authorship, it may be at once observed, applies most forcibly to the first four chapters, which are also connected by their acrostic form, and especially by the peculiarity in the order of the alphabet already alluded to as still found in chaps. ii, iii, and iv, and perhaps at one time found even in chap. I.

The first elegy commences with a picture of the distress of Zion during and after the siege (i. 1-11), Jerusalem, or the people of Judah, being figured as a widowed and dishonoured princess. Then in the latter half of the poem she herself takes up the lamentation, describes her grievous sorrow, confesses the righteousness of Jehovah's anger, and invokes retribution on her enemies. In the second chapter the desolation of the city and the horrors of the siege are again rehearsed and made more bitter by allusion to the joy of the enemies of Israel. The cause of the calamity is national sin, which false prophets failed to denounce while repentance was still possible, and now no hope remains save in tears and supplication to stir the compassion of Jehovah for the terrible fate of his people. The third elegy takes a personal turn, and describes the affliction of the individual Israelite or of the nation under the type of a single individual under the sentence of Jehovah's just but terrible indignation. But even this affliction is a wholesome discipline. It draws the heart of the sinner nearer to his God in penitent self-examination, sustained by trust in Jehovah's unfailing mercy, which shows itself in the continued preservation of His people through all their woes. From the lowest pit the voice of faith calls to the Redeemer and hears a voice that says, "Fear not." Jehovah will yet plead the cause of His people, and so in the closing verses the accounts of humble entreaty pass into a tone of confident appeal for just vengeance against the oppressor. In the fourth acrostic the bitter sorrow again bursts forth in passionate wailing. The images of horror inscribed on the poet's soul during the last months of Jerusalem's death-struggle and in the fight that followed are painted with more ghastly detail than in the previous chapters, and the climax is reached when the singer describes the capture of the king, "the wrath of our nostrils, the appointed of Jehovah, of whom we said, 'Under his shadow we shall live among the nations.'" The cup of Israel's sorrow is filled up. The very completeness of the calamity is a proof that the iniquity of Zion has met with full recompense. The day of captivity is over, and the wrath of Jehovah is now ready to pass from His people to visit the sins of Edom, the most merciless of its foes.

Thus far there is both unity and progress in the thought.

¹ See *Acac. Stephen*, chap. xviii., and the notes in Müller's edition, Leipzig, 1878.

Behind the division into four acrostics has a larger grouping in three stanzas, each of which begins with the elegiac *Yahweh*, followed by a representation in increasing detail of the great calamity, and passes on through the thought of Jehovah's righteousness to hope, which, as in Psalm cxxxvii, finds its characteristic culmination and point of rest in the assurance of righteous vengeance. The central section (chaps. i. and ii.) is the most subdued in tone, and sounds the profound depths of religious feeling, while the opening section presents the theme in its broadest unity, under the form of personification, and is balanced in chap. iv by the surging flood of an anguish which pours itself forth all the more unreservedly that it contains the seeds of hope.

The fifth chapter, which takes the form of a prayer, does not follow the scheme common to the three foregoing sections. The elegy proper must begin with the utterance of grief for its own sake. Here on the contrary the first words are a petition, and the picture of Israel's woes comes in to support the prayer. The point of rest too is changed, and the chapter closes under the sense of continued wrath. The centre of the singer's feeling no longer lies in the recollection of the last days of Jerusalem, but in the long continuance of a divine indignation which seems to lay a measureless interval between the present afflicted state of Israel and the happy days of old which are so fresh in the recollection of the poet in the first four chapters. The details too are drawn less from one moving misfortune than from a continued state of bondage to the servants of the foreign tyrant (viii 8), and a continued series of misdeeds and miseries. And with this goes a change in the consciousness of sin. "Our fathers have sinned, and are not; and we have borne their iniquities" (vii 7; compare Zeoh. i. 2-6, and similar complaints in very late psalms). These differences, combined with the absence of the acrostic form, suggest that the chapter may be a later addition. It may be noted also that in ver. 6 the community which joins in the prayer has humiliating relations to Assyria (Syna) on the one hand and to Egypt on the other, which seems to imply that it dwells in Palestine,—a situation to which the complaint that strangers possess its land and houses, that the weak numerical state of Israel is in constant danger from Babylon (viii 9), and the picture of the foxes that walk among the ruins of Zion, may also point. Moreover, the fact that the book has five parts, like the Psalter and the Pentateuch, makes it very conceivable that it received its present form after the Pentateuch was complete, that is, after the time of Ezra. The linguistic arguments for the unity of the book (most fully stated by Nagelsbach, p. xvi.) seem to break down as regards chap. v.

According to a tradition which passed unquestioned among Jews and Christians till recent times, the author of the whole book is the prophet Jeremiah. To estimate the value of this tradition, we must trace it back as far as possible. A note prefixed to the Septuagint translation says that, "after Israel was taken captive and Jerusalem laid waste, Jeremiah sat down and wept, and sang this elegy over Jerusalem." This note may very possibly have stood in the Hebrew copy of the translator, but it certainly cannot be regarded as part of the original text, and it does not bring the tradition within three hundred years of the age of Jeremiah. Another argument bearing on the authority of the tradition has regard to the original place of the book in the Old Testament canon. In Hebrew Bibles the Lamentations stand among the Hagiographa, forming one of the five Megilloth or small books written on separate rolls for liturgical use on separate occasions. In the common order of printed Hebrew Bibles the book stands third among the Megilloth, because in the order of the ecclesiastical year the solemnity of the 9th of Ab was the third annual occasion at which a Megillah was used (see *Cantabrigia*, vol. v. p. 32). In the Septuagint and Syriac, on the other hand, the Lamentations are attached to the book of Jeremiah, Baruch intervening in the former version; and it has been often supposed that this was the older arrangement,—that is, that even in Hebrew copies the book originally formed an appendix to Jeremiah, and was afterwards separated for liturgical reasons. The argument for this view turns on the fact that side by side with the Talmudic enumeration of twenty-four Old Testament books, agreeably to the present Hebrew arrangement, there was another enumeration which gave twenty-two books, taking Ruth with Judges and Lamentations with Jeremiah (Jerome, *Prolog. Gal.*). This seems to be the reckoning

adopted by Josephus, but the evidence that it had an established place among the Jews of Palestine at or even after his time is scanty and precarious.¹ At any rate the artificial scheme which accommodates the number of sacred books to the number of the twenty-two Hebrew letters is one that can hardly be original. If first appears about the time of the labours of the rabbins in the last days of the Jewish state to give final form to the canon.

Here then there is nothing to carry us beyond the evidence of the Septuagint, and Noldke has pointed out that there is some reason to suspect that the Septuagint translation of Lamentations is not by the same hand with that of Jeremiah, which goes to prove that even in the Greek the two books (which are in fact separated by the Apocryphal Baruch) were not originally one. Certainly the book of Lamentations has not shared the very peculiar history of the text of Jeremiah, the Greek of the former agreeing with the Hebrew so closely as to make it probable that the text was early established by frequent liturgical use, while the prophecies underwent many variations in transmission. There is, however, one piece of evidence in the Hebrew canon itself which ancient writers accepted as connecting the name of Jeremiah with our book. In 2 Chron. xxv. 25 we read that Jeremiah pronounced a dirge over Josiah, and that the death of Josiah was still referred to according to stated usage in the dirges used by singing men and women in the author's day, and collected in a volume of *תנאים*—the ordinary Jewish name of our book. Josephus says that the dirge of Jeremiah on this occasion was extant in his days (*Ant.* x. 5, 1), and no doubt means by this the canonical Lamentations. Jerome on Zech. xii. 11 understands the passage in Chronicles in the same sense; but modern writers have generally assumed that, as our book was certainly written after the fall of Jerusalem, the dirges alluded to in Chronicles must be a separate collection. This, however, is far from clear. The *תנאים* of the Chronicler had, according to his statement, acquired a fixed and statutory place in Israel, and were connected with the name of a prophet. In other words they were canonical as far as any book outside the Pentateuch could be so called at that age. Moreover, the allusion to the king, the anointed of Jehovah, in Lam. iv. 20, though it really applies to Zedekiah, speaks of him with a warm sympathy which later ages would not feel for any king later than Josiah. The Chronicler in particular recognizes only thoroughly good kings (of whom Josiah was the last), and kings altogether bad, for whom he had nothing but condemnation, and with whom he certainly could not imagine a prophet to sympathize.² It thus seems highly probable that in the time of the Chronicler, that is, about the close of the Persian period, the book of Lamentations had a recognized liturgical use in the hands of a guild of singers, and was already connected with the name of Jeremiah, though the passage in Chronicles does not make it apparent that the whole official collection of dirges was ascribed to him. But even this testimony is some two centuries and a half later than the events which the book of Lamentations bewails, and is connected with an undoubted error, though a natural one, as to the reference of the book. We cannot therefore feel sure that the tradition current in the guild of singers was authentic and continuous; the general subject of the Lamentations, and particularly the obvious applicability to the personal circumstances of Jeremiah of

such passages as i. 14, 55 (comp. Jer. xx. 7; xxxviii.), made it natural or even inevitable to think of him as author, if any attempt was made to connect the book, as the later Jews sought to connect all books, with some known name. Nor can we lay special weight on the acceptance of the tradition by an author who transfers post-exile Psalms to the Davidic age (1 Chron. xvi. 7 sq.).

When we proceed to test the internal probability of the tradition we find it to be surrounded by grave difficulties. The language, as Ewald observes, and Nagelsbach (p. xi. sq.) has shown with great completeness, is very remote from that of Jeremiah, and even if we separate out chap. v, in which the features already pointed out make it peculiarly difficult to think of him as author, the standpoint of the book corresponds very imperfectly with that of the prophet. Jeremiah, through all his life, was a man standing by himself, isolated from his people. At the taking of the city the Chaldeans themselves acknowledged this and treated him with favour. He was carried into Egypt against his will, still counselling patient submission to the foreign rule, and there he continued in opposition to the mass of the fugitives as decidedly as before. The Lamentations, on the contrary, show us a poet in sympathy with the old life of the nation, whose attitude to the temple services, and especially to the king, is far more popular than Jeremiah's. Nor could Jeremiah speak of the calamity as involving the cessation of revelation and the silence of prophecy (ii. 9); for the Divine word in his breast was as clear and strong after the catastrophe as before it. The judgment, terrible as it was, had far less painful significance to Jeremiah than to the nation at large (Jer. xiv. 1 sq., xlii. 9 sq.). To this it may be objected that in chap. iii, where the singer's complaint takes a more personal turn, Jeremiah himself is pictured in his isolation from Israel at large. A closer examination shows, however, that this interpretation turns on a single word in iii. 14. The addition of a final *ו*, not always written in old times, changes "all my people" into "all peoples," restores the harmony between iii. 14 and verses 61-63, and makes the singer of chap. iii, as the general argument of the chapter requires, a representative of Israel among the heathen, not an isolated figure among unsympathetic countrymen.

Thus viewed, the Lamentations are the earliest evidence of the great national repentance wrought by the fall of the Jewish state. We have here for the first time a genuine expression of popular feeling fully penetrated by those convictions of Israel's sin and Jehovah's righteousness which the people of Judah had long resisted, mocking and persecuting the divine messengers who had sought to force them on the conscience of their countrymen. This cry of deepest anguish from the depths of a nation's despair, chastened by a sense of sin, and rising at length into an attitude of sublime faith in the confident appeal to the righteousness and love of Jehovah, contains the germ of the new life of the Israel of the restoration, and may be taken as the starting point of a fresh epoch in the Old Testament development. It is not probable that these new thoughts and new hopes found so clear and perfect literary expression in the very first days of the exile. Several passages, especially ii. 14 compared with Ezek. xiii. (780 N^o 12), appear to indicate acquaintance with the book of Ezekiel, which is, as Nagelsbach points out, another argument against authorship by Jeremiah, and combines with the expression in ii. 9 to point to the time when the study of the written word, so characteristic of the age of the exile, had begun to supply the lack of continuous oral revelation. It is hardly possible to give a more exact determination of the place and time of writing. Ewald argues for an origin among the fugitives in Egypt; but the passages to which he appeals (i. 3; iv. 18 sq.; v.

¹ The supposed testimony of Origen (*Euseb.* *h. E.* vi. 26) breaks down, for if it applied to the Hebrew Bible it would also prove, what we know to be false, that the epistle of Jeremiah stood in the Hebrew canon. Origen, Jerome, and other Christian writers were probably influenced by the statement of Josephus. The testimony of the Book of Jubilees, as cited by Synellus and Oedreus, is very doubtful (Baruch, B. der Jub., p. 527 sq.).

² See Noldke, *Atheist. Literatur*, p. 144.

back, and wing-coverts generally, are of a glossy greyish-black, most of the feathers having a white shaft and a median tawny line. The quill-feathers, both of the wings and tail, are of a dark blackish-grey. The irides are of a light orange, and the sclerotic tunica,—equivalent to the "white of the eye" in most animals,—which in few birds are visible, are in this very conspicuous and of a deep crimson, giving it an air of great ferocity. In the young of the year the whole head, neck, and throat are clothed in dull black, and most of the feathers of the mantle and wing-coverts are broadly tipped and mesially streaked with tawny or lightish grey.

The Lämmergeyer breeds early in the year. The nest is of large size, built of sticks, lined with soft material, and placed on a ledge of rock—a spot being chosen, and often occupied for many years, which is nearly always difficult of access, and not unfrequently quite inaccessible, to man, from the precipitous or overhanging configuration of the cliffs. Here in the month of February a single egg is usually laid. This is more than 3 inches in length by nearly 2½ in breadth, of a pale but lively brownish-orange. The young when in the nest are clad in down of a dirty white, varied with grey on the head and neck, and with ochraceous in the iliac region. How long the eggs take in hatching, or how long the young remain nestlings, seems to be unknown. Equally unknown is the length of time that elapses before the latter assume the adult plumage, but it is probable that this period must at least exceed a twelvemonth.

There is much discrepancy as to the ordinary food of the Lämmergeyer, some observers maintaining that it lives almost entirely on carrion, offal, and the most disgusting garbage; but there is no question of its frequently taking living prey, and it is reasonable to suppose that this bird, like so many others, is not everywhere uniform in its habits. Its very name shews it to be the reputed enemy of shepherds, and it is in some measure owing to their hostility that it has been exterminated in so many parts of its European range. The usual mode of proceeding is said to be by suddenly rushing at the animal, especially if it be young, when in a somewhat dangerous position, so startling it as to make it lose its foothold and fall down the precipice.¹ But the Lämmergeyer has also a great partiality for bones, which when small enough it swallows and slowly digests. When they are too large, it is said to soar with them to a great height and drop them on a rock or stone that they may be broken into pieces of convenient size. Hence its name *Ossifrage*,² by which the Hebrew *Peres* is rightly translated in the Authorized Version of the Bible (Lev. xi. 13; Deut. xiv. 12)—a word corrupted into *Οερνα* (g.v.), and applied to a bird which has no habit of the kind.

The Lämmergeyer of north-eastern and south Africa is deemed by systematists to be specifically distinct, and is known as *Gypaetus meridionalis* or *G. nudipes*. In habits it seems closely to resemble the northern bird, from which that the colouring-matter on the eggs (to be presently described) also arises from the same cause. This opinion has, however, been denied by several other naturalists, though none of them seem to have tried the experiment; while Mr Hume, who has (*Serp. Book*, p. 46), confirms Herr Merz's statement. In confinement, moreover, the bird has been observed always to lose or not to acquire its leucy tint.

¹ Stories are told of the attacking human beings under such circumstances, and the present writer is not disinclined to believe that some of such stories may be true, though he is unable to refer to any that rest on testimony sufficient to dispel all doubt.

² Among other crimes attributed to the species is that, according to Pliny (*Hist. Nat.*, x. cap. 3), of having caused the death of the poet Æschylus, by dropping a tortoise on his bald head! In the Atlas range the food of this bird is said to consist chiefly of the *Turdus meruloides*, which "it carries to some height in the air, and lets fall on a stone to break the shell" (*Ibid.*, 1859, p. 177). It was the *ἀερας* and *ἀερας* of Greek classical writers.

it differs in little more than wanting the black stripe below the eye and having the lower part of the tarsus bare of feathers. It is the "Golden Eagle" of Bruce's *Travels*, and has been beautifully figured by Mr Wolf in Dr Rüppell's *Syst. Vögel der Vögel Nord-Ost-Afrika's* (Tab. 1). (A.N.)

LAMONT, JOHANN VON (1808-1879), was born at Bräemar, Aberdeenshire, on December 13, 1808. He was sent at the age of twelve to be educated at the Scottish monastery in Ratisbon, and apparently never afterwards returned to his native country,—so that he became to all intents and purposes a German. After passing through the gymnasium and lyceum, he devoted himself to theology; but his strong bent for scientific studies was recognized by the head of the monastery, F. Denison, and on his recommendation he was admitted to the then new observatory of Bogenhausen (near Munich), where he worked under Soldner, latterly as his assistant. After the death of his chief in 1835 he was, on Schumacher's recommendation, (Steinhilf, supported by Bessel, also competing for the office), appointed to succeed him as conservator of the observatory. In 1853 he became professor of astronomy at the university of Munich. He held both these posts till his death, which took place on the 6th August 1879. Though by no means a man of commanding genius, Lamont occupied a very important place among the scientific men of his day. As evidence of the universal respect in which he was held, it may be mentioned that he was a member of the Academies of Brussels, Upsala, and Prague, of the Royal Society of Edinburgh, of the Cambridge Philosophical Society, and of many other learned corporations. His work bore for the most part on astronomy and magnetism. Among his contributions to the former may be noted his great star catalogue, and his determination of the mass of Uranus from observations of its satellites (*Mem. Astron. Soc.*, 1838). His *Handbuch des Erdmagnetismus* (Berlin, 1849) is a standard work on the subject.

For fuller details concerning his published work the specialist may be referred to Poggenordt's *Biographisch-Literarisches Handwörterbuch*, or to the Royal Society's *Catalogue of Scientific Memoirs*.

LA MOTTE FOUQUÉ. See Fouqué.

LAMP. Technically a lamp is an apparatus in which to burn fluid combustible substances. Lamps are mostly intended for yielding light; but there are also special forms the purpose of which is to afford highly concentrated heat in a convenient and portable form. The substances used in lamps for lighting are of two classes—(1) fixed oils, and (2) fluid hydrocarbons obtained from the distillation of bituminous shales, &c. (paraffin oil), petroleum, and essential oils. The latter class may be distinguished as mineral oils. Till very recently fixed oils were almost exclusively used for lamps; but since the introduction of the cheaper and more convenient mineral oils, in the second half of the 19th century, the use of fixed oils has steadily decreased in all parts of the world.

There is scarcely any fixed or fatty oil which has not been used, more or less, for burning. Many oils are so used in the districts which produce them, although they hardly enter into ordinary commerce under the name of burning oils. The so-called fish oils (sperm, whale, and seal) were, in recent times, principal burning oils, and to a limited extent are still so employed. Of the vegetable oils of commerce, colza oil is the most extensively used as an illuminant, and after it come other rape oils, poppy oil, the lower qualities of olive oil, castor oil, or gingelly oil, candle-nut oil, and ground-nut oil, all of which, however, are local or restricted in consumption. The suitability of fixed oils for burning purposes depends on their purity or freedom from foreign matters, and on their limpidity, or, what is in effect the same thing, the temperature at which they solidify. Thus cocoa-nut fat is consumed in ordinary

lamps in tropical regions, although in temperate latitudes it is a permanent solid. In the combustion of a fixed oil in lamps, the oil undergoes destructive distillation, and at the burning point is resolved into a gaseous mixture. The comparative viscosity of all fixed oils renders it necessary to adopt some device supplementary to the capillary action of the wick for maintaining at the level of the burner a supply of oil sufficient to support uniform combustion. Again, the lubricant properties of fixed oils make it practicable to adopt various mechanical devices to regulate the supply of fuel to the burner, and otherwise control illumination.

The mineral oils, on the other hand, are, as solid, mixtures of various volatile hydrocarbons which give off inflammable vapours at comparatively low temperatures, and in consumption in lamps they come to the burning point in the condition of vapour. With highly volatile oils, and the use of imperfectly fitted lamps, though not with proper oil and fittings, there is some danger of explosion; there is also a risk that with imperfect combustion deleterious gases may be diffused through an apartment. Mineral oils possess such a high degree of impidity that the suction of the wick alone is generally sufficient to bring the necessary supply of fuel to the burner.

The qualities of a lamp are judged of by the brilliancy, steadiness, and uniformity of light it yields in proportion to the quantity of oil it consumes, by the convenient position of the light in relation to the equal illumination of the space it has to light, by the form, portability, and convenience of the lamp itself, and by the simplicity and economy of its construction, regard being had to efficiency. The chief points to consider in connexion with the structure of lamps are (1) the means of supplying oil to the burner and of regulating that supply, (2) the form and arrangement of the wick or medium over which the flame is supported, (3) the regulation and control of the currents of air in the lamp which support combustion, and (4) the position of the oil reservoir in relation to the dissemination of the light and the stability of the lamp itself.

The simple form which was used down to the end of the 18th century, and which as a "cruise" continued in common use in Scotland till the middle of this century, illustrates the most elementary and most imperfect arrangement of a lamp. Here, as in the lamps of antiquity, the oil vessel lies immediately behind the burning point of the wick, with which the oil is about level when the reservoir is full. The wick is a round soft cord or fibrous mass. Such a lamp has no merit but simplicity. The light is thrown only forward and to the sides, the back being entirely in shadow. The wick, being a round solid mass, takes up oil equally at the centre and circumference; but to the outer edges of the flame only is there any access of air; consequently combustion in the centre is imperfect, resulting in a smoky unsteady flame, and a discharge into the atmosphere of the acid products of destructive distillation. Further, as the level of the oil sinks in the reservoir, the wick has to feed the flame from a greater distance by mere capillary force, and, the supply thus diminishing, the light decreases in proportion.

Since the time when inventors first began to better the primitive lamp, just one hundred years ago, the improvements in lamp construction have been enormous, the forms and modifications of invention bearing on lamps have been innumerable, and many excellent devices which did good service have been superseded by others simpler and more efficient. Notice can here be taken only of such inventions as developed new principles and features of originality.

The first improvement was in wicks and burners. In 1783 Leger of Paris devised a flat band or ribbon wick and burner, which produced a broad thin flame with no

core, so that all parts of the oil supply were brought into intimate contact with the air, and perfect combustion and a steady flame were secured. The deficiencies of the flat wick flame were that the light was comparatively thin and impoverished, and that the parts of a room facing the thin ends of the flame were badly illuminated. To some extent these evils were overcome by the adoption of a curved form of burner, which in the end led up to the burner invented by Ami Argand of Paris, and patented in England in 1784. In its simplest form the Argand burner consists of two concentric tubes or cylinders, between which the tubular wick is contained. The inner tube is open throughout, and to it a current of air passes from below, and, being carried upwards by the draught of the flame, atmospheric oxygen for combustion is supplied as well to the inner circumference as to the outer side of the flame, whence the name "double current burner" which it frequently receives. An adequate and controllable flow of air to the interior of the Argand burner having been secured, it remained to devise some means by which the current supplied to the outer circumference of the flame could be strengthened and regulated. This Argand secured by means of a chimney, which was made at first of sheet iron and suspended over the flame, but that device was quickly abandoned in favour of a glass chimney which rested on a perforated gallery placed a little below the level of the burner. Subsequent experience suggested the formation of a shoulder or constriction on the chimney at a point a little above the level of the flame, whereby the air current is directed inward against the external surface of the flame, thus materially improving the combustion. Argand's original burner is the parent form of innumerable modifications all more or less complex in their adaptations.

A typical example of the burner and chimney is represented in fig. 1, in which the burner is composed of three tubes, *d*, *f*, *g*. The tube *g* is soldered to the bottom of the tube *d*, just above *o*, and the interval between the outer surface of the tube *g* and the inner surface of the tube *d* is an annular cylindrical cavity closed at bottom, containing the cylindrical cotton wick immersed in oil. The wick is fixed to the wick tubes *ki*, which is capable of being moved spirally, within the annular cavity is also the tube *f*, which is capable of being moved round, and serves to elevate and depress the wick. *P* is a cup that screws on the bottom of the tube *d*, and serves to receive the superfluous oil that drops down from the wick along the inner surface of the tube *g*. The air enters through the holes *o*, *o*, and passes up through the tube *g* to maintain the combustion in the interior of the annular flame. The air which maintains the combustion on the exterior part of the wick enters through the holes *m*, with which *n* is perforated. When the air in the chimney is raised by the heat of the flame, the surrounding heavier air, entering the lower part of the chimney, passes upward with a rapid current, to restore the equilibrium. *RG* is the cylindrical glass chimney with a shoulder or constriction at *R*, *G*. The oil flows from a side reservoir, and occupies the cavity between the tubes *g* and *d*. The part *ki* is a short tube, which receives the circular wick, and slides spirally on the tube *g* by means of a pin working in the hollow spiral groove on the exterior surface of *g*. The wick-tube has also a catch, which works in a perpendicular slit in the tube *f*; and, by turning the tube *f*, the wick-tube will be raised or lowered, for which purpose a ring, or gallery, *m*, fits on the tube *d*, and receives the glass chimney *RG*; a wire *S* is attached to the tube *f*,

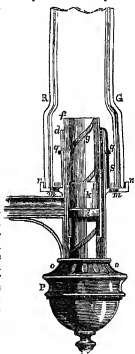


Fig. 1

and, bending over, descends along the outside of *d*. The part *u*, that supports the glass chimney, is connected by four other wires with the ring *g*, which surrounds the tube *d*, and can be moved round. When *u* is turned round, it carries with it the ring *g*, the wire *S*, and the tube *f*, and thereby produces elevation or depression of the wick.

A device in the form of a small metallic disk or button, known as the *Liverpool button* (here having been first adopted in the so-called *Liverpool lamp*, effects for the current of air passing up the interior of the Agard burner the same object as the construction of the chimney *FG* secures in the case of the external tube. The button fixed on the end of a wire is placed right above the burner tube *g*, and thence an equally all round against the flame the motion of *u* which presses up through *g*. The result of these expedients, when properly applied, is the production of an exceedingly solid brilliant white light, absolutely smokeless, thus showing that the combustion of the oil is perfectly accomplished.

The means by which a uniformly regulated supply of oil is brought to the burner varies of course with the position of the oil reservoir. In some lamps, not now in use, by ring formed reservoirs and other expedients, the whole of the oil was kept as nearly as possible at the level of the burner. In what are termed fountain, reading, or study lamps, the principal reservoir is above the burner level, and various means are adopted for maintaining a supply from thence at the level of the burner. But the most convenient position for the oil reservoir in lamps for general use is directly under the burner, and in this case the stand of the lamp itself is utilized as the oil vessel. In the case of fluid oils it is necessary with such lamps to introduce some apparatus for forcing a supply of oil to the burner, and very many methods of effecting this have been devised, most of which were ultimately superseded by the moderator lamp. The Carcel or pump lamp, invented by Carcel in 1809, is still to some extent used in France. It consists of a double piston or pump, forcing the oil through a tube to the burner, worked by ingenious clockwork arranged to go a certain number of times.

An example of a form of reading lamp still in general use is seen in section in fig. 2. The lamp is mounted on a stand on which it can be raised or lowered at will, and fixed by a thumb screw. The oil reservoir is in two parts, the upper *ac* being an inverted flask which fits into *bc*, from which the burner is directly fed through the tube *h*. *A* is an overflow cup for any oil that escapes at the burner, and it is placed with air holes for admitting the current of air to the centre tube of the Agard burner. The lamp is filled with oil by withdrawing the flask *ac*, filling it, and inserting it into its place. The under reservoir *bc* fills from it to the burner level *es*, on a line with the mouth of *ac*. So soon as that level falls below the mouth of *ac*, a bubble of air gets access to the upper reservoir, and oil again fills up to the level *es*, and so on it goes as long as combustion continues and the supply of oil in *ac* endures. The principle is susceptible of numerous modifications.

The moderator lamp (fig. 3), invented by M. Franchot about 1836, from the simplicity and efficiency of its arrangements rapidly superseded almost all other forms of mechanical lamp. The two essential features of the moderator lamp are (1) the strong spiral spring which, acting on a piston within the cylindrical reservoir of the lamp, serves to propel the oil to the burner, and (2) the ascending tube *C* through which the oil rises upwards to the burner. The latter consists of two sections, the lower fixed to and passing through the piston *A* into the oil reservoir, and the upper attached to the burner. The lower or piston section moves within the upper, which forms a sheath enclosing nearly its whole length when the spring is fully wound up. Down the centre of the upper tube passes a wire "the moderator," *P*, *G*, and it is by this wire that the supply of oil to the burner is regulated. The spring exerts its greatest force on the oil in the reservoir when it is fully wound up, and in proportion as it expands and descends its power decreases. But when the apparatus is wound up the wire passing down the upper tube extends throughout the whole length of the lower and narrower piston tube, obstructing to a certain extent the free flow of the oil. In proportion as the spring uncoils, the length of the wire within the lower tube is decreased, the upward flow of oil is facilitated in the same ratio as the force urging it upwards is weakened. In all mechanical lamps the flow is in excess of the consuming capacity of the burner, and in the moderator the surplus oil, flowing over the wick,

falls back into the reservoir above the piston, whence along with new supply of oil it descends into the lower side by means of leather valves *a*, *a*. *B* represents the tack which, with the piston *D*, winds up the spiral spring and against *B* when the lamp is prepared for use. The moderator wire is seen separately in *GG*, and *FGO* illustrates the arrangement of the sheathing tubes in the upper section of which the moderator is fixed.

Lamps for Mineral

Oils.—At an early period numerous attempts were made to utilize the highly inflammable volatile hydrocarbons and alcohols, which from their cheapness and abundance offered some hope of competing with the fixed oils then in universal use for illuminating purposes. These lamps had little success, and no small danger accompanied their limited use. The *Vesta*

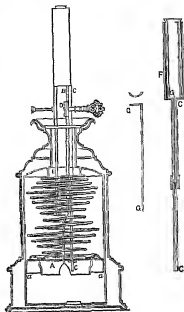


FIG. 3.—Section of Moderator Lamp

lamp of Young, introduced in 1834 for burning spirit of turpentine under the name of camphine, procured a smokeless flame by means of the Agard burner, constricted chimney, and *Liverpool button*, with the access of abundant air. It was not, however, till the introduction of paraffin oils and petroleum that mineral oil lamps became of great importance. Lamp makers had not to direct their attention to mechanical arrangements, for mineral oils rise abundantly by capillarity alone, the problem was to produce a sufficiently powerful current of air to ensure complete and smokeless combustion of these richly carbonaceous compounds, and, in view of the highly volatile nature of the liquids dealt with, to prevent their exposure to the air, and more particularly to prevent the heating of the oil reservoir which would generate explosive mixtures, or vapours of dangerous tension.

Mineral oil lamps, like those for fixed oils, are constructed with both circular or tubular and flat-wick burners. In the case of the latter a cone or brass cap is placed over the burner, having a slit or opening a little longer and wider than the wick-holder itself. This cone serves to direct the whole current of air which enters below against the surface of the flame, and mingling with the vapour of the oil produces perfect combustion, with a white flame which rises over the slit in the cone. The cool air current entering under the cone is also beneficially utilized in preventing the undue heating of the oil reservoir and the metallic wick-holder which passes down into it.

These flat wick lamps are simple in construction, cheap, and so far as they go, economical light producers, but their flame is thin, and it is not practicable to compensate for the thinness by increased breadth of wick, because in such a case the edges of the light come so near the chimney that at these points the glass becomes rapidly heated, causing unequal expansion and destruction of the chimney. In 1855 Messrs James & Joseph Hinks of Birmingham secured a patent for improvements in the burners of mineral oil lamps, "whereby two or more flat flames or one circular or nearly circular flame may be produced by the use of two or more single flat wicks." Under this patent was manufactured their well-known duplex lamp, which has gone far to supersede all other forms.

An improved form of their lamp is shown in fig. 4, in which a portion of the cone B is removed to show the two parallel flat wicks A, A, which have each a separate slit or opening in the cone C is the coincident window for raising or lowering the wicks in the tubes, by which the wicks can be moved separately or simultaneously as desired. D is a lever for raising the extinguisher E, whereby not only is the light instantly extinguished, but the wicks are also covered and protected from dirt, while all evaporation by the wick-holder is prevented. Messrs Hinks & Son have further devised an automatic lighting attachment which obviates the necessity of raising the glass chimney for lighting the lamp.

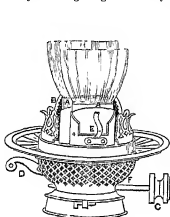


FIG 4—Duplex Burner



FIG 5—Conical Burner

Messrs Hinks claimed in their 1865 patent the use of "two or more flat flames," and since that period numerous burners have been produced in foreign countries in which more than two flat wicks are used. The crown burner of Bunsen in Vienna contains no less than six flat wicks. There are triplex burners, too, in which the wicks are arranged as a triangle, a most valuable lamp of this construction is the "Hesperus" of Messrs Jones & Willis of Birmingham. Another form, the triplexcon, has three burners so closely placed together that the flames coalesce into a solid flame about half an inch in thickness. Further, there are star-shaped and cruciform burners, and others of little practical value.

The conical or tubular burners for mineral oils have been much simplified from the forms necessary in the case of colza, &c. A tubular wick is no longer required, a simple flat wick of a size that will allow its edges exactly to meet round the upper edge of the burner ring is used. In the form shown in fig. 5 the wick-holder and burner consists of a hollow truncated cone, with a vertical conical section removed from its side. The flat wick passes up through this cone, its edges meeting and forming in effect a circular wick at the top, while the central current of an gets ready access to the tube by the conical opening formed in its side, and the outer current passes up within the chimney walls as usual. This form also is easily susceptible of numerous modifications. (J. P. A.)

Ancient Lamps.—Though Athenæus states (xv 700) that the lamp (λύχνος) was not an ancient invention in Greece, it had come into general use there for domestic purposes by the 4th century B.C., and no doubt had long before been employed for temples or other places where a permanent light was required in rooms of the torch of Homeric times. Herodotus (ii 62) sees nothing strange in the "festival of lamps," Lychnokata, which was held at Sais in Egypt, except in the vast number of them. Each was filled with oil so as to burn the whole night. Again he speaks of evening as the time of lamps (περὶ λύχνων, vii 215). Still, the scarcity of lamps in a style anything like that of an early period, compared with the immense number of them from the late Greek



FIG 6

and Roman age, seems to justify the remark of Athenæus. The commonest sort of domestic lamps were of terra-cotta and of the shape seen in figs. 6 and 7, with a spout or nozzle (μικτήρ) in which the wick (θυσία) burned, a round hole on the top to pour in oil by, and a handle to

carry the lamp with. A lamp with two or more spouts was διπλὸς, τριπλὸς, &c., but these terms would not apply strictly to the large class of lamps with numerous holes for wicks but without nozzles.

Decoration was confined to the front of the handle, or more commonly to the circular space on the top of the lamp, and it consisted almost always of a design in relief, taken from mythology or legend, from objects of daily life or scenes such as displays of gladiators or chariot races, from animals and the chase. A lamp in the British Museum has a view of the interior of a Roman circus with spectators looking on at a chariot race. In other cases the lamp is made altogether of a fantastic shape, as in the form of an animal, a bull's head, or a human foot. Naturally colour was excluded from the ornamentation except in the form of a red or black glaze, which would resist the heat. The typical form of hand lamp (figs. 6, 7) is a combination of the flatness necessary for carrying steady and remaining steady when set down, with the roundness evolved from the working in clay and characteristic of vessels in that material. In the bronze lamps this same type is retained, though the roundness was less in keeping with metal.

Fanciful shapes are equally common in bronze. The standard form of handle consists of a ring for the fore finger and above it a kind of palmette for the thumb to press on to keep the lamp steady. Instead of the palmette is sometimes a crescent, no doubt in allusion to the moon. It would only be with bronze lamps that the cover protecting the flame from the wind could be used, as was the case out of doors in Athens. Such a lamp was in fact a lantern. Apparently it was to the lantern that the Greek word *lampas*, a torch, was first transferred, probably from a custom of having guards to protect the torches also. Afterwards it came to be employed for the lamp itself (λύχνος, *lucerna*). When Juvenal (*Sat.*, xii 277) speaks of the *aeneas lampas*, he may mean a torch with a bronze handle, but more probably either a lamp or a lantern. Lamps used for suspension were mostly of bronze, and in such cases the decoration was necessarily on the under part, so as to be seen from below. Of this the best example is the lamp at Cortona, found there in 1840 (engraved, *Monuments d. Inst. Arch.*, vii pls 41, 42, and in Dennis, *Cities and Cemeteries of Etruria*, 2d ed., ii p. 403).



FIG 8

It is set round with sixteen nozzles ornamented alternately with a siren and a satyr playing on a double flute. Between each pair of nozzles is a head of a river god, and on the bottom of the lamp is a large mask of Medusa, surrounded by bands of animals. These designs are in relief, and the workmanship, which appears to belong to the beginning of the 5th century B.C., justifies the esteem in which Etruscan lamps were held in antiquity (Athenæus,

v 700) Of a later but still excellent style is a bronze lamp in the British Museum found in the baths of Julian at Paris (figs 8, 9, 10) The chain is attached by means of two dolphins very artistically combined Under the nozzles are heads of Pan (fig. 8), and from the sides

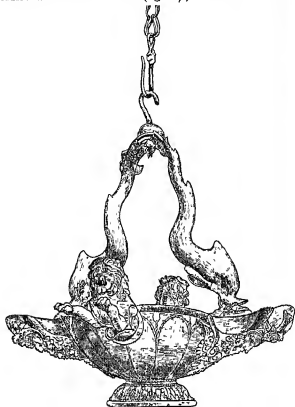


FIG 9 — Bronze Lamp in British Museum

project the foreparts of lions (fig 10) To what extent lamps may have been used in temples is unknown Probably the Erechtheum on the acropolis of Athens was an exception in having a gold one kept burning day and night, as this lamp itself must have been an exception in its artistic merits It was the work of the sculptor Callimachus, and was made apparently for the newly rebuilt temple a little before 400 B.C. When once filled with oil and lit it burned continuously for a whole year The wick was of a fine flax called Carpasian (now understood to have been a kind of cotton), which proved to be the least combustible of all laxes (Pausanias, i 26, 7) Above the lamp a palm tree of bronze rose to the roof for the purpose of carrying off the fumes But how this was managed it is not easy to determine unless the palm be supposed to have been inverted and to have hung above the lamp spread out like a reflector, for which purpose the polished bronze would have served fairly well The stem left hollow would collect the fumes and carry them out through the roof. This lamp was refilled on exactly the same day each year, so that there seems to have been an idea of measuring time by it, such as may also have been the case in regard to the lamp stand (*λύγανος*) capable of holding as many lamps as there were days of the year, which Dionysius the Sicilian tyrant placed in the Prytaneum



Fig 10

of Taientum. At Phais in Achaia there was in the market place an oracular statue of Hermes with a marble altar before it to which bronze lamps were attached by means of lead. Whoever desired to consult the statue went there in the evening and first filled the lamps and lit them, placing also a bronze coin on the altar A similar custom prevailed at the oracle of Apis in Egypt, Pausanias adds (vi 22, 2) At Argos he speaks of a chasm into which it was a local custom continued to his time to let down burning lamps, with some reference to the goddess of the lower world, Persephone (ii 22, 4) At Cnidus a large number of terra-cotta lamps were found crowded in one place a little distance below the surface, and it was conjectured that there must have been there some statue or altar at which it had been a custom to leave lamps burning at night (Newton, *Discoveries at Italica*, &c., ii, p. 394) These lamps are of terra-cotta, but with little ornamentation, and so like each other in workmanship that they must all have come from one pottery, and may have been all brought to the spot where they were found on one occasion, probably the funeral of a person with many friends, or the celebration of a festival in his honour, such as the *parentalia* among the Romans, to maintain which it was a common custom to bequeath property For example, a marble slab in the British Museum has a Latin inscription describing the property which had been left to provide among other things that a lighted lamp with incense on it should be placed at the tomb of the deceased on the kalends, nones, and ides of each month (*Mus. Marbles*, v, pl. 8, fig. 2) For birthday presents terra-cotta lamps appear to have been frequently employed, the device generally being that of two figures of victory holding between them a disk inscribed with a good wish for the new year — *ANNV NOV FAVSTV FELIX* This is the inscription on a lamp in the British Museum, which besides the victories has among other symbols a disk with the head of Janus. As the torch gave way to the lamp in fact, so also it gave way in mythology In the earliest myths, as in that of Demeter, it is a torch with which she goes forth to search for her daughter, but in the late myth of Cupid and Psyche it is an oil lamp which Psyche carries, and from which to her grief a drop of hot oil falls on Cupid and awakes him Terra-cotta lamps have very frequently the name of the maker stamped on the foot Clay moulds from which the lamps were made exist in considerable numbers (A. S. M.)

LAMP-BLACK is a deep black pigment consisting of carbon in a very fine state of division, obtained by the imperfect combustion of highly carbonaceous substances, which, producing a smoky flame, forms a deposit of soot or lamp-black. It is manufactured from scraps of resin and pitch refuse and inferior oils and fats, and other similar combustible bodies rich in carbon For making lamp-black from resinous bodies a cylindrical stone chamber into which the flow of air can be easily regulated by openings at its lower part is used Within the chamber is suspended a cone of sheet-iron fitting closely to the circumference of the chamber The iron cone, which has an opening at the top, serves for a chimney, and can be raised or lowered in the chamber at will The resinous material to be burned is placed in a cast-iron pot, and heated till it gives off vapours, when it is placed in the chamber and set on fire The access of air is regulated to produce the maximum of smoke consistent with the maintenance of combustion The abundant deposit of lamp-black on the walls of the chamber and cone is at the end of the operation collected by allowing the cone to sink, thus scraping the walls and carrying the whole deposit with it. Some manufacturers employ a series of small chambers communicating with each other, a stove tube leading into the first. These chambers have

an opening below by which the deposit of lamp-black is removed, and in the last of the series the best quality is obtained. The finest lamp-black is produced by the combustion of a special form of lamp, the deposit from this being finely divided and lustrous in hue. Lamp-black so collected contains traces of oil, which may be removed by heating to redness in a covered crucible. The oil present, however, is not detrimental to its employment for printing ink and as a pigment for oil painting, which are its principal uses. Further, lamp-black is largely used for "ebonizing" cabinet-work, and in the waxing and lacquering of leather. It is the principal constituent of China ink, and it has numerous other applications.

LAMPEDUSA, a small island in the Mediterranean, about 90 miles east of Mahadia in Tunis, and 100 miles west of Malta, in 35° 28' N. lat. and 12° 26' E. long. Situated on the edge of the submarine platform which extends along the eastern coast of Tunis, it must be considered as attaching itself physically to the African continent, but politically it belongs to the kingdom of Italy, and forms part of the commune of Licata in Sicily. In its 19 miles of coast it presents a great number of bays, of which the largest serves as a harbour, and is capable of admitting vessels of from 300 to 400 tons burden. The highest point of the island is about 330 feet above the sea. There are no springs, and the water obtained from the artificial wells is usually brackish. The soil is mostly calcareous, beds of marl occur here and there on the surface. Vines, fig-trees, carob-trees, and camach are successfully grown, and the wild olive flourishes luxuriantly. Firewood used to be obtained from the island for Malta. Rabbits swarm in all directions. The population in 1871 was 946.

Lampedusa is the Lopedusa of Strabo. In 1555 Andrew Doria anchored the vessels of Charles V at Lampedusa, after an engagement with the Turks. Alphonsus of Aragon made the island a fief of one of his courtiers, who sold it in 1677 to the prince Ferdinand Tommasi. But no permanent settlement seems to have been effected; the place, according to popular belief, was so terribly haunted by apparitions. Sir Konrad Digby relates (1628) that his men told him "there dwell no persons in Lampedusa, but there is a lamp perpetually burning. The Turks have great reverence to the place, and always leave oil or bread or something behind them through devotion, but they know not for whom, and it hath proved very fatal to carry away anything from thence as well to Christians as to Turks." Dumont, who personally visited the island, mentions a "little chapel dedicated to the Virgin, in which there is an altar with a turban laid upon it, which is usually called Mohammed's tomb," and adds the popular belief that any one attempting to carry off the gifts would be miraculously prevented escaping the island. The earl of Sandwich (1787) found Lampedusa with but a solitary inhabitant; and Captain Smyth states that about 1816 it was leased by an Englishman, Fernandez, who lived alone with his family. Ferdinand II. of Bourbon claimed it as Government property, and from 1848 attempts were made to establish a regular colony at the national expense. About £17,000 per annum was expended on the project, but the result was far from satisfactory. The population, introduced from Sicily, remained stationary during twenty years. Catherine II. at one time proposed to purchase Lampedusa for the purpose of making it a Russian naval station.

If it could be shown that Shakespeare derived the material of *The Tempest* from an Italian original, Lampedusa would have very strong claims to be considered the first prototype of the enchanted island. It is the Lapedusa of *Orlando Furioso*, the scene of the shipwreck of Roger of Sicily and of his conversion by the hermit. A Similian legend which forms the subject of Wieland's poem *Klelia und Sindbad*, oder die Bekehrung von Lapedusa, tells how two ladies of Palermo were cast ashore on the island, and found there two hermits who fell so deeply in love with them as to renounce their ascetic life. In Stollan's "the hermit of Lapedusa" corresponds to the English Visor of Bray, lighting up the chapel near his cell with equal readiness for the Crescent or the Cross.

See *Cruina, Porto-Greco*, Basel, 1864; Digby, *Journal of a Voyage into the Mediterranean*, London Society, 1689; Dumont, *Journal de Voyage en Levant*, La Haye, 1784; London, 1798; Captain Smyth, *Minor Description of the Reservoirs of Sicily*, 1854; *Journal of the Voyage of the Challenger*, vol. i, 1868.

LAMPREY, a fish belonging to the family *Petromyzontidae* (from *petros* and *pōion*; literally, stone-anchors), which with the hag-fishes or *Myxine* forms a distinct suborder of fishes, the *Cyclostomata*, distinguished by the low

organization of their skeleton, which is cartilaginous, without vertebral segmentation, without ribs or real jaws, and without limbs. The lampreys are readily recognized by their long, eel-like, scinless body, terminating anteriorly in the circular, suctorial mouth which is characteristic of the whole suborder. On each side, behind the head, there is a row of seven branchial openings, through which the water is conveyed to and from the gills. By means of their mouth they fasten themselves to stones, boats, &c., as well as to other fishes, their object being to obtain a resting place on the former, whilst they attach themselves to the latter for the purpose of deriving nourishment from them. The inner surface of their cup-shaped mouth is armed with pointed teeth, with which they perforate the integuments of the fish attacked, scraping off particles of the flesh and sucking the blood. Mackerel, cod, pollack, and flat-fishes are the kinds most frequently attacked by them in the sea; of river-fish the migratory *Salmonidae* and the shad are sometimes found with the marks of the teeth of the lamprey, or with the fish actually attached to them. About ten species are known from the coasts and rivers of the temperate regions of the northern and southern hemispheres. In Great Britain and Europe generally, three species occur, of which the two larger, if not all three, are met with also in North America, viz., the large spotted Sea-lamprey (*Petromyzon marinus*); the River-lamprey or Lampers (*P. australis*); and the Small Lampers or "Pride" or "Sand-Piper" (*P. branchialis*). The first two are migratory, entering rivers in the spring to spawn; of the river-lamprey, however, specimens are met with in fresh water all the year round. Lampreys, especially the sea-lamprey, are esteemed as food, and were formerly even more so than at present; but their flesh is not easy of digestion. Henry I. is said to have fallen a victim to this, his favourite dish. The species of greatest use to the river-lamprey, which as bait is preferred to all others in the cod and turbot fisheries of the North Sea. Yarrell states that formerly the Thames alone supplied from 1,000,000 to 1,200,000 lampreys annually, but their number has so much fallen off that, for instance, in 1876 only 40,000 were sold to the cod-fishers. That year, however, was an unusually bad year; the lampreys, from their scarcity, fetched £8, 10s. a thousand, whilst in ordinary years £6 is considered a fair price. The season for catching lampreys closes in the Thames about the middle of March. The origin of the name lamprey is obscure; its Latinized form *Lampetra*, which occurs in all ichthyological works of the Middle Ages, was unknown in classical times; and its derivation from *lampers petrus* is a specimen of etymological ingenuity. The development of lampreys has received much attention on the part of naturalists, since Aug. Müller discovered that they undergo a metamorphosis, and that the minute worm-like lampreys previously known under the name of *Ammocoetes*, and abundant in the sand and mud of many streams, were nothing but the undeveloped young of the river-lampreys and small lampreys. See **ICHTHYOLOGY**.

LAMPRIIDIUS, ÆLIUS. See **AUGUSTAN HISTORY**, vol. iii. p. 74.

LAMPESACUS, an ancient Greek colony in Mysia, Asia Minor, known as Pityna or Pityne before its colonization by Ionian Greeks from Phocæa and Miletus, was situated on the Hellespont, opposite Callipolis in Thrace. It possessed a good harbour; and the neighbourhood was famous for its wine, so that, having fallen into the hands of the Persians during the Ionian revolt, it was assigned by their king to Themistocles to provide him with wine, as Perceote did with meat, and Magnesia with bread. After the battle of Mycale (479 B.C.), Lampesacus joined the Athenians, but, having revolted from them soon afterwards,

had to be reduced by force. In the Roman wars against Antiochus of Syria, its inhabitants were received as allies of Rome. Lampascus was the chief seat of the worship of Priapus, and it is related that Alexander the Great was with difficulty restrained from destroying the city on account of the immorality fostered by the obscene rites of that god. The modern Lamsaki is probably not on the site of Lampascus, but must be near it.

Plate
III.

LANARK, an inland county of Scotland, lies between 55° 15' and 55° 57' N. lat., and between 3° 20' and 4° 23' W. long., and is bounded N. by Dumbarton and Stirling, E. by Stirling, Linlithgow, Midlothian, and Peebles, S. by Dumfries, and W. by Ayr, Renfrew, and Dumbarton. Its greatest length north-west to south-east is over 50 miles, and its greatest breadth from east to west over 30 miles. The total area comprises 568,868 acres, or 888 square miles. Though only the twelfth as regards extent, it stands far above all the other Scottish counties in point of population, having 904,405 inhabitants in 1881, or only 18,909 less than the aggregate of the three counties that rank next to it.

The greater part of the county to the east and south, included in what is known as the upper ward, consists of high moorlands frequently rising into lofty rounded hills, in many cases more than 2000 feet above sea-level, the highest summits being Coulter Fell (2456) and Tinto (2350) in Carmichael parish, and Green Lougher (2403), Five Cairn Lougher (2377), Queensberry Hill (2285), Sergeant Law (2257), and several others in Crawford parish, which consists chiefly of a cluster of mountains. The highest inhabited land in Scotland is at Leadhills, a village in the southern extremity of the county, which is about 1300 feet above sea-level. The remainder of the county to the north-west of Tinto softens down to gentle undulations, never rising to an elevation of more than 700 feet, and gradually opening out into the fertile vale of Clyde.

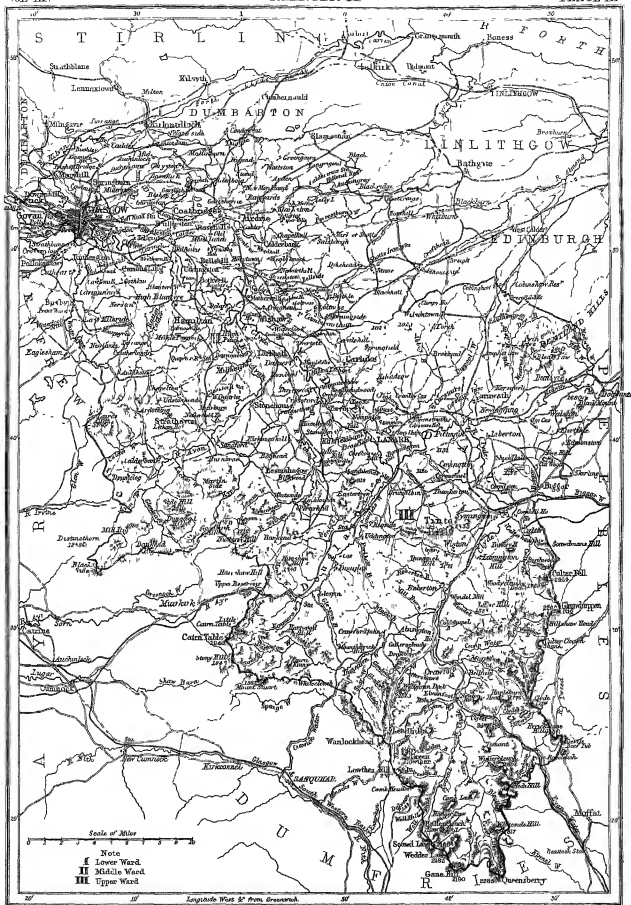
The principal river is the Clyde, which is formed of several streams rising among the mountains that separate Lanark from Peebles and Dumfries near to the sources of the Tweed and Annan, the chief of these streams being the Crook Burn, Fowtroll Water, and Elvan Water. Running almost north, the river is joined by the Glengonner Burn, the Dunston Water, and other streams, after receiving the Medwyn near Carstairs it flows south-west, and then, on being joined by the Douglas Water, it turns abruptly to the north-west—its general direction for the rest of its course. At Bonnington, the first of the famous falls of Clyde, the banks slope gently downwards, and are adorned with lofty trees and leafy shrubbery. The river widens as it reaches the fall, and its course remains uninterrupted until it suddenly descends a precipice 27 feet in height in a broad and unbroken stream. From this point it rolls turbulently along between lofty and precipitous banks of sandstone rocks beautified with wood until it reaches the magnificent fall of Corra, where it rushes over a precipice 85 feet in height into the deep abyss of the loch. Through a deep ravine it reaches a small fall called Dundaff Linn, and after passing a singular piece of rock called "Wallace's Chair," skirts New Lanark and the county town of Lanark. Shortly afterwards it receives the Mounie, which, dashing and foaming from the split rocks of Cartland Crags, adds to the volume of the stream and contributes at the precipice of Stonebyres to form the fourth fall of Clyde. Near the ruins of Craigneath Castle it receives the Nathan, and a little further on the Aron, and then sweeps through the richly wooded hangings of Hamilton past Bothwell to Glasgow, where it becomes navigable. The lochs are few and small, the principal being Bishop Loch between the parishes of Cadder and Old Monkland, Black Loch in New Monkland, and Johnston Loch in Cadder. The Hillend

reservoir for supplying the Forth and Clyde and the Monkland Canals has an area of 307 acres. The Forth and Clyde Canal traverses the north-west corner of the county; the Monkland Canal connects Glasgow with the southern extremity of Old Monkland parish; and the Ardrossan Canal passes by Govan to Renfrew and Ayr.

Geology and Minerals.—Lanarkshire is nearly wholly occupied by the Carboniferous strata forming the coal-field of the Clyde basin. This is almost entirely confined to the county, but portions of it extend into Dumbartonshire, Renfrewshire, and Stirlingshire. The formation rests on traps and ashes associated with the Lower Calciferous Sandstones, which towards the east separate the coal-field from that of the Lothians, and in the west from that of Ayr. The middle portion of the formation, which contains the best coal-seams with blackband and other ironstones, is without limestone, and apparently of freshwater origin, although a bed of marine fossils has been detected in the series near Glasgow. Towards the border on all sides a lower marine series with encinal and coralline limestones crops out. It also contains many valuable coal-seams and veins of ironstone, and, while affording a great variety of marine fossils, possesses a few interpolated beds of estuarine or freshwater origin. The line of junction between this lower series and the Old Red Sandstone occurs in the vicinity of the Falls of Clyde, Lanark, and Carstairs. Besides the older trap rocks, which bound the field to the east and west, others, probably of the same age as the Upper Carboniferous series, rise through and disturb the strata of the interior in many places; and numerous basaltic dykes, which, however, are generally unconnected with faults in the strata, extend through the area of the coal-field in an easterly direction. These, like the other erupted masses, usually alter the strata with which they come into contact, converting coal into coke and clay into Jasper, and highly indurating the shales and sandstones. The isolated coal-field of Lesmahagow, about 7 miles square, is nearly surrounded by Old Red Sandstones, upon which also the coal rests.

The amount of coal available in the Lanark coal-field is estimated at 2,044,000,218 tons, slightly less than that in the Midlothian coal-field, and less than a fourth of that available in Scotland. The mines lie scattered over a considerable area, but the principal coals are in the districts between Glasgow, Hamilton, and Airdrie. The coal-field is perhaps best developed in the neighbourhood of Hamilton, the seam being rich and easily reached; and the famous Walsaw "all coal" is there found in its best state. There is a valuable seam of gas coal at Lesmahagow; this is also frequently associated with blackband ironstone. The number of shafts or pits from which minerals were raised in 1880 was 452, and connected with these 35,882 persons were employed underground and 5355 on the surface. The gross amount of minerals raised was 11,071,064 tons, nearly one-half of the whole amount raised in Scotland. The total amount of coals raised was 10,285,909 tons, of ironstone 757,291, of freestone 195,419, of oil shale 95,850, of limestone 50,410, of lead ore 1801, and of granite 1295. The lead-mines are at Leadhills in the parish of Crawford. From the ore silver to the extent of 6 lb 12 oz to the ton is obtained. Copper ore is found in the mines, and also antimony, but the quantity does not repay the cost of mining. The gold-mines are said to have been discovered in the reign of James IV., and it is stated that in 1549 as many as 800 persons were employed in connexion with the industry, and that upwards of £100,000 sterling value was collected. The gold-field extends over an area of 25 miles by 12, but it is only in the neighbourhood of the lead-mines that gold is found in considerable quantity. It does not, however, repay the labour of search and washing. Freestone and sandstones are abundant.

Agriculture.—The upper ward of Lanarkshire consists principally of moorland, even where the land is not too elevated to admit of successful tillage. The climate of this district is variable, and the rainfall considerable. Wheat is grown in the lower valleys, but the cereals best adapted for those portions of the district where grain is cultivated are oats and barley. In the higher grounds potatoes and Scotch kail are almost the only vegetables grown. Some



portions of this district, on the borders of the Clyde, are however, very fruitful. The feeding of cattle and dairy and sheep farming are largely followed. Generally twenty-five to thirty cows are kept, but on some farms most attention is directed to the rearing of cattle or sheep. Several large sheep farms are occasionally held by one tenant. In the middle ward the land is generally stung clay, with the exception of the alluvial deposits on the banks of the Clyde. A large portion of it is occupied by peat, and the presence of coal-pits has in many instances deteriorated the soil. In this district oats and barley are

the principal crop. The banks of the Clyde have been occupied with orchards since the days of the Venerable Bede. Apples, pears, and plums are largely grown, but of late years more attention has been paid to gooseberries, currants, and strawberries. The district of the lower ward is much exposed to westerly breezes, but though humid is warm, severe frosts being seldom of long duration. It is very highly cultivated, its proximity to Glasgow having greatly stimulated improvements.

The following table gives a classification of holdings in 1876 and 1880.—

Years.	60 Acres and under		From 60 to 100 Acres.		From 100 to 200 Acres.		From 200 to 500 Acres		From 500 to 1000 Acres.		Above 1000 Acres.		Total	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1876	1,463	22,624	713	64,245	854	134,066	64	28,826	13	3,840	1	1,592	3,107	244,572
1880	1,406	23,551	694	62,584	880	182,292	76	28,788	13	8,597	1	1,874	3,101	247,141

The largest farms are in the upper ward, where they generally vary from 100 to 500 acres, although the largest number are between 100 and 200 acres.

According to the agricultural returns for 1881 the total area under crops was 247,777 acres, a percentage of 48.5, the percentage in 1870 being 41.3. The area under corn crops was 59,976 acres; under grain crops, 19,578, rotation grasses, 63,861; permanent pasture, 118,407. The area under woods was 16,780 acres; orchards, 531, market gardens, 310; and nursery grounds, 89. Of corn more than four-fifths of the area was under oats, which in 1881 occupied 44,982 acres, while only 3790 were under wheat, 1408 beans, and 682 barley. Potatoes were grown on 9427 acres, turnips and swedes on 8552, and vetches on 1321.

The total number of horses in 1881 was 7765, of which 5611 are stated to be used solely for purposes of agriculture, and 2154 to be unbroken horses and mares kept for breeding purposes. The celebrated Clydesdale draught horses are supposed to have been bred from Flanders horses, imported in the 17th century by one of the dukes of Hamilton. The number of cows in 1881 was 23,730, of other cattle two years of age and above 10,869, and under two years of age 19,557. The average number of cattle to every 100 acres under cultivation is 2.8, the average for Scotland being 2.3. The cows are principally the Ayrshire breed, but there is also a cross between the Ayrshire and the improved Lanark. The best cheese is made in the Curmawth and Leamnahagow districts. Sheep in 1881 numbered 205,593, an average of 84.2 to every 100 acres under cultivation, the average for Scotland being 141.8. Hags, which are largely kept by the coal-miners, numbered 5766.

According to the owners and heritages return, 1879-78, the land was divided among 9717 proprietors, and amounted to 658,097 acres, with a gross annual value, including minerals, of £1,786,268. Of the owners 7927, or 81 per cent., possessed less than 1 acre, and the average value per acre was £28. 5s. 8d. There were seven proprietors who owned upwards of 10,000 acres, viz., the countess of Home, 61,948 acres; the duke of Hamilton, 46,781 acres; Sir Simon Macdonald Lockhart, 31,656; Sir Thomas R. Colclough, 29,604; the earl of Hopkirk, 19,180; Sir Wincham Anstruther, 18,624; and A. D. W. Baillie Colquhoun (now Lord Leven), 10,883. The duke of Buccleuch possessed 9091 acres, and Colonel Buchanan 8549.

Manufactures.—In 1879 there were 814 iron-works, 5146 puddling furnaces, and 849 rolling mills. These are chiefly situated in the neighbourhood of Ayrshire, Coatbridge, Wishaw, Leamnahagow, and Glasgow. The principal other manufactures—cotton, flax, and silk—are connected chiefly with Glasgow, by which article the reader is also referred for details regarding shipping and ship-building.

Railways.—Both the North British and the Caledonian systems have numerous lines and branches, both for general traffic and for minerals, supplying the county generally with ample railway communication.

Population.—Owing to the rapid development of the manufacturing and mining industries of the county, and especially to the fact that a great portion of Glasgow is included within its limits, the increase of the population since the beginning of the century has been very great. From 147,692 in 1801 it had increased in 1881 to 316,819, in 1861 to 680,190, in 1871 to 766,889, and in 1881 to 904,406, of whom 449,192 were males and 455,214 females. The county includes the greater part of the parliamentary burgh of Glasgow (population in 1881, 487,948), the parliamentary burghs of Airdrie (18,868), Hamilton (18,997), Lanark (4908), and Rutherglen (11,265). Glasgow, Lanark, and Rutherglen are also royal burghs, and in addition to Airdrie and Hamilton the police burghs are Biggar (1656) in the upper ward; Wishaw (15,115) and Motherwell (15,911) in the middle ward; and Govan (49,448), Hillhead

(6683), Maryhill (12,616), Partick (27,896), and Gornhill (9634) in the lower ward immediately adjoining Glasgow. The other towns are Baillieston, Bollshead, part of Busby, Cumbernauld, Cambuslang, Carlinke, Coatbridge (population 18,425), Holytown, Larkhall, Leamnahagow, Newnams, Shettleston, Stonehouse, Strathaven, and Whitist. There are also over seventy villages, the majority numbering over 500 inhabitants, and very many under 1000.

Administration.—The county comprises forty-nine parishes and two parts of parishes. For purposes of county taxation it is divided into an upper, a middle, and a lower ward, and the middle ward has also been lately divided into two districts for police purposes. The county is represented in parliament by two members, one for the northern division and one for the southern division.¹ The city of Glasgow returns three members, while Lanark, Hamilton, and Airdrie are included in the Falkirk district of burghs, and Rutherglen in the Renfrewshire district. A sheriff ordinary court is held at Glasgow, and sheriff courts are held at Lanark, Airdrie, and Hamilton.

History and Antiquities.—Lanarkshire at an early period was inhabited by a Celtic tribe, the *Demoni*, whose territory was divided by the Roman wall of Antonine between the Forth and Clyde, but neither of whom were ever fully subdued by the Romans. Traces of these early inhabitants are still to be seen in remains of fortifications, mounds, and circles, and numerous stone-axes, bronze calts, hand-mills, and urns belonging to the same period have also been dug up. Two Roman roads entered the county from Dumfriesshire, one after the other, the first junction near Crawford proceeded by Biggar, Carstairs, and Carlinke, being joined at several points by others. Along the route of the roads there are many traces of camps and fortifications, and camps and other relics are frequently found. After the departure of the Romans, a district of country which included Lanarkshire was united into the kingdom of Strathclyde, which in the 7th century was subdued by the Saxons of Northumbria, large numbers, however, of the Celtic population migrating to Wales. Formerly Lanarkshire included a portion of Renfrew, but this was disjoined in the time of Robert III. Lanark at the same time was divided into two wards, the upper and the lower, with Lanark and Rutherglen as the chief towns in each ward. The division into three wards—upper, middle, and lower—took place in the last century. Among the more important events of later history connected with the county are the battles of Drumclog in the parish of Arvanoda, 1st June 1679, in which the Covenanters defeated Graham of Claverhouse, and of Bothwell Bridge at Bothwell near Hamilton on the 22d June of the same year, in which the Covenanters were defeated by the duke of Monmouth with great slaughter. The principal buildings of interest besides those noticed in the separate articles on particular towns, are the ruins of Blantyre Priory, the remains of the ancient Douglas Castle, Craigentinny Castle (the Tulliehouse of Sir Walter Scott, where Mary Queen of Scots found refuge after her escape from Lochleven), and Bothwell Castle. See Irving's *History of the Upper Ward of Lanarkshire*, 3 vols., 1864.

¹ The parishes comprised in North Lanarkshire are the following:—**Lower Ward:** Barony, Cadder, Carmichael, Cathcart (part), city parish of Glasgow, Govan (part), and Rutherglen; **Middle Ward:** Arvanoda, Blantyre, Bothwell, Cambuslang, Delnate, East Kilbride, Glasgow, Hamilton, New Monkland, and Old Monkland. The following parishes comprise South Lanarkshire:—**Middle Ward:** Cambuslang, Dalzell, Shotts, and Stonehouse; **Upper Ward:** Biggar, Carlinke, Carmichael, Curmawth, Carstairs, Covington and Thankerton, Crawford, Crawfordjohn, Oulter (part), Dolphinton, Douglas, Dumyarn, Lanark, Leamnahagow, Liberton, Moffat (part), Peishead, Symington, Walslow, Wenden and Lexington, and Winton and Robertson.

LANARK, a royal and parliamentary burgh, the chief town of the above county, is situated on a slight eminence near the Clyde, 32 miles south-west of Edinburgh, and 26 south-east of Glasgow. It consists principally of one main street, which is spacious and well-paved. The industries are hand loom weaving and nail making. In the neighbourhood there are extensive oil-works. The county buildings, in the Grecian style, were erected in 1836, and the assembly-rooms, erected in 1827, occupy the site of an old Franciscan monastery. The population of the town in 1871 was 5099, and in 1881 it was 4908.

A parliament was held by Kenneth III. at Lanark in 978, and occasionally it was the residence of the Scottish kings. Its charter is said to have been bestowed by Alexander I. It was more than once the scene of the exploits of William Wallace. New Lanark, a manufacturing village situated on the Clyde about a mile distant, is famous for its connection with the communistic projects of Robert Owen.

Plata
IV.

LANCAIRE, or COUNTY OF LANCASTER, a maritime county in the north-west of England, lies between 54° 40' and 55° 33' N. lat., and between 3° 16' and 1° 68' W. long. A detached portion in the north, known as Furness, is situated between Cumberland and Westmoreland. The remainder of the county, separated from Furness by Morecambe Bay, is bounded N. by Westmoreland, E. by Yorkshire, S. by Cheshire, and W. by the Irish Sea, which forms also the southern boundary of Furness. The outline of the county is irregular. Its greatest length is 76 miles; south of the Ribble the average breadth is about 40 miles, while to the north it is only about 10 miles. The total area is 1,207,926 acres, or 1887 square miles. With the exception of a narrow tract of country along the south coast, the Furness division consists of hilly moorlands, a continuation of the Cumberland mountains, intersected by deep valleys. The highest summits of this region are Conistown Old Man (3633 feet) and Seathwaite Fell (2837 feet). A similar elevated district, forming part of a mountainous chain stretching from the Scottish border, runs along the whole eastern boundary of the main portion of the county, and to the south of the Ribble occupies more than half the area, stretching west nearly to Liverpool. The moorlands in the southern districts are covered chiefly with heather. Towards the north the scenery is frequently picturesque and beautiful, the green rounded elevated ridges being separated by pleasant cultivated valleys variegated by woods and watered by rivers. None of the summits of the range within the boundaries of Lancashire attain an elevation of 2000 feet, the highest being Blackstone Edge (1323 feet), Pendle Hill (1831 feet), and Bowsforth Hill (1700 feet).

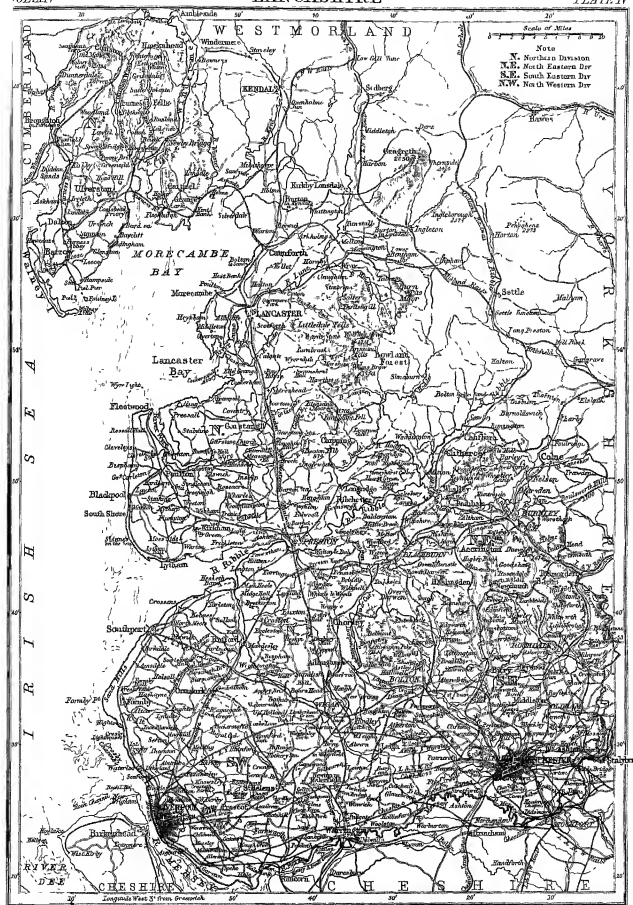
Along the sea-coast from the Mersey to Lancaster there is a continuous plain occupied at one time by peat mosses, many of which have, however, been reclaimed. The largest is Chat Moss between Liverpool and Manchester. In some instances these mosses have exhibited the phenomenon of a moving bog. A large district in the north belonging to the duchy of Lancaster was at one time occupied by forests, but these have wholly disappeared. The coast is very irregular in outline, the principal inlets being the estuaries of the Mersey and Ribble, Lancaster Bay, and Morecambe Bay. To the south of Furness, between Morecambe Bay and the estuary of the Duddon, there is a small group of islands, the largest of which is Walney, 9 miles long, and with a breadth varying from a quarter to three-quarters of a mile. The principal river is the Mersey, which divides the county from Cheshire, and flowing by Stockport and Warrington opens into a fine estuary before reaching the sea at Liverpool. It drains an area of 680 square miles, and receives on its north bank the Irwell and the Sankey. For large vessels it is navigable to Warrington, and for smaller vessels to Stockport, the Irwell being navigable to

Manchester. The Ribble, which rises in the mountains of the West Riding, forms for a few miles the boundary between Lancashire and Yorkshire, and then flows south-west to Preston, receiving the Hodder from the north and the Calder and Darwen from the south. The Wyre enters Morecambe Bay at Fleetwood. The Lune rises in Westmoreland, and falls into the sea at Lancaster Bay. The Winstar separating Lancashire and Westmoreland, the Leven from Lake Windermere, the Onke from Lake Conistown, all flow south into Morecambe Bay, and the Duddon forming the boundary of the county with Westmoreland enters the Irish Channel. Windermere, the largest and most beautiful of English lakes, is partly included in the county. Some miles to the west and parallel with Windermere is Conistown Lake, 6½ miles long and 2 miles broad; and between the two larger lakes is Seathwaite Water, 12 miles in length by half a mile in breadth.

About the middle of last century the Sankey Canal, 10 miles long, the first in Britain, was constructed to bring coals from St Helens to Liverpool. Shortly afterwards the duke of Bridgewater projected the great canal, completed in 1761, from Manchester across the Irwell to Worsley. The Leeds and Liverpool Canal, begun in 1770, connects Liverpool and other important towns with Leeds by a circuitous route of 130 miles. The other principal canals are the Rochdale Canal, the Manchester Canal, between Manchester and Huddersfield, the Lancaster Canal, and the Ulverston Canal.

Geology and Minerals.—The greater part of Furness is occupied by slaty Silurian rocks belonging to the mountain formations of Cumberland and Westmoreland. This is mingled occasionally with Carboniferous Limestone, and in the lower region along the coast there is an Old Red Sandstone district and also a very rich deposit of iron ore. To the north of the Lune the country is occupied with Carboniferous Limestone. Near the sea are some low Old Red Sandstone cliffs, and the formation is also seen on the borders of Westmoreland, near Kirkby Lonsdale. South of the Lune the greater part of the higher ground is formed of Millstone Grit. Along the valley of the Mersey there is an extensive bed of New Red Sandstone, containing rock-salt, and the same formation occurs along the western boundaries of the county, but it is covered for the most part by the glacial drift deposits, which occupy nearly all the low ground, and in some cases fill up the valleys between the mountains. The coal-field of Lancashire occupies an irregular area of 217 square miles lying between the Ribble and the Mersey, its length being about 30 miles and its average breadth about 7 miles. The field extends into Cheshire and North Wales, and is separated from the Yorkshire field by the Millstone Grit which crops out beneath the Coal-measures. To the south of the Lune, near Ingletown, there is also a small coal-field which extends into Yorkshire. The upper Coal-measures consist chiefly of shales, sandstones, and limestones, with a bed of blackband ironstone. The middle measures contain a considerable variety of workable seams, the lowest being very valuable, and there is an important mine of cannel coal. The lower measures consist of flags, shales, and thin seams of coal, with garnetiferous floors and roofs of slate. This coal is extensively mined in the mountain districts to the north-east of the bed. The coal district is traversed by immense dislocations which divide the field into several belts. Nearly all the marine fossils obtained are molluscs allied to *Anthracosia*, with the exception of a remarkable series obtained on the banks of the Tame near Ashton-under-Lyne.

The available coal supply of Lancashire is estimated at 8,165,000,000 tons. The amount raised in 1863 was 8,236,000 tons; in 1871 it was 13,861,000 tons, but for several years it



has exceeded 18,000,000 tons, and in 1880 reached 19,120,204 tons. The amount of coal carried from Lancashire is about 11,000,000 tons, of which about 7,000,000 tons are shipped. The produce of the West Lancashire coal-field in 1880 was—coal 9,600,486 tons, freelay 18,960 tons, and iron 1840 tons, the latter being obtained from the rubbish and ore of the pits. The coal is produced in the neighbourhood of Wigan, St Helens, and Prescott, and the freelay in the St Helens district. In the North and East Lancashire district 9,619,866 tons of coal were raised, 110,876 tons of freelay, 4880 of alum shale, and 679 of copperas lumps. Through the kindness of Mr Joseph Dickinson, inspector of mines for this district, we are enabled to give the produce of the field in seven principal divisions, viz.—(1) the small detached field of Lunedale (lower series of measures), coal 410 tons; (2) the Burnley coal-field (lower and middle series), coal 1,058,015, freelay 10,276; (3) an adjoining field lying south-east of a line drawn from Chorley to Blackburn (lower series), coal 958,274, freelay 45,749; (4) a group lying further south-east and extending to Bump, Rochdale, and Littleborough (lower series), coal 808,388, freelay 13,298; (5) the part west of Chorley and southwards adjoining the Wigan coal-field (lower series), coal 2,930,027, copperas lumps 679; (6) the part east of the former division (middle and upper series), coal 4,789,495, freelay 19,217; (7) the extreme south-east part south of Rochdale, and east of the city of Manchester (lower and middle series), coal 960,249, freelay 16,836, alum shale 4830. Rich red hematite iron is obtained in great abundance in the district of Furness, the quantity raised in 1871 being 923,045 tons, and in 1880 it was 1,185,543 tons. Only a small quantity of sulphur is raised, 20,000 tons in 1876, valued at £900. Some copper is obtained in the Furness district, but the total quantity of ore raised in 1880 was only 442 tons. There are in various districts of the county large quarries for freestone and flagstone, the quantity raised in 1880 being 2404,070. A fine blue slate is obtained in Furness. As much as 3978 tons of hydraulic limestone was in 1880

dag out of the Arncliffe mine near Manchester. There is a mine of native oxide of iron at Warton, near Cornforth, from which, in 1880, 189 tons were obtained. Lead-ore and zinc ore are being exploited between Clitheroe and Chathburn, and rocksalt at Preaton near Fleetwood.

Climate and Agriculture.—The climate in the hilly districts is frequently cold, but in the more sheltered parts lying to the south and west it is mild and genial. From its westerly situation and the attraction of the mountains there is a very high rainfall, an average of nearly 50 inches annually being reached in the mountainous districts, while the average for the other districts is about 35. The soil after reclamation and drainage is fertile; but, as it is for the most part a strong clayey loam, it requires a large amount of labour. In some districts it is more of a peaty nature, and in the Old Red Sandstone districts of the Mersey there is a tract of light sandy loam, which is easily worked, and well adapted for wheat and potatoes. A considerable portion of country is still under peat, but the reclamations within late years have been very large, and at the same time great advances have been made in the methods of culture. In some districts the ground has been rendered unfit for agricultural operations by the rubbish from coal-pits. A very large area is in pasturage, and dairy farming, owing to the populous character of the district, is very common.

The following table gives a classification of holdings according to size in 1875 and 1880. —

Years.	50 Acres and under		50 to 100 Acres.		100 to 500 Acres		500 to 1000 Acres.		Above 1000 Acres		Total			
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.		
1875	18,310	299,109	2,878	203,619	1,468	226,184	74	26,898	12	8,070	1	2,195	22,688	784,006
1880	17,438	286,009	8,077	219,412	1,562	236,174	104	31,655	13	8,582	1	2,728	22,170	783,408

Nearly all the yearly tenants are subject to two years' notice to quit. Great freedom is allowed in regard to rotation and to sale of produce, and it is a frequent custom to sell hay and straw, and to purchase artificial manure for the meadow lands to about one-third of the value sold. According to the agricultural returns for 1881 the total cultivated area was 787,782 acres, a percentage of 46.15 raised of 1876, 47.70. The principal crops were corn, 101,461 acres; under green crops, 69,971; rotation grasses, 68,887; and permanent pasture, 560,148, more than two-thirds of the whole under cultivation. Only 2578 acres were fallow. Of the area under corn crops 69,878 acres, or considerably more than the half, were occupied with oats, wheat coming next with 20,469 acres, while barley occupied 11,569. The large area of 42,869 acres was under potatoes, turnips and swedes occupying 10,867 acres.

The total number of horses in 1881 was 88,484, of which 24,567 were used solely for agricultural purposes. Cattle numbered 222,938 (123,669 being cows), an average of 18 to 1 every 100 acres under cultivation. They are mostly polled Suffolk, red, Yorkshire, and Leicester. Sheep numbered 284,317, an average of 28 to 1 every 100 acres under cultivation, the average for England being 62 to 1. Cheviots are kept on the higher grounds, on the low grounds Southdowns and Leicesters. Pigs in 1881 numbered 37,700.

The county in 1872-78 was divided among 48,768 proprietors, possessing 1,011,798 acres, with an annual valuation of £18,878,377. Of the owners 76,177, or 87 per cent., possessed less than 1 acre, and the average value, including mineral, was £13, 14s. 4d. per acre. Nineteen proprietors owned upwards of 5000 acres, the largest proprietor being the earl of Downy, who possessed 47,898 acres, with a rental of £186,735. Among other large proprietors were the duke of Bridgewater's trustees, the duke of Devonshire, the Marquis de Castelnau, the earl of Stamford and Warrington, the earl of Wilton, the earl of Sefton, Lord Lilford, and Lord Eskdale.

Manufactures.—Lancashire is the principal seat of the cotton manufacture, not only in England, but in the world. The history of the industry in the county, and statistical details regarding it, will be found in the article Cotton, vol. vi 489 sq. In 1876 the total number of factories was close on 2000, and the number of persons employed in these was nearly 870,000. The centre of the industry is Manchester and the neighbouring towns, especially Oldham.

Previous to the American war it employed nearly 100,000 more persons than at present. The woollen, silk, and linen manufactures employed in 1879 about 60,000 persons. There are a great variety of industries dependent on these staple manufactures, such as bobbin making, the preparation of dyes, calico printing, and the manufacture of machinery and of steam engines. Barrow-in-Fur-

ness is noted for the manufacture of iron and steel. Warrington has a large trade in sole leather and in the celebration of its crown, sheet, and plate glass, and Prescott for its watches. Chemicals are largely manufactured in several towns. The principal seaports are Liverpool, Barrow, Ulverston, Lancaster, Fleetwood, and Preston, to the separate articles on which the reader is referred for particulars regarding shipping. The population of the county has principal watering-places are Blackpool, Lytham, Morecambe, and Southport.

Railways.—The London and North-Western, Midland, and Lancashire and Yorkshire Railways pass through the county, and it is intersected in all directions by a network of branch lines. *Population and Administration.*—The population in 1881 was more than five times as great as in 1801. In that year it was 678,486, or only a little more than the population of Liverpool at the present time. In 1861 it amounted to 2,429,440, in 1871 to 2,910,496, and in 1881 to 3,464,225, of whom 1,667,979 were females and 1,796,246 males. The population of the northern parliamentary division was 978,417, of the north-eastern division 288,544, of the south-eastern 634,968, and of the south-western division 482,148, — the population outside the limits of parliamentary boroughs being just 1,626,073, and that of the parliamentary boroughs 1,938,152. Liverpool (629,485) is represented by three members, Manchester (population of municipal borough 841,508, of parliamentary division 868,676) by three members, Salford (176,288) by two, Oldham (mun. 111,848, parl. 162,611) by two, Bolton (mun. 105,426, parl. 105,978) by two, Preston (mun. 98,583, parl. 92,307) by two, Blackburn (mun. 104,014, parl. 100,618) by two, Wigan (45,199) by two, Burnley (mun. 56,887, parl. 58,009) by one, Rochdale (68,866) by one, Bury (mun. 61,583, parl. 49,746) by one, Ashton-under-Lyne (mun. 67,027, parl. 48,388) by one, Warrington (mun. 41,456, parl. 46,867) by one, and Clitheroe (mun. 10,777, parl. 14,469) by one. As each division of the county has also two members, the total representation for the county is thirty-two members. The parliamentary boroughs of Stalybridge and Stockport are chiefly in Cheshire. The other principal municipal boroughs are Accrington (81,486), Barrow-in-Furness (47,111), Blackpool (14,448), Bockle-cum-Lancaster (27,112), Horwich (28,050), Lancaster (20,764), Over Darwen (20,747), St Helens (67,284), Southport (99,121), Salford and Pendleton (18,108), and Todmorden, chiefly in Yorkshire (26,881). There are besides a large number of other towns of over 10,000 inhabitants. The county palatine comprises six hundreds. It is attached to the duchy of Lancaster and so to the crown. It is in the northern circuit, and assizes are held for North Lancashire at Lancaster, and for South

Lancashire at Liverpool and Manchester. The county has one court of quarter sessions, and is divided into twenty occasional divisions. The city of Manchester and the boroughs of Bolton, Liverpool, and Wigan have commissions of the peace and separate courts of quarter sessions, and the boroughs of Ashton-under-Lyne, Blackburn, Bury, Lancaster, Oldham, Preston, Rochdale, Salford, and Warrington have commissions of the peace. There are ten police divisions. Most of the municipal boroughs have their own police. The county is chiefly in the diocese of Manchester, formed in 1847, but the northern portion of Furness is in Carlisle, a portion formerly in Chester is now part of the newly formed diocese of Liverpool, and a small portion adjoining Yorkshire is in Ripon. The shire of the duchy of Lancaster, with a crown office, was at one time a court of appeal for the shire of the county palatine, but now even its jurisdiction in regard to the estates of the duchy is merely nominal. The shire of the county palatine has concurrent jurisdiction with the High Court of Chancery in all matters of equity within the county palatine, and independent jurisdiction in regard to a variety of other matters.

History and Antiquities.—Before the Roman invasion Lancashire formed part of the extensive northern province of the Brigantes, of whose occupation a few names and earthworks are the chief remains. The Romans held the district for three centuries and a half, and erected various camps or stations at Manchester, Ribchester, Lancaster, Colne, &c. They also constructed various roads, one entering the county at Warrington, and passing almost north to Carlisle. Manchester appears to have been the chief centre of this district, as the roads branched out thence in every direction.—into Cheshire by Stockport, by Stretford, and by Warrington, to Yorkshire by Lathom or by Overborough near Colne, by Ribchester to Lancaster, by Kirkham to the Wyre, and by Westhaughton and Blackrod to Preston. The Roman remains found within the county are thus summarized by Mr. W. P. Watkin in the *Transactions of the Historic Society of Lancashire and Cheshire* for 1880, p. 80:—

"Excluding perhaps Northumberland, I doubt whether any English county has produced so many elaborate articles in the precious metals and in bronze as the Roman province. The silver arm from Littleborough, near Manchester and Overborough, the gold rings from Skelthorpe, the silver cup from Eborac, the 'Yeh' 'am' of silver articles from Wainwright, the bronze shield from Kirkham, the small ring with the gold chain from the same place, form an almost unequalled collection of British-Roman works of art."

After the departure of the Romans Lancashire was included in the kingdom of Strathclyde for some time retained its independence, but, although King Arthur, according to some authorities, fought several battles against them on the banks of the Douglas at Wigan, the Saxons gradually occupied the whole county, and during the Heptarchy it formed part of the kingdom of Northumbria. How extensive was their occupation may be judged of from the Saxon names of towns and villages remaining to the present day. Towards the end of the 9th century, however, the Danes invaded and permanently settled in the Furness district, and also in the south-west coast of the county, and in the opposite peninsula of Wirral in Cheshire, in all which places many Danish names of villages are still found.

In Domesday the portion of Lancashire between the Ribble and the Mersey was included in Cheshire and the remainder in Yorkshire. A great part of the lands between the Ribble and Mersey was granted by the Conqueror to Roger de Poitou of the family of Montgomery. It was then conferred by Henry I. on Stephen de Blois, afterwards king, on the demise of whose brother William it reverted to the crown, and was granted to one of the earls of Chester. That line becoming extinct in 1282, it passed to William de Ferrers, and after the second revolt of Robert de Ferrers, King Henry III. granted it to the younger Henry de Lacy, Crouchback, and with it the earldom of the county. (See *LANCASTER, HOUSE OF*.) In 1261 the county became a palatinate, and again, after sixteen years' abeyance, in 1377. Henry IV., soon after ascending the throne, passed an Act declaring that the inheritance and title of the duchy of Lancaster should remain to him and his heirs for ever a distinct and separate inheritance from the lands and possessions of the crown, and from the reign of Henry V. the sovereigns of England have held the duchy, as well out of as within the county palatine. At the Reformation most of the leading families of the county adhered to the Catholic faith, and a few, as the Bunsells of Little Crosby and the Howes of Heyton, were left it. During the civil wars they were ardent supporters of the royalist cause, especially the Derby family, and the county was frequently the scene of sieges, as at Manchester, Liverpool, Warrington, Lathom House, &c., and of battles, as at Atherton Moor, Wigan, Preston, and Winwick.

The Cistercian abbey of Furness is perhaps one of the finest and most extensive ecclesiastical ruins in England. Whalley abbey, first founded at Stanlaw in Cheshire in 1178, and removed in 1296, belonged to the same order. There was a priory of Black Canons at Burnage, founded in the time of Richard I., one at Conishead dating from Henry I. and one at Lancaster. A convent of Augustinian friars was founded at Cartmel in 1138, and one at War-

ington about 1260. There are some remains of the Benedictine priory of Upholland, changed from a college of secular priests in 1218; and the same order had a priory at Lancaster founded in 1064, a cell at Lytham, of the reign of Richard I., and a priory at Penwortham, founded shortly after the time of the Conqueror. The Premonstratensians had Cockersey Abbey, changed in 1160 from a hospital founded in the reign of Henry II., of which the chapter-house remains. At Kersal, near Manchester, there was a cell of Cistercian monks founded in the reign of John, while at Lancaster there were convents of Dominicans and Franciscans, and at Preston a priory of Grey Friars built by Edmund, earl of Lancaster, son of Henry III.

Besides the churches mentioned under the several towns, the more interesting are those of Aldingham, Norman doorway, Aughton; Cartmel priory church, with choir and transepts of the Transition between Norman and Early English, south chapel decorated, and nave and windows Perpendicular; Hawkehead; Hoysall, Norman with traces of Saxon; Hoole; Hytton, Kirkby, rebuilt, with very ancient font; Kirkby Ireleth, late Perpendicular, with Norman doorway, Leyland; Melling (in Lonsdale), Perpendicular, with stained glass windows; Middleton, rebuilt in 1524, but containing part of the old Norman church and several monuments; Osmickip, Perpendicular with traces of Norman, having two towers one of which is detached and surmounted by a spire, Overton, with Norman doorway, Radcliffe; Norman, Burton, Perpendicular, with fine brass and recumbent figures of the Molyneux family, also a screen exquisitely carved; Skid, near Ribchester, Norman arch and old monuments; Trawell, late Perpendicular; Upholland priory church, Early English, with low masonry tower; Unsworth, Norman, with embattled tower and several old monuments, Walton, anciently the parish church of Liverpool, Decorated and Perpendicular, with Runig stone monuments.

The principal old castles are those of Lancaster, noticed below; Dalton, a small rude tower occupying the site of an older building, two towers of Gleanston Castle, built by the lords of Aldingham in the 14th century; the ruins of Greenhalgh Castle, built by the first earl of Derby, and demolished after a siege by order of parliament in 1645; the tower of Knollyn in Peel Island near the entrance to Barrow, erected in the reign of Edward III., now a most dilapidated ruin, but "massive, great, and impressively solemn." There are many old timber houses and mansions of special interest, as well as numerous modern seats.

The printed histories of Lancashire are those by Edward Baines (1826, 94 et seq.), edited by Harland, 1868-70; and by Thomas Lister (1868-69). Many interesting papers on special subjects will be found in the 110 volumes issued by the Cheshire Society, instituted in 1868, and in the 10 volumes of *Transactions of the Lancashire and Cheshire Historic Society*, also in the *Falstaff Note-Book* for 1881. For a fuller list of the bibliography of the county and its several towns see *Falstaff Note-Book*, 1881, and *Lancashire and Cheshire Authors*, 1876, and Anderson, *Topography of the United Kingdom*, 1881.

LANCASTER, a municipal borough and seaport town, the capital of Lancashire, England, is situated on the left bank of the river Lune, about 7 miles from its mouth, and on the London and North-Western Railway, 52 miles north-west of Manchester. It is built on the slope of an eminence crowned by the old castle and church, and commanding fine views of the river and surrounding country. The older portion of the town is irregularly built, but of late years it has been much improved by the formation of new streets; and the sanitary and other arrangements are complete and satisfactory. The Lune is crossed by a bridge of five arches erected in 1786, and to the north of the town the Lancaster Canal is conveyed over the river by a handsome aqueduct. The ancient castle occupies the site of a Roman *castrum*. The Saxon foundations of a yet older structure still remain, and the tower at the south-west corner is supposed to have been erected during the reign of the emperor Hadrian. The Dungeon Tower, also supposed to be of Roman origin, was taken down in 1818. The greater part of the old portion of the present structure was built by Roger de Poitou, who, however, utilized some of the old Roman towers and the old walls in its erection. In 1322 much damage was done to the castle by Robert Bruce, whose attack it successfully resisted, but it was restored and strengthened by John of Gaunt, who added the greater part of the Gateway Tower as well as turrets to the Lunges Tower, which on that account has been named "John of Gaunt's Chair." During the wars of the Commonwealth the castle was captured by Cromwell. Shortly afterwards it was converted into the county jail,

and the building now includes the governor's house and the crown and justus courts. To the north-east of the castle is the church of St Mary, in the Early English style, originally erected by Roger de Poitou, but partly rebuilt in 1759, when the present lofty tower was added. The church contains several old monuments and brasses. A large Gothic Roman Catholic church, with a convent and schools adjoining, was erected in 1858, and there are also several other churches and chapels of some architectural pretensions. There is a grammar school, completed in 1865. Among the charitable institutions are the county lunatic asylum, the Ripley orphan hospital, opened in 1864, erected and endowed at a cost of £100,000, the dispensary and infirmary instituted in 1781, and the Royal Albert asylum for idiots and imbeciles. The town possesses a large market and a handsome town-hall. The principal industries of the town are cotton and silk spinning, cabinetmaking, and the manufacture of oil-cloth table-covers, and there are also iron-foundries, marble-polishing works, and a manufactory for milney carriages and waggons. The bulk of the shipping is engaged in the coasting trade, and large vessels require to unload at Glasson, 5 miles down the river, the cargoes being carried up to the town by lighters. The population of the municipal borough in 1871 was 17,245, and in 1881 it was 20,724.

From discoveries of cells, flint arrow-heads, and other similar remains, it is probable that Lancaster was an old British town. Its Roman name is unknown, but inscribed Roman altars, tombstones, Samian ware, and other pottery, and the remains of the old fortress preceding the castle, and of other buildings, leave no doubt that it was a Roman station of great importance. It was constituted a borough in the fourth year of Richard I., and it first returned members to parliament in the twenty-third year of Edward I. The privilege was withdrawn for some years before 1547, but from that time was enjoyed without interruption until 1867, when it was disfranchised for corrupt practices. The town was plundered and burned by the Scots in 1299 and 1289, was nearly depopulated during the Wars of the Roses, was captured by the Parliamentary forces in 1646, and retaken by the Royalists under the earl of Derby in the same year, was held by the Parliamentary troops in 1648, and was partly destroyed by fire in 1698. It was entered by the rebels in 1715, and again by a larger force of them in 1745.

See Clarke, *Lancaster*, 1807, 2d ed. 1811, *Lancaster Records*, 1809; Hall, *Lancaster Castle*, 1864; Simpson, *History and Antiquities of Lancaster*, 1869; and a paper on "Roman Lancaster," by W. Thompson Watkins, in *Transactions of the Historic Society of Lancashire and Cheshire*, 1876.

LANCASTER, theshire city of Lancaster county, Pennsylvania, U.S., is situated on the Conestoga river, 68 miles west of Philadelphia by rail. It was founded in 1730 and incorporated as a borough in 1742, was the State capital from 1799 to 1812, and in 1812 became a city. It is laid out on the rectangular plan, and is unusually well built. The city is the seat of numerous charitable and educational institutions. Among the latter is Franklin and Marshall College, the chief educational establishment of the Reformed Church, which also maintains a theological seminary in connexion with it. The court-house is an imposing edifice, erected in 1853 at a cost of \$166,000. The county jail is a massive sandstone structure, with a tower 110 feet high, built at a cost of \$110,000 in 1851. Lancaster is the centre of one of the wealthiest agricultural regions in the United States. Its cotton, iron, and other mills are numerous and large, and it contains one of the most extensive watch factories in the country. Its tobacco trade requires nearly 100 large warehouses for its accommodation. A valuable trade in coal, lumber, leather, and grain is also carried on. James Buchanan, the fifteenth president of the United States, lived in Lancaster, and is buried there. The population in 1880 numbered 26,846.

LANCASTER, the chief city in Fairfield county, Ohio, United States, is situated on the Hocking river, about 30 miles south-east of Columbus. It is a well-built little

manufacturing town, busy with foundries, flouring-mills, and various manufactures, such as agricultural implements and machinery. The court-house cost \$160,000; and the city hall and public schools are also fine buildings. The neighbouring country is fertile, being especially noted for its grain, live stock, and vineyards. The population in 1880 was 6803.

LANCASTER, HOUSE OF. The name House of Lancaster is commonly used to designate the line of kings immediately descended from John of Gaunt, fourth son of Edward III. But the history of the family and of the title goes back a whole century further to the reign of Henry III., who created his second son, Edmund, earl of Lancaster, in 1267. This Edmund received in his own day the surname of Crouchback, not, as was afterwards supposed, from a personal deformity, but from having worn a cross upon his back in token of a crusading vow. He is not a person of much importance in history except in relation to a strange theory raised in a later age about his birth, which we shall notice presently. His son Thomas who inherited the title, took the lead among the nobles of Edward II.'s time in opposition to Piers Gaveston and the Spensers, and was beheaded for treason at Pontefract. At the commencement of the following reign his attainder was reversed and his brother Henry restored to the earldom, who, being appointed guardian to the young king Edward III., assisted him to throw off the yoke of Mortimer. On this Henry's death in 1345 he was succeeded by a son of the same name, sometimes known as Henry Tort-Col or Wryneck, a very valiant commander in the French wars, whom the king, for his greater honour, advanced to the dignity of a duke. The title was new in those days, for only one duke had ever been created in England before, and that was fourteen years previously, when the king's son Edward, so well known in history as the Black Prince, was made duke of Cornwall. This Henry Wryneck died in 1361 without heir male. Of his two daughters, Maud, the elder, was twice married, but died childless little more than a year after her father. The second, Blanche, became the wife of John of Gaunt, who thus succeeded to the duke's inheritance in her right; and on the 13th November 1362, when King Edward attained the age of fifty, he was created duke of Lancaster, his elder brother, Lionel, being at the same time created duke of Clarence. It was from these two dukes that the rival houses of Lancaster and York derived their respective claims to the crown. As Clarence was King Edward's third son, while John of Gaunt was only his fourth, it ought to have followed in ordinary course that on the failure of the elder line the issue of Clarence should have taken precedence of that of Lancaster in the succession. But the rights of Clarence were conveyed in the first instance to an only daughter, and the ambition and policy of the house of Lancaster, profiting by advantageous circumstances, enabled them not only to gain possession of the throne but to maintain themselves in it for three generations before they were dispossessed by the representatives of the elder brother.

As for John of Gaunt himself, it can hardly be said that this sort of politic wisdom is very conspicuous in him. His ambition was generally more manifest than his discretion; but fortune favoured his ambition, even as to himself somewhat beyond expectation, and still more in his posterity. Before the death of his father he had become the greatest subject in England, his three elder brothers having all died before him. He had even added to his other dignities the title of king of Castile, having married, after his first wife's death, the daughter of Peter the Cruel. The title, however, was an empty one, the throne of Castile being actually in the possession of Henry of Trastamara, whom

the English had vainly endeavoured to set aside. His military and naval enterprises were for the most part disastrous failures, and in England he was exceedingly unpopular. Nevertheless during the later years of his father's reign the weakness of the king and the declining health of the Black Prince naturally threw the government very much into his hands. He even aimed, or was suspected of aiming, at the succession to the crown; but in this hope he was disappointed by the action of the Good Parliament a year before Edward's death, in which it was settled that Richard the son of the Black Prince should be king after his grandfather. Nevertheless the suspicion with which he was regarded was not altogether quieted when Richard came to the throne, a boy in the eleventh year of his age. The duke himself complained in parliament of the way he was spoken of out of doors, and at the outbreak of Wat Tyler's insurrection the peasants stopped pilgrims on the road to Canterbury and made them swear never to accept a king of the name of John. On gaining possession of London they gave still more emphatic proof of their dislike to him by burning his magnificent palace of the Savoy. The young king himself shared the general feeling, and after a few years John of Gaunt ceased for a time to have much influence. Richard found a convenient way to get rid of him by sending him to Castile to make good his barren title, and on this expedition he was away three years. He succeeded, however, so far as to make a treaty with his rival, King John, son of Henry of Trastámara, for the succession, by virtue of which his daughter Catherine became queen of Castile some years later. After his return the king seems to have regarded him with greater favour, created him duke of Aquitaine, and employed him in repeated embassies to France, which at length resulted in a treaty of peace, and Richard's marriage to the French king's daughter.

Another marked incident of his public life was the support which he gave on one occasion to the Reformer Wycliffe. How far this was due to religious and how far to mere political considerations may be a question; but it is certain that, in one way or another, not only John of Gaunt but his immediate descendants, the three kings of the house of Lancaster, all took deep interest in the religious movements of the times. A reaction against Lollardy, however, had already begun in the days of Henry IV., and both he and his son were obliged to discontinue opinions which were believed to be politically and theologically dangerous.

Accusations had been made against John of Gaunt more than once during the earlier part of Richard II.'s reign of entertaining designs to supplant his nephew on the throne. But these Richard never seems to have wholly credited, and during his three years' absence his younger brother, Thomas of Woodstock, duke of Gloucester, showed himself a far more dangerous intriguer. Five confederate lords with Gloucester at their head took up arms against the king's favourite ministers, and the Wonderful Parliament put to death without remorse almost every agent of his former administration that had not fled the country. Gloucester even contemplated the dethronement of the king, but found that in this matter he could not rely on the support of his associates, one of whom was Henry, earl of Derby, the duke of Lancaster's son. Richard soon afterwards, by declaring himself of age, shook off his uncle's control, and within ten years the acts of the Wonderful Parliament were reversed by a parliament no less arbitrary. Gloucester and his allies were then brought to severe account; but the earl of Derby and Thomas Mowbray, earl of Nottingham, were taken into favour as having opposed the more violent proceedings of their associates. As if to show his entire confidence in both these noblemen, the king

created the former duke of Hereford and the latter duke of Norfolk. But within three months after the one duke accused the other of treason, and the truth of the charge, after much consideration, was referred to trial by battle according to the laws of chivalry. But when the combat was about to commence it was interrupted by the king, who, to preserve the peace of the kingdom, decreed by his own mere authority that the duke of Hereford should be banished for ten years—a term which was immediately after reduced to five—and the duke of Norfolk for life.

This arbitrary sentence was obeyed in the first instance by both parties, and Norfolk never returned. But Henry, duke of Hereford, whose milder sentence was doubtless owing to the fact that he was the popular favourite, came back within a year, having been furnished with a very fair pretext for doing so by a new act of injustice on the part of Richard. His father, John of Gaunt, had died in the interval, and the king, troubled with a rebellion in Ireland, and sorely in want of money, had seized the duchy of Lancaster as forfeited property. Henry at once sailed for England, and landing in Yorkshire while King Richard was in Ireland, gave out that he came only to recover his inheritance. He at once received the support of the northern lords, and as he marched southwards his followers became more numerous at every turn. The whole kingdom was soon practically at his command, and Richard, by the time he had recrossed the channel to Wales, discovered that his cause was altogether lost. He was conveyed from Chester to London, and forced to execute a deed by which he resigned his crown. This was rected in parliament, and he was formally deposed. The duke of Lancaster then stepped forward and claimed the kingdom as due to himself by virtue of his descent from Henry III.

The claim which he put forward involved, to all appearance, a strange falsification of history, for it seemed to rest upon the supposition that Edmund of Lancaster, and not Edward I., was the eldest son of Henry III. A story had gone about, even in the days of John of Gaunt, who, if we may trust the rhyming Hardyng (*Chronicle*, pp. 290, 291), had artfully got it inserted in chronicles deposited in various monasteries, that this Edmund, surnamed Crouchback, was really hump-backed, and that he was set aside in favour of his younger brother Edward on account of his deformity. No chronicle, however, is known to exist which actually states that Edmund Crouchback was thus set aside; and in point of fact he had no deformity at all, while Edward was six years his senior. Hardyng's testimony is, moreover, suspicious as reflecting the prejudices of the Percys after they had turned against Henry IV., for Hardyng himself expressly says that the earl of Northumberland was the source of his information (see note, p. 353 of his *chronicle*). But a statement in the continuation of the *Chronicle* called the *Epilogium* (vol. iii. pp. 369, 370) corroborates Hardyng to some extent; for we are told that John of Gaunt had once desired in parliament that his son should be recognized on this flimsy plea as heir to the crown; and when the earl of March denied the story and insisted on his own claim as descended from Lionel, duke of Clarence, Richard put an end to the discussion and imposed silence on both parties. However this may be, it is certain that this story, though not directly asserted to be true, was indirectly pointed at by Henry when he put forward his claim, and no one was then bold enough to challenge it.

This was partly due, no doubt, to the fact that the true lineal heir after Richard was then a child, who had just succeeded his father as earl of March. Another circumstance was unfavourable to the house of Mortimer—that it derived its title through a woman. No case precisely similar had as yet arisen, and, notwithstanding the pre-

more trustworthy, he found himself at leisure to accept some of the numerous invitations which crowded upon him, and to expound what he called "his system" by lectures in various towns. In this way many new schools were established, and placed under the care of young men whom he had trained. In a memorable interview with George III., Lancaster was encouraged by the expression of the king's wish that every poor child in his dominions should be taught to read the Bible. Royal patronage brought in its train resources, fame, and public responsibility, which proved to be beyond Lancaster's own powers to sustain or control. He was vain, reckless, and improvident. In 1808 a few noblemen and gentlemen came to his rescue, paid his debts, became his trustees, and founded the society which was at first called the Royal Lancasterian Institution, but was afterwards more widely known as the British and Foreign School Society. With the strongest wish to retain his services and to treat him with liberality, they soon found that he was impatient of control, and that his wild impulses and heedless extravagance made it impossible to work with him. He quarrelled with the committee, set up a private school at Tooting, became bankrupt, and in 1818 emigrated to America. There he met at first with a warm reception, gave several courses of lectures which were well attended, and wrote to friends at home letters full of enthusiasm and of high hopes for future usefulness, not unmingled with bitter denunciations of what he called the ingratitude and treachery of those who had been associated with him in England. But his fame was short lived. The miseries of debt and disappointment were aggravated by sickness, and he settled for a time in the warmer climate of Caraccas. He afterwards visited St Thomas and Santa Cruz, and at length returned to New York, the corporation of which city made him a public grant of 500 dollars in pity for the misfortunes which had by this time reduced him to lamentable poverty. He afterwards visited Canada, where for a time his prospects brightened. He gave lectures at Montreal, and was encouraged to open a school which enjoyed an ephemeral success, but was soon abandoned. A small annuity provided by his friends in England was his only means of support. He formed a plan, however, for returning home and giving a new impetus to his "system," by which he declared it would be possible "to teach ten thousand children in different schools, not knowing their letters, all to read fluently in three weeks to three months." But these visions were never realized. He was run over by a carriage in the streets of New York in October 1839, and was so much injured that he died in a few hours.

As one of the two rival inventors of what was called the "monitorial" or "mutual" method of instruction, his name was prominent for many years in educational controversy. Dr ANDREW BELL (*q. v.*) had in 1797 published an account of his experiments in teaching, and Lancaster in his first pamphlet, published in 1808, frankly acknowledges his debt to Bell for some useful hints. The two worked independently, but Lancaster was the first to apply the system of monitorial teaching on a large scale. As an economical experiment his school at the Borough Road was a signal success. He had one thousand scholars under discipline, and taught them to read, write, and work simple sums at a yearly cost of less than six pence a head. His tract *Improvements in Education* described the graduation of ranks, the system of signals and orders, the functions of the monitors, the method of counting and of spelling, and the various devices he adopted for punishing offenders. Bell's educational aims were humbler, as he failed to "elevate above their station those who were doomed to the drudgery of daily labour," and therefore did not desire to teach even writing and ciphering to the lower classes. The main difference between them was that the system of the one was adopted by ecclesiastics and Conservatives,—the "National Society for the Education of the Poor in the parishes of the Established Church" having been founded in 1811 for the propagation; while Lancaster's method was patronized by the *Edinburgh Review*, by Whig statesmen, by a few liberal Churchmen, and by Nonconformists generally. It was the design of Lancaster and his friends to make national education Christian,

but not sectarian,—to cause the Scriptures to be read, explained, and recited in the schools, without seeking by catechisms or otherwise to attract the children to any particular church or sect. This principle, since almost universally adopted by the school boards of England, was at first vehemently denounced as blasphemous and mischievous, and as especially hostile to the Established Church. To do this in justice, it must be owned that the rival claims and merits of Bell and Lancaster were urged with more passion and unfairness by their friends than by themselves. Yet neither is entitled to hold a very high place among the world's teachers. Bell was cold, shrewd, and self-willing. Lancaster had more enthusiasm, a genuine and abundant love for children, and some sagacity in devising plans both for teaching and governing. But he was shiftless, wasteful, and unmethodical, and incapable of sustained and high-principled personal effort. His writings were not numerous. They consist mainly of short pamphlets descriptive of the successes he attained at the Borough Road. His last publication, *An Estimate of the Chief Elements and Transactions of his Own Life*, appeared in America in 1833, and is characterized, even more strongly than his former writings, by looseness and incoherence of style, by egotism, and by a curious incapacity for judging fairly the motives and the merits of his friends or his foes.

Subsequent experience has not justified the sanguine estimate of the *Edinburgh Review*, who so early as 1810 described Lancaster's method as "a beautiful and inestimable discovery, a plan now in eight ways near to perfection, by which education could be placed within the reach of all classes." We have since come to believe that intelligent teaching requires skill and previous training, and that even the humblest instruments are not to be well taught by those who have only just acquired them for themselves, or to be attained by mere mechanical drill. But in the early stages of national education the monitorial method served a valuable purpose. It brought large numbers of hitherto neglected children under discipline, and gave them elementary instruction at a very cheap rate. Moreover, the educational results attained were in no sense contemptible. The little monitors were often found to make up in brightness, tractability, and energy for their lack of experience, and to teach the arts of reading, writing, and computing with surprising success. And one cardinal principle of Bell and Lancaster is of some importance. They regarded a school, not merely as a place to which individual pupils should come for guidance from teachers, but as an organized community whose members were much to learn from each other. They sought to place their scholars from the first in helpful mutual relation, and to make them feel the need of common efforts towards the attainment of common ends. (J. G. F.)

LANCELET (*Brachistoma* [or *Amphioxus*] *lanceolatum*). This creature, the lowest in the scale of fishes, with which class it is generally associated, lacks so many characteristics of vertebrates generally that some naturalists regard it as the type of a separate division. It is of small size (about 3 inches long), compressed, semi-



Lancelet (*Brachistoma lanceolatum*). *a*, mouth, *b*, abdominal pores, *c*, vent.

transparent, pointed at both ends, without limbs, but with a low fold of the skin, representing the median fin of fishes. The mouth, surrounded by tentacles, is situated below the anterior end of the body, the vent at a short distance from the opposite end. The water which has been received through the mouth for the respiratory function, as well as the spawn, are expelled by another opening in front of the vent (*porus abdominalis*). The skeleton is extremely rudimentary, and consists almost wholly of a simple notochord; neither skull nor ribs or limbs are developed. The lancelet possesses no brain or organ of hearing, and no kidneys. The heart retains the embryonic condition of vertebrates, is tubular and without chambers, the blood is colourless. Thus the lancelet shows unmistakable analogies to invertebrates, among which, indeed, it was placed by its first describer, Pallas; and as, besides, the earliest stages of its development are almost identical with those of invertebrate animals, it may well be regarded as a form intermediate between the two great divisions of the animal kingdom, viz., the vertebrates and invertebrates.

The lancelet has been found in numerous localities of

the temperate and tropical zones, sometimes in deep water, but more frequently in shallow sandy places of the coast, probably it is much more common than is generally supposed, but easily escapes observation on account of the transparency of its body, and the rapidity with which it buries itself in the sand. It is noteworthy that the first two specimens from which the species became known, although discovered at an interval of more than fifty years, were found on the Cornish coast. The first fell into the hands of the Russian naturalist Pallas, who took it to be a slug, and described it in 1774 under the name of *Limnaea lanceolata*. The second was found by Couch in 1831, who recognized it as a fish and sent it to Yarrell. Since then it has been met with on other parts of the British coast, in North America, the West Indies, Brazil, Peru, Tasmania, Australia, and Borneo. For further details of its organization we refer to the article *IMBRYOLOGY*.

LANCWOOD is a straight-grained, tough, light, elastic wood obtained from the West Indies and Guiana. It is brought into commerce in the form of taper poles of about 20 feet in length and from 6 to 8 inches in diameter at the thickest end. Lancelwood is principally used by carriage-builders for shafts; but since the practice of employing curved shafts has come largely into use it is not in so great demand as formerly. The smaller wood is used for whip-handles, for the tops of fishing rods, and for various minor purposes where even grained elastic wood is a desideratum. The wood is obtained from two species of *Guttaria*, a genus belonging to the natural order *Anonaceae*. The black lancewood or carleeri of Guiana (*Guttaria virgata*) is a tree which grows to a height of 50 feet, of remarkably slender form, and seldom yields wood of more than 8 inches diameter. The yellow lancewood tree (yardi-yari of Guiana) is of similar dimensions, found in tolerable abundance throughout Guiana, and used by the Indians for arrow-points, as well as for spars, beams, &c.

LAN-CHOW-FOO, the chief town of the Chinese province of Kan-suh, and one of the most important cities of the interior part of the empire, stands on the right bank of the Yellow River. The population is estimated by Gustav Kraitner (Bela Szechenyi expedition) at half a million in 1878. The houses, with very few exceptions, are built of wood, but the streets are paved with blocks of granite and marble. Silks, wood carvings, silver and jade ornaments, tin and copper wares, fruits, and tobacco are the chief articles of the local trade. Tobacco is very extensively cultivated in the vicinity. Since the occupation of Keshgar by the Chinese, the provincial governor resides three years at Su-chow and three years at Lan-chow-foo.

LANCIANO, the chief town of a circle in the province of Chieti, Italy, is situated on three hills, about 5 miles from the Adriatic coast. It is one of the most beautiful cities in the Abruzzi Citatiore, and has broad regular streets, and several fine buildings. The cathedral, an imposing structure with a fine clock-tower, is built upon bridges that span the gorge of the Feltrino, and is dedicated to our Lady of the Bridge. The churches of Santa Lucia and Santa Maria Maggiore, built on the sites of heathen temples, and the theatre, also deserve notice. Although the industry and trade of the town have declined, a considerable miscellany of manufactures is still carried on. The textile industry, dealing with flax, hemp, silk, wool, and cotton, is the leading one; iron-working, rope-making, and the manufacture of wax, soap, cream of tartar, &c., follow. There are four yearly fairs. In 1872 the population was 8758; including the suburbs it was 16,842, or, embracing the commune, 17,840.

Lanciano claims a respectable antiquity for, although Flavius Arde or Arre Fructicianus is to be placed about a mile from the present town, there is no doubt that under the early empire the

present site was occupied by a town, as the oldest of the bridges on which the cathedral stands was erected by the senate and people of Avannum, under Duclatun. During the Middle Ages Lanciano was of considerable importance, and enjoyed various privileges, chiefly of a commercial nature.

LANCRET, NICOLAS (1660-1743), was born in Paris on 22d January 1660, and became a brilliant painter of light comedy, but of light comedy which reflected the tastes and manners of French society under the regent Orleans. His first master was Pierre d'Ulin, but his acquaintance with and admiration for Watteau induced him to leave D'Ulin for Gillot, whose pupil Watteau had been. Two pictures painted by Lancret and exhibited on the Place Dauphine had a great success, which laid the foundation of his fortune, and, it is said, estranged Watteau, who had been complimented as their author. Lancret's work cannot now, however, be taken for that of Watteau, for both in drawing and in painting his touch, although intelligent, is dry, hard, and wanting in that quality which distinguished his great model; these characteristics are due possibly in part to the fact that he had been for some time in training under an engraver. In 1719 he was received as Academician, and became councillor in 1735, in 1741 he married a grandchild of Boussault, author of *Leopold at Court*, but he survived his marriage only two years, dying, in his eighty-fourth year, on 14th September 1743.

The number of his paintings (of which over eighty have been engraved) is immense; he executed a few portraits and attempted historical composition, but his favourite subjects were balls, fairs, village weddings, &c. The British Museum possesses an admirable series of studies by Lancret in red chalk, and the London National Gallery shows four paintings—the Four Ages of Man (engraved by Desplaces and L'Armoise), which have been cited by D'Argenville amongst the principal works of Lancret. See *D'Argenville, Vie des Peintres*; and Ballot, *Éloge de M. Lancret*.

LAND, in the sense in which it will be used in this article, which treats especially of its possession and tenure, includes that portion of the earth of which industry has rendered either the surface or the mineral riches underneath available for human requirements. It forms thus the storehouse from which nearly all human wealth is drawn, since it nourishes the animals and plants which supply mankind with food and clothing, and yields the stone, the coal, and the metals which make existence possible and progressive. The history of its use is therefore a main element in the history of our race, and the manner of its tenure and employment lies at the root of political and economic science. In the present article it is proposed to sketch in outline the historical development of the ideas relating to land, and briefly to point out the leading principles which influence its tenure and beneficial employment under present circumstances.

The history of land commences with the division of men into tribes, for the division of tribes involves distinction of territory. The earliest age, when men lived solely on wild fruits or on the produce of the chase, may still be pictured to us in the habits of the North American Indians, while the second or pastoral stage is represented in modern times by the life of the Tartars of the Asian steppes. In both these conditions an immense tract of country is absorbed in the support of a small population, but the hardships of existence, aided sometimes by organized systems of child-murder, serve to keep the inhabitants within the limits of subsistence. Under such circumstances each tribe jealously guards its own territory from intrusion by others, but within its range all members of the community have equal and unrestricted rights of use. Among civilized nations the principle still survives. Each modern nation claims a special ownership in the fisheries within a certain distance of its coasts; but among the inhabitants of these coasts there is a common right to fish in the waters thus reserved. So also each modern state recognizes the shores as far as high water

mark, and the estuaries with their herds of wild fowl, as the common property of its subjects. Even inland game is still not individual property, and in countries where legal rights are so ancient or so modern as in the Channel Islands and the United States of America, the local law is alike liberal in allowing to every one the right of sporting over his neighbour's ground, except in so far as modified by express and recent legislation.

Village
tenants.

But the higher races very early discovered an ampler means of industrial existence than the natural produce of the earth affords. At what period in human history the artificial cultivation of plants was discovered it is impossible to say. We know that it was posterior to the division of the Aryan currents that flowed towards Hindustan and towards Europe, but before the subdivision of the latter, for the words denoting a field, a plough, and some species of grain have a common root in the Greek, the Latin, and the Germanic dialects, but not in the Sanskrit. But so soon as agriculture began it involved of necessity an approach to more settled habits. This change in the manner of life would combine with the fuller and more regular supply of food to promote a rapid increase of population. So long, however, as this did not exceed the resources of the territory belonging to the tribe, it would not of itself involve any change in the idea that its use was common to all. A certain portion of ground would be devoted to tillage, a certain number of the tribe would be appointed to perform the acts of cultivation, and the produce would be stored in the general barn. We have at the present day examples of such a system in some of the alpeuds of the Swiss canton of Valais, where a portion of the lands of the village is cultivated by joint labour, and the produce devoted to joint feasting. But it appears that in general this stage rapidly progressed to one of apportionment of the land in separate and smaller districts. The tribes, augmenting in numbers and perhaps in extent of territory, subdivided itself into villages, and each village exercised a tolerably independent rule over its own district. Within this range it still maintained a community of the forest and pasture, but the special skill and toil demanded by husbandry in most cases soon led to the appropriation to each family of a portion of the arable land in exclusive property. Still, however, the principle of common right prevailed so far that the village rulers changed every year the lots assigned for culture, so that one year of crop, followed by a relapse into natural growth for a succession of years, was the normal rotation. It is one which modern science cannot condemn, for where space is ample and the use of manure is unknown, there is no sounder method of cultivation. It is still, according to M. Leveley, exemplified in the Ardennes region of Belgium.

Private
property
in land.

It is at this stage that contemporary observers first describe the tenure of land in ancient times, and illustrations of its survival in modern periods grow abundant. These will be hereafter pointed out. But except in special circumstances it is obvious that progress could not stop here. As population increased in each district, the available hunting grounds would diminish, and at the same time the necessity of more extensive and more frequent cultivation of crops would increase. By this process, in the absence of manure, the land would inevitably become less productive. But just as it demanded more labour it would become more definitely appropriated to a single family, for those who laboured most would not willingly give place to those who had been less active. A stage would then be reached in which community of possession would be limited to the pasture lands of the village, and the arable lands would be possessed in permanence by each family. There generally was, indeed, while the territory still sufficed, a recognition of the right of each individual to an allotment from the

common land. But at last the period would come in which this could be no longer afforded, and when either the tribe must migrate in a body, or cast off a swarm to seek its fortunes elsewhere, or leave a certain number of its members without the privilege of landed possession, to obtain subsistence in services to the rest, or in trades. When the two former alternatives become impracticable, the third is the inevitable course. Private property in land becomes then established, and we have thenceforward a new system, involving consequences for good and evil which legislation seeks to regulate.

With this general notion of the course of development History it will now be convenient to trace, in some instances which will have most affected the world's progress, the history and the results of the use and appropriation of land.

In primitive Rome each household formed an absolute Primitive despotism, of which the father was the despot; households were united into gentes by derivation from a common ancestor, and the state consisted in a combination of gentes. To each household there was originally assigned a small portion (2 jugers, 12 acres) of land to be held in perpetuity as private property (*hereditas*), and it may be assumed that on the death of a paterfamilias each son would be entitled to a like amount from the common lands of the gens. These common lands formed the main possession of the gentes, and it appears that they were to some degree cultivated in common, as well as used for pasturage. The state, however, also held common lands, partly original, partly derived from cession by each conquered neighbor, and these were let for rent (*vectigal*) in so far as not partitioned out. Cicero (*De Rep.*, ii. 9, 14) says that Numa was the first who divided the conquered lands into private shares, but it is certain that the example was only partially followed. But by the time of Servius Tullius the original private portion of many households must have been greatly but unequally enlarged, for his new military organization was based on the obligation of service imposed on the freeholders (*asseclis*) as distinguished from the mere labourers and breeders of children (*proletarii*). The "classes" of the assidui were five, those who possessed 20 jugera (12½ acres), and who were specially designated classici, and those who possessed respectively 15, 10, 5, and 2½ jugera. The first class, or classici, were about the half of the whole number of assidui, the second, third, and fourth classes comprised each about one-eighth of the entire number, and the fifth class was slightly more numerous. The equites formed a separate order, based on the possession of a still larger extent of land. At the same time a register of land was established, in which each owner was required to enter his property, and which was revised every four years, and sales were directed to be made before two witnesses. These arrangements show that even at this epoch the system of separate private property was in full operation, and that the difference of wealth which it engenders had already reached an advanced stage.

The progress of conquest, which at once enlarged the territory, brought in tribute, and furnished slaves, rapidly increased such inequalities. Trade, which followed conquest, and in which capitalists made large fortunes, tended in the same direction. Very early in Roman legal history we come upon tenancy-at-will, under the name of *precarium*, which of itself showed that there must have been large estates capable of subdivision. But besides tenants, the extensive landowner had a household of retainers, clients, freedmen, and latterly slaves, who tilld his ground for his personal profit. Thus there would be little demand for free labour, and the petty husbandman, whose small inheritance was inadequate for a growing family, fell necessarily into debt. His land would then be seized under the strict Roman law of bankruptcy, and he himself

would sink into slavery, or at best into the already overcrowded class of labourers for insufficient hire. At the same time the conquered lands, which by theory were the property of the state, and to which every citizen had an equal right, were largely portioned out to the existing landowners, who held the chief posts and influence in the government. The revenues drawn from tribute were also farmed out to capitalists, and the taxes on the public were augmented in consequence of the permitted frauds of the collectors. At last came the crisis. The army, no longer representing the wealth of the state, but rather the proletariat, intimated, and from the Mons Sacer menaced the city. It was the commencement of the long struggle of which the successive *AGRIAN LAWS* (*l.s.*) were the landmark and remedies.

The object of these laws was well illustrated by the Licinian proposal (387 A.U.C.), nearly one hundred years after the first outbreak of discontent. It enacted that no citizen should hold more than 800 jugera of the public lands, that no one should graze more than one hundred oxen and five hundred sheep on the common lands, and that every landowner should be obliged to employ a number of free labourers proportioned to that of his slaves. But this, as all other laws proposed on behalf of the people, was coupled with political changes of which the main object was to open up new fields of ambition to those of the plebeians who were already opulent. When that object was attained, the agrarian remedies were suffered to fall into desuetude. The successful wars waged in the 6th and 7th centuries A.U.C. gave a temporary outlet to labour in the formation of agricultural colonies. But it at the same time immensely increased the number of slaves, who were treated as mere beasts of toil, to be worked out or sold off when no longer profitable. The free population, on the testimony of Cato and Polybius, diminished; the slave population increased, and became in many districts an organized danger to public safety. A century later the Gracchi again endeavoured to restore health to the body politic by a distribution of the state lands among the proletariat. The attempt was stifled in blood, but the necessity of the measure was proved by the fact that a full generation later Cn. Julius Caesar carried out the same reform.

The time for remedy was, however, past. The great estates (*latifundia*) had already been created; they were respected by the reformers, alike popular and imperial, and their inevitable growth swallowed up the small farms of new creation, and ultimately destroyed Rome. For its misadventure was gone; the wealth of millionaires could not purchase back honesty or courage; and the defence of mercenaries failed to form any barrier against the wars of hardy northern invaders. Pliny's words "*latifundia perdidit Italiam*" embrace the truth, yet more fully made clear in many a generation after he wrote.

We shall now examine the systems prevalent in the nations by which the Roman empire was overthrown. Two great Roman writers, Caesar and Tacitus, have given us a vivid picture of the German customs showing us the tenure of land in its earliest forms. Caesar (*De Bell. Gall.*, vi.) says of the Germans of his time:—

"They are not much given to agriculture, but live chiefly on milk, cheese, and flesh. No one has a fixed quantity of land or boundaries of his property, but the magistrates and chiefs every year assign to the communities and families who live together as much land and in such spots as they think suitable, and require them in the following year to remove to another allotment. Many reasons for this custom are suggested: one is that they should not be led by permanence of residence to renounce the pursuits of war for agriculture, another that the desire of extensive possession should not induce the more powerful to seize the land of the weaker, another that they should not construct their houses with greater care to keep out heat and cold, another that the love of money should not excite parties and disputes, and lastly that the mass of the people might remain con-

tented with the justice of an arrangement under which every one saw his position as comfortable as that of his next neighbour. As to the tribes themselves, their chief glory is to have their territory surrounded with as wide a belt as possible of desolated waste. They deem it not only a special mark of valour that every neighbouring tribe should be driven to a distance, and no stranger should dare to reside in their vicinity, but at the same time they view it as a measure of precaution against the risk of sudden attacks."

A hundred years later the description of Tacitus shows that a certain modification of habit had been induced. Bringing together the leading particulars, we find he speaks of Germany as "covered with woods and morasses, the land fairly fertile but unsuited for fruit trees, well adapted for pasture, and carrying numerous herds of small sized polled cattle, in which the chief wealth of the natives consisted." But they seem no longer to have changed their actual dwellings every year, but to have

"Built them with a certain rough solidity, and in villages, though the houses were not contiguous, but each was surrounded by a space of its own. The right of succession by children was recognized, and in default of children brothers and uncles took, but there was no right of making a will. They preferred to secure property by war rather than by industry. Interest on loans was unknown. The land was apportioned (to villages apparently) according to the number of cultivators, and divided among them according to their rank, there being ample room for all. Every year they changed the arable land, which formed only a portion of the whole, not attempting to make labour vie with the natural fertility and abundance of the soil by planting orchards or setting out gardens and fields, but content with a single crop. Their food consisted chiefly of wild fruits, freshly killed game, and cereals, their drink was a liquor prepared from barley or wheat, fermented like wine. Their slaves were not kept in the house, but each had a separate dwelling and an allowance of food, and they were treated with humanity, as servants or tenants."

These institutions were then obviously based on the existence of an ample supply of unenslaved and common land. But the natural increase of population, combined with the pressure put on the Germanic tribes from the east by the Slavs, made their territories too small for their ambition, if not for their maintenance, and five or six succeeding centuries were marked in the history of Europe chiefly by successive Germanic conquest and occupation of western and southern territory. The enormous increase of power and possession made it impossible for the original tribal government to survive; the great generals developed into kings and emperors, and their lieutenants, more or less independent according to individual capacity and distance from the capital, became dukes and counts. Gradually military authority, embracing the old idea of the land being the property of the state, evolved the new notion of feudalism. The sovereign represented the state; to him in that capacity land conquered from the enemy, or forfeited by unsuccessful rebellion, became subject, and he granted it to his followers on condition of faithful service in war. They promised to be "his men," and from their own tenants they exacted in turn the like promise on the like conditions. The general insecurity made even free owners willing to buy the support of the sovereign on similar terms. Thus by degrees, less by derivation from the ideas of Roman law, to which it is sometimes attributed, than by the mere necessity of the times, and as a consequence of the incessant state of warfare in which mankind existed, there came to be established the feudal doctrine that all land was held of the sovereign on condition of suit and service, and that each immediate tenant of the sovereign was entitled to sub-infeudate his possession on the same principles. Gradually the further attributes of property were added; service in war was commuted into rent, and the peaceful service of tilling the lord's reserved domain. The right of hereditary succession became grafted on the personal grant; the power of sale and devise followed. Local usages still had influence, but it may be said broadly that from about the 10th century private property, subject to feudal

conditions, became the principle of the tenure of land in Europe.

Thus, however, some nations in which feudalism has struck no root, or at least has not succeeded in seriously modifying the original type of common possession. It will be best to advert to some of them before proceeding further with the history of feudalism in its modern development.

India.

The Indian branch of the Aryan stock has preserved with great fidelity the original notion of the possession of land. The village, consisting of detached houses and surrounded with the district belonging to it, forms still a self-regulating community. It is a legal person, to which the state looks for its rights, but which when performing them is free from internal state interference. It holds the forest and pasture ground in common property, allowing their use to each person entitled to the village rights. To each family is further apportioned a measure of arable land, but the stage is in general passed at which this portion is changed in successive years, and it is therefore the hereditary property of the family. But it is not in strictness subject either to will, to mortgage, or to sale. It is divisible on the death of the head of the family among his children, any of whom may transfer their shares to another member of the village, but not, except with its leave, to a stranger. These ancient customs have to some extent been modified by the introduction of English law, which, among other things, has subjected the villagers to the grinding exactions of the money-lenders, by giving creditors the security of an English mortgage. It cannot but be regretted that the desire to not justly which has led to the change should have been misled by the idea that whatever institution exists in England is necessarily and everywhere else equally equitable and necessary.

Harold
peoples.

In Europe the Slav peoples, the latest arrival of Aryan stock in Europe, have preserved best the ancient characteristics of land tenure. Checked in their advances to the south-east, they have formed a narrow borderland in Bulgaria, Servia, Croatia, and Dalmatia, between the Germans on the one side and the Turks on the other. Here, therefore, we have the case of a population growing within a restricted area, under circumstances which prevented the development of extensive military sway, and its consequent feudalism. Accordingly we find prevailing a system midway between the ancient communism of the Germanic tribes and the institution of private property. The tribes have become broken up into families. Common lands, except where there is mountain or forest, have been partitioned into the separate ownership of families. But within the families there is still a strong sentiment of community. In the Serbian and Bulgarian villages each family household consists of probably several generations, all housed under the same roof or within the same outlying. The head of the family is judge rather than master; any member of the family may depart, but in so doing he abandons his claim to the family property, a claim, however, which in some cases may revive should he return to the paternal home. All who remain work in common at their appointed duties, and share in common the produce. The family possessions are inalienable; the share of each member is untransferable.

Russia.

To the north and east the faculty of unlimited emigration to the unoccupied lands of the steppe permitted or enforced the preservation of a still earlier type of common property. When the Russian village found its lands inadequate to its growing population, it threw off a swarm. The emigrants travelled in a compact body till they passed beyond the limits of present cultivation, and then took up their position on such lands as pleased them. For their protection against the aboriginal hunters who still roamed over the plains they built their houses on the uniform plan

of an enclosed village, and the same reason concurred with native habit to induce them to maintain the system of common pasturage, and of united cultivation of the land apportioned to cropping. When the central government became strong enough to assert its sway over the scattered settlements, it levied its tax on the *mir*, or village community, and the community apportioned the amount per capita among its members. But, as land was ample in extent for all, it gave to each male, from the moment even of birth, a right to a share. When the shares became inadequate a fresh migration took place.

Serfdom took its rise in the prohibition of these migrations. Forbidden to depart to new lands, the peasants were compelled to submit to the demands for their labour either of the Government, where it held estates in the neighbourhood of a village, or of nobles to whom grants of land had been made by the czar. Generally they were thus forced to give half their time to labour for their master. But they still continued possessors of their share in the village lands, and entitled to apply the other half of their time to its cultivation.

When emancipation came, their rights were regulated on the same basis. The village was maintained as an industrial and fiscal organization. But each peasant was declared to be entitled to a certain fixed minimum of land for his own property, varying according to the district, but on an average about 12 acres. For this, in so far as being in excess of the village lands it had to be made up from the land of adjoining owners, he is required to pay either service, to the extent of forty days in the year, or rent, at an average rate of about 2s. 4d. per acre. Such provisions can only be temporary. They resemble much those which prevailed in Germany prior to the modern reforms in tenure. They subject the peasant, untaught and unaccustomed to habits of individual energy, to a tax which he is not able to meet, and the suffering and complaints which are the consequence are at present general throughout Russia.

In Switzerland also there has survived a system only slightly altered from that of the original communities. For here also conquest with its attendant feudalism was stayed, and freeman and free institutions survived the wreck which war made throughout western Europe. In the forest cantons especially there still exists an essential community of land right. The inhabitants possess separately and by ordinary rules of inheritance certain portions of land. But in several cantons the bulk of the land, both arable, forest, and pastoral, forms the allmend of the state, or of the commune,—the common property, to which every descendant of the original inhabitants has a right. This common land is either partitioned out by lot to each person entitled, or is let for a rent, which is applied to the common benefit, or is made the subject of common labour, and the produce of bread and wine is devoted to common merry-makings. When the arable land is divided among cultivators, the period allowed before repartition is from five to nine years, and it is stated that so strong is the feeling of common interest that the shortness of the time does not interfere with the highest cultivation by each successive occupant. In some districts it furnishes farms of 20 acres to each family, in others it only suffices for allotments of a few peches.

In France the custom of village proprietary survived in many districts down to the middle of the 17th century. But previous to the middle of the 18th century nearly the whole of the soil had passed into the hands of great landowners. The tenants and peasants were ground down with heavy exactions, not only in the form of rent, but of state taxation, and in services, or *corvées*, to be rendered to the lord or to the state. The artificial life of the nobles at court destroyed all sympathy between them and the

cultivators, and brought them to look on their dependants as little more than beasts of burden, valuable only for the profit that might be made of them. The feeling engendered on the other side broke out in the Revolution. The country estates, from which the *émigrés* had fled, were sold in portions, and in many cases bought in fee simple for a trifle by the former tenants of the farms. The law of equal division among children continued the process of subdivision. It proceeds in an augmenting ratio, and though a few large properties still subsist, the bulk of the land in France is now held in small properties. It is not, however, universally cultivated by the owner. There is a large proportion of tenants, holding generally under leases not exceeding nine years; and there is no doubt that the shortness of the term impairs production. Another evil is the *morcellement* caused by the law of compulsory division on inheritance, but this must not be understood as objected to chiefly on the ground of the small extent of ground held by each proprietor. The real disadvantage complained of by French writers on agriculture is that through successive family divisions each man's total property consists of a number of small plots scattered up and down, and the remedy desired is not an interference with the present law of succession, but only an enactment to facilitate exchange and consolidation of plots, so as to give to each cultivator his whole property within one boundary.

In France there are now about 2,000,000 properties under 12 acres, and 1,000,000 between 12 and 26 acres, while there are only 150,000 above 100 acres. Of the whole population there are 1,750,000 who cultivate their own land with their own hands, and who are not tenants, 850,000 who cultivate as tenants, and only 87,000 who cultivate by aid of a foreman or steward. Of farm labourers there are only 870,000. Belgium, Switzerland, Denmark, Norway, Sweden, and great portions of Italy are similarly divided into small holdings cultivated in general by the owner and his family.

In Germany, although feudalism was fully developed as a legal system and as the foundation of the aristocracy, it did not succeed in extirpating entirely the ancient rights of the people. A large portion of the land was held always as peasant properties, entirely free from any dues of service. Among these, in certain districts, there survived an organization essentially identical with that described by Tacitus. The village had its domain or mark, subdivided into the arable, the pasture, and the forest. In some cases the first of these was partitioned into individual and permanent properties, but in all the pasture and forest remained the joint property of the village. Instances, however, were not wanting even in our own days where the arable portion was subject to annual or less frequent repartition, and to apportionment by lot to each cultivator for the time which custom ordained. But even where this usage did not prevail, it was incumbent on all the villagers (as in Russia) to cultivate their several portions of the arable mark with the same crops and at the same seasons, for as soon as the crops were removed the whole community enjoyed a right of pasturage on the stubble. The rotation was, therefore, of the simplest, consisting in general of a triennial succession of wheat or rye as winter-sown grain, followed by oats and barley as spring-sown crop, and then fallow. It differed from the worse form of that of the ancient Germans in that the circumscribed limits of each village domain made it now impossible to allow to the whole arable mark a period of rest under pasturage.

But intermixed everywhere with the relics of the free village institutions, the tree of feudalism struck its roots, and carried with it a species of serfage. None who were not noble could as a rule purchase land. On the lands of the nobles the tenants were bound to give to their lord a

portion of their time in gratuitous labour. They held, however, their farms under conditions of permanency, subject to this tax of labour, and to a variety of small and irregular exactions of the nature of rent. On this state of things in Prussia the Stein and Hardenberg reforms took effect. They gave to every peasant the same power as the noble enjoyed to become a landowner. Between the nobles and their tenants they partitioned the land in absolute property, the landlord retaining one-third, the tenant receiving two-thirds. Common rights, and rents, were made purchasable by the owner of the soil at twenty years' purchase of their estimated value. And laws of 1821 and 1850 sanctioned the division of common lands among all who previously had an interest in them. To aid the peasantry in purchasing up the dues still payable to their former landlords, land credit banks were introduced in 1850. These institutions advanced to the peasant owner the sum necessary for the purchase of the old rights over his property, commuted as they had already been to a definite sum. The advance thus made constituted a first charge on the land, and was represented by debenture bonds for small amounts. The owner might pay to their credit, at whatever time and in whatever sums he was able, instalments towards their redemption, but he was bound to redeem them fully within fifty years.

These reforms have converted large parts of Germany into the property of small owners residing on and tilling their own land, free from obligation to any other person. There do not seem to be data for judging of the economic result, because statistics do not distinguish between the produce of small properties and that of the large properties intermixed with them. But the most careful observers agree that the social results are similar in Germany to what they are elsewhere. The peasants, attached to their holdings, form the most stable element in the community. Their love of the land shows itself in the high prices given for it, and, as we shall see elsewhere, in the tendency to borrow in order to purchase more. It can at least be said that, whatever be the hardships of their lot, they would not exchange it for any other.

The tenure of land in Great Britain may be traced with Great sufficient accuracy from the character of the elements of British which the nation is composed. Under the Celtic tribes there can be no doubt that the ideas which we now prevail among the ancient Irish and among the Scottish clans down to modern times formed the universal rule. The land was the possession of the clan; the chief was the leader but not the owner. The temporary and partial occupation by the Romans may have introduced the notion of absolute private property, and we may assume that it was at least asserted by each of the conquerors as cared to cultivate estates taken from the barbarians. But the withdrawal of the Romans, followed by the Saxon invasion, must have re-established the principle of common village ownership which formed the basis of both Celtic and German tenure. In the later Saxon period, however, there is no doubt that private ownership became gradually more extended. Then the feudal idea began to make progress in England, as it did at the same period on the Continent. It received an immense impulse from the Norman Conquest. William may not have claimed the whole land of England as his own, but the vast tracts which fell into his hands through confiscation of rights of so-called rebels were granted by him in the character of lord to such of the Saxons as he could trust, and to those of his own followers whom he desired to reward. When law began to form a system, the early Norman lawyers took this principle as the basis of their system. Thenceforth it became the undisputed maxim of English law, as well as of Scottish (with the exception of some isolated remains of "ndal."

rights in Orkney), that the sovereign was supreme lord of all the land, and that every one held under him as tenant in England, vassal in Scotland, names which have survived in legal theory and language down to the present day. They expressed then as now the unquestionable legal rule that there is no such thing in our system as an absolute private right of property in land, but that the state alone is vested with that right and concedes to the individual possessor only a strictly defined subordinate right, subject to conditions from time to time enacted by the community.

Within Scotland the feudal system has been preserved in remarkable purity. The majority of the larger estates, as well as many small ones, are still nominally held of the crown, and pay an annual rent, or "feu-duty," along with certain fines on succession or alienation, nor is the title of any heir or vendee complete till he has received the written acknowledgment of the sovereign. But each owner who holds of the sovereign may grant a subordinate estate to be held of himself as "superior" or lord, on such terms as he thinks fit, and the "vassal" thus constituted must in future obtain recognition of his title from his immediate superior, just as if he held directly of the crown. It is only within the last few years that the subordinate vassals thus holding have been allowed the means of commuting the services they had bound themselves to pay to the "subject superior," and of converting themselves into direct vassals of the crown, which forms the nearest approach to private property permitted by the law of Scotland.

In England feudal forms became partially obliterated at an earlier period. In 18 Edward I. parliament had put an end to subinfeudation. The services due by the crown's tenants were by a statute of Charles II. reduced to a form which left them merely nominal. But at a very remote period there had sprung up a tenure which in many respects was equivalent to feudal tenure. The serfs who cultivated the lord's lands, although at first subject to his absolute pleasure, yet, being left undisturbed for a considerable series of years, fell under the doctrine of English jurisprudence which recognizes custom as having the force of law. They gained thus a right of occupation in permanence, paying only such rents or services as were entered in the copy of the rolls of the manorial court, from which their tenure came to be designated copyholds. By degrees they obtained manumission from servitude, and with it the right of alienating or bequeathing the land they thus held. There were therefore two principal classes of property in England, freeholds, holding in general directly of the crown, and copyholds, holding of a lord of the manor, but both with indefeasible title subject to trifling services ascertained by custom or by statute. It would seem that in these two forms a very large number of those whom we now should call yeomen or peasant proprietors were established throughout the country. But in addition to these there were on the large estates a great number of those whom we should now properly call tenants-at-will, renting lands of the lord, and not established for a sufficient length of time to have acquired the status of copyholders.

About the middle of the 14th century English wool was found to be peculiarly well adapted to the use of the weavers of the Low Countries, and brought a high price. This led the owners of the large estates to substitute pasturage for tillage, and by consequence many of the cultivating tenants-at-will were evicted. Hence arose complaints precisely similar in motive and language to those which in our own times have been excited by the clearings in Ireland and the Highlands for the purpose of substituting sheep farming in place of husbandry by cottars and crofters. During the 16th century, probably for the same reason, the extensive wastes which covered a large part of England began to be

enclosed, to the consequent disturbance of a number of squatters (called at the time "champions," from *champs*) who had settled on them, and derived a not very sufficient subsistence from feeding a few animals on the commons. It is noticeable that both Fitzherbert and Tresser, the earliest English agricultural writers, and the latter himself one of the people, commend the enclosures, on the ground that the land so reduced to separate ownership produced much more than it had done as commons. But these causes, combining with the breaking up of the monasteries, and the absorption of church lands into the estates of the adjoining landowners, gave rise to much disorder and misery. Parliament attempted to deal with the causes and effects by enactments directed by turns against the high rate of wages, against the destruction of farm houses and cottages, and against the idle or unemployed tramps who roamed over the country. It was a period of dislocation of social relations, of which we are not now in a position to judge accurately. But undoubtedly the ultimate result was a considerable increase in the magnitude of the larger estates and farms, gained by a proportionate decrease in the number of both of smaller size. It is from this period that we must date the diminution of the class of yeomen which has been the theme of lamentation with economists and historians down to our own times.

Contemporaneously with these changes the law was receiving those adjustments which tended to preserve the large estates undiminished in the possession of their hereditary owners. Entails were sanctioned by statute (*De donis, 13 Edw. I.*), but broken down some two centuries later by the ingenious judicial devices of fines and recoveries. Trusts were invented by the churchmen, but attacked by parliament, only to be re-established under the technical name of trusts upon uses. Lastly, estates for life were invented, and, being skillfully combined with so much of the principle of entails as the courts had sanctioned, they have formed the still existing method by which family estates are preserved from dispersion. The rule of law is that all persons living at the date of a settlement may be restricted to mere estates for their own lives, instead of taking the fee simple with full right of alienation. In this way each son when he succeeds finds himself merely a tenant for life, and as such possessed of no power to prevent his own son from becoming owner in fee simple when he in turn shall succeed. But a father so situated is little inclined to leave to his son powers of which he himself is deprived, while his son is generally willing to barter his future liberty for a present liberal allowance. Thus father and son strike a bargain; the father buys the son's surrender of his future right, and the son, for a price, agrees to submit himself to the restraints of being merely tenant for life when his father shall die. The process repeated from generation to generation has re-established in practice the system of entails which the courts had abrogated as contrary to public policy, and which every writer from Bacon downwards has denounced as hurtful to the nation.

Similar rules prevailed in Scotland. But, as entails were there of later introduction, they were much more strict, and from 1680 to 1848 land might be settled in an endless succession of unconvertible life estates. In the latter year an Act was passed which, with a good deal of complication, substantially limits the right of creating life estates to one generation as in England. In 1875 another Act introduced the useful principle that the owner of a life estate might in certain circumstances buy up and extinguish some of the contingent interests in succession to his own at their present value, ascertained by computation based on the expectation of life.

The system of entails, or of creation of estates for life only, which has thus prevailed for several centuries in the

United Kingdom, is sufficient to account for the fact that the large estates have continually augmented, in size and number, by the corresponding absorption of the small properties of yeomen. These small properties are seldom subjected to strict settlement. The owners occasionally fall into difficulties, and then their land is sold to pay their debts. They are frequently moved by natural affection either to divide their estates among children, or to subject them to charges for children other than the heir, and thus also tends to bring them into the market for sale. But the large adjoining properties, the owners of which have been induced by family pride to limit their right to mere life interests, are not liable to be sold for debt. The immediate possessor may be crippled during his life, but his heir will succeed to the estate free from incumbrance by any prior possessor. In the same way the powers of each successive owner to charge the estate for younger children, and the liability to sale for payment of such charges, is restricted within narrow limits. These properties therefore continue undiminished; and when a small adjoining freehold comes into the market, it is seldom that the owner of the larger estate cannot find the money to effect its purchase. Once obtained, it is included in the next settlement of the larger estate, and thus permanently withdrawn from the operation of natural processes of disintegration. On the whole, it follows that large estates tend to grow, and in precisely the same proportion small ones tend to disappear.

It may be further observed that this tendency is materially aided by an absurdly bad and expensive conveyancing system, and by the law of mortgage. The costs of transfer of land are so enormous in England that they form a very large percentage on the price of small properties, and preclude any one from purchasing them, with the motive of making a living upon them. So also the insecurity of title, which is greatest on the smaller properties, because they have been dealt with less carefully, compels any owner who needs an advance to pay usurious interest, by which his ruin is speedily effected, and the property brought to sale. On the other hand a large property changes hands at less comparative expense, and the necessity of a sale to meet temporary difficulties is at less cost obviated by mortgage, which permits the owner to hold on till some windfall of legacy or marriage once more reinstates him in easy circumstances, and enables him to take advantage of his poorer neighbour's necessities. This does not mean that he cheats the small proprietor in the bargain. On the contrary, the desire of the rich to segment their estates induces them to give more than the real worth for the smaller properties. But this concurrence of circumstances tends steadily in the direction of increasing large estates and diminishing from age to age those that are small. The practical result is easily shown by a few figures. The cultivated land of the United Kingdom (including parks and permanent pastures, but not mountain or waste) amounted in 1890 to 47,515,747 acres. The total acreage is 77,635,301 acres. By the Domesday Book of 1875 it appeared that one-fourth of the total acreage (excluding plots under 1 acre) is held by 1200 owners, at an average for each of 16,200 acres; another fourth by 6200 persons, at an average of 3160 acres; another fourth is held by 60,770 persons, averaging 380 acres each; and the remaining fourth by 251,830 persons, averaging 70 acres each. (Oxoid) Peers, in number about six hundred, hold rather more than one-fifth of all the land in the kingdom. Thus one-half of the whole territory is in the hands of only 7400 individuals; the other half is divided among 813,500 individuals. The total population of the United Kingdom (not including Channel Islands and Isle of Man) in 1881 was 36,100,000, so that barely one in a hundred owns more than an acre of soil.

Of tenant farmers there are in Great Britain 561,000, in Ireland 600,000. About 400,000 of these in Great Britain, but above 500,000 of those in Ireland, occupy less than 15 acres of cultivated soil, the average size of the remaining holdings being in Great Britain about 160 acres, in Ireland 75 acres.

In the countries which have been colonized from England the system of small properties rather than large has been generally adopted. The first settlers in New England carried with them the idea of the village community. They decreed that grants of land should be made to each household to the extent of 90 acres, but the rest of the land apportioned to each village was to be held in common. This system has been now expanded into the homestead United States law (see HOMESTEAD), prevailing over the whole United States, in virtue of which a citizen of the States is entitled to a free grant of 160 acres ($\frac{1}{4}$ square mile) on condition of bringing it into cultivation within five years. The influence of slavery in the Southern States tended, as in Rome, to create large estates, but its abolition has arrested this course. On the whole, with exception of a very few gigantic farms in the extreme west, it may be said that both the United States and Canada are countries of small farms, seldom exceeding 150 to 300 acres, and almost universally cultivated by the owner. The pastoral lands of Australia and New Zealand are still held in "runs" of immense extent, but whenever cultivation makes way there is a growing movement in the direction of opening them up to purchase in small farms.

The above sketch, imperfect as the limits of space have compelled it to be, of the history of land tenure throughout the world shows that it has pursued one unvarying course. Commencing in community of tribal possession, it has everywhere by degrees been appropriated to the village, then to the family, and at last to the individual. But in every stage the conditions of its enjoyment and use have been absolutely regulated by the community in reference to the general welfare. A history so uniform would seem to rest on principles of human nature, and to be incapable of reversal. Nevertheless in the present age two opposite parties have impugned its lessons. The one would revert to the almost prehistoric times when community of property, of labour, and of wealth formed the rule of existence. The other speaks of individual property, especially in land, as a sacred and indefeasible principle, and denounces every restraint or modification introduced by the state as spoliation. Between these extremes an infinite variety of ideas for more or less making land or its produce public property, or more or less restricting the right of the personal owner, have been put forward, and some, with some confusion, strenuously advocated. A brief attempt will now be made to discriminate between what in these ideas is sound and what is impracticable.

The principles of communism have unquestionably struck deep roots in the minds of large classes of the public, chiefly in Germany, but to no inconsiderable extent in other countries and even in England. Nor can they be dismissed as merely criminal and worthy of no answer but repression. The answer must rather be that they are based on hopes and beliefs in the capability of human nature for self-sacrifice, which we have no warrant in yet accepting as our practical guide. A golden age may yet return, in which all shall be for the country and no one for himself, and we may even imagine that such successive ages show its nearer approach. But at least it has as yet not come. In every community there are found a large number of individuals who would not work honestly except under the compulsion of self-interest or of close superintendence. No socialist scheme has yet been devised which copes with this tendency.

In all of them a vast hierarchy of official inspection would be demanded, which, even if adequate, would cut up the profits. In all of them relapse from freedom to experiment. For the case of the culture of land, an art involving such variety of method applied to such variety of circumstance, it seems, as yet, impossible to conceive arrangements by which joint possession could result in beneficial production. We know it even among families to be at present a hindrance and source of loss. Nor has any definite scheme been yet proposed by socialists to show how it could be worked by the state. Till its advocates at least do this, and permit us to judge as men of business of the practical effect of their system in a given area and with given machinery, it were waste of time to discuss their aspirations and their imaginary results.

Those who, at the opposite pole, refuse to admit the right of the state to impose such conditions on private property as it deems for the general benefit may be dismissed even more briefly. Not only do they show entire ignorance of the history of land tenure at all times, but they belie the daily action of British legislation. Parliament seldom lets a session pass without making laws which assert the right of the state to take possession of property for public or private benefit, to tax it, and to restrain or regulate the rights of its owners over it. Nor is there any theory of the basis of property which does not tacitly admit that it is subject to the authority of the community. If derived from occupation, it owes its title to the agreement of the community to support that title. If derived from labour, it is valid only for the life of the labourer, and whoever succeeds to him must take it, not as a gift from a dead man whose rights end with the grave, but as a gift from the state, which deems that there is advantage in encouraging labour by the certainty of transmitting its produce. In every view it must be admitted that the state, by whose regulations and force property is maintained, must have an unqualified right to prescribe the conditions under which it will confer its gifts on private individuals.

The general object of supporting private property in land is to increase its produce, by inducing the owner, through motives of self-interest and affection for his family, to bestow on it the greatest amount of labour. It is agreed by all practical authorities that the soil of Great Britain might be rendered greatly more productive by the increased expenditure of capital, which when explained means in one shape or other the larger employment of labour, both in effecting permanent improvements and in conducting the acts of cultivation. The interest of the public in strengthening the motives which may lead to such additional production is unquestionable. The soil is the support of the nation, furnishing to it primarily both its subsistence, its clothing, its fuel, and the raw materials of its trade with other countries. Some indeed argue that freedom of trade with other countries, permitting unrestricted import of all these articles, has rendered the profitable use of the soil at home comparatively unimportant. But this is inaccurate for several reasons. First, importation involves at all events the expense of all that labour which is devoted to the carrying trade. Secondly, it involves dependence on other nations for other articles than food, to an extent which may easily become fatal. If, for instance, agriculture in England were to employ less labour, because it was more profitable to import wheat for subsistence and cotton on which to employ labourers, there is not only the risk, sufficiently grave, that both may be stopped by war, but the ever present probability that manufacturing industry may be displaced by competition from countries where its raw material can be obtained without the cost of carriage, and

where in some cases labour may, owing to climate or a lower standard of living, be cheaper. Such a rivalry is already visible in America, in India, and in Russia. If through these causes the manufactures should decay, and the artisans be driven to emigrate, certainly the depopulated fields of Great Britain would be unable to maintain her in her present rank among nations.

An entirely opposite school has, however, stated a principle, which, though not applied by it to the question of the tenure of land, would if true be hostile to the application of further capital to the soil. Political economists (see, *e.g.*, Mill, bk. i. chap. xii.) have asserted that every successive application of capital to cultivation must be less profitable than the first. This is called the "law of diminishing production from land," and it has been said to be "the most important proposition in political economy." But the fact is that it is true only if the qualification be added "in the existing state of knowledge." That is to say, it is true that, if a given amount of labour applied in raising wheat, for example, will raise 16 bushels on an ordinary soil, twice the amount of labour will not, *per se*, raise 32 bushels on the same soil, or even 16 bushels on a very inferior soil. But chemistry and experiment tell us that if, instead of expending the second quantity of labour in merely ploughing twice instead of once, we spend it in purchasing and applying nitrogen, phosphoric acid, and potash in proper proportions to the soil, either directly as artificial manures, or still more cheaply as manure from animals whose food has contained these elements, we do get a return considerably more than double for the double amount of labour which the application involves. This is exemplified in the fact that rents rose about 20 per cent. in England when these appliances came into use, in spite of a stationary range of prices, showing that the additional capital thus devoted to agriculture gave a higher return than the capital that had been previously employed.

A further illustration may be found in the fact that the capital that has been expended by the Improvement Companies in England, under the supervision of the Inclosure Commissioners, has yielded on an average a return of 15 per cent. of increased rental on the expenditure, over and above the profit made by the tenant farmer (Caird). Since this average includes a few cases in which defective knowledge has led to loss, it is evident that, when capital is applied to agriculture with reasonable scientific knowledge and skill, it is capable of still yielding returns at a full average rate, even after payment of the salaries earned by the scientific and practical education which has directed its employment. Nor is there any reason to believe that the process has come, or nearly come, to an end. It certainly does not follow that soil is capable of unlimited production; for it is quite certain that its powers in this respect are sharply defined by the amount of light and heat which in any given situation the plants growing on it can receive. But it is becoming daily more probable that up to that limit advancing science and practical skill will tend to equalize the cost of production, making the application of labour to inferior soils as profitable as to superior, and making capital as productive when approaching the limit of its useful application as when it is, in the form of raw labour, applied to soils newly brought under cultivation.

But, on the other hand, the doctrine that the land can be made more productive by the application of more capital, and that the state has a strong interest in increasing production, is fatal to all that variety of proposals which have been made for what is called, in rather uncouth and exceedingly vague phrase, "nationalisation of the land." All of these start with the suggestion that the land of the country, being the property of the community, should be resuscitated.

Doctrine
of supremacy
of private
rights.

Law of
diminishing
production
from land.

Nation-
alisation
of land.

by it for a new arrangement or distribution. In some schemes it is proposed that the state shall buy out the present owners, paying them the full value of the fee simple; in others it is proposed that the state shall simply resume the land on the death of the present owners, without paying any compensation to their heirs. Conceding the abstract justice of both propositions, it admits of little doubt that they would not be for the public benefit. Under the first the state would make a very bad bargain. Land, on account of its attractions as a subject of private property, brings a market price nearly 30 per cent. above its actual value. It sells usually at a rate computed to yield a clear return of not more than 3 per cent. But in order to bring this return the owner is obliged to lay out, in maintenance of buildings, drains, roads, fences, and other incidents, sums which on an average are not much less than a third of the net produce. If then the state is to buy at the rate of 3 per cent. what actually yields only 3 per cent., it is clear that the public will be a loser on the transaction. On the other hand, if the state is to take possession of land on the death of the present owners, either without compensation or with a compensation less than the market value, the result would be at once to stop all further improvement by the actual possessors. No one would spend money on that which was to pass, not to his own heirs, but to the public, and the land when it reverted to the state would be in a condition requiring enormous outlay to restore its exhausted fertility, and to remedy the general decay into which its appliances would have been suffered to fall. If again it is urged that the state might obviate this evil by offering compensation for the actual value of improvements which might be made, it can only be answered that private landlords and tenants have not yet found a method of satisfactorily ascertaining such value; that even when the principle is accepted tenants frequently prefer, when certain of not obtaining a renewal of their lease, to exhaust the land rather than trust to arbitration giving them an equivalent; and that this tendency would be enhanced when the state became the landlord and the valuers were appointed by it.

Supposing, however, the operation to be accomplished, and the state to have become the universal landowner, the next question is, What it is to do with the land? On this there is a still greater variety of suggestion. Some would have the land let by the state on lease merely, and would apply the rental to extinguish taxation. Others would have the state to sell in fee simple. But in both cases there arises the further question, To whom shall the advantage of a lease or a sale be given? Here there breaks out the dispute between the advocates of large and small estates and of large and small farms. Some would offer the priority of choice to the existing tenants; but, as this would result in the creation of a large proportion of estates or farms extending to hundreds or even thousands of acres, its superiority over the present system can only be considered as partial. Others would break up the whole land of the country into peasant properties, and even go so far as to furnish each with a house. But, considering that this scheme would further involve the abandonment of most of the existing farm houses and farm buildings, which would be quite useless to peasant proprietors, it would impose a heavy financial loss on the nation.

It must be further kept in view that there are only 47 millions of cultivable acres to be divided among 55 millions of persons, and that the acres are of every conceivable difference of value, dependent not merely on soil but on situation, climate, cropping, capability for improvement, and a thousand other circumstances. To divide these into plots of equal value would be a task of enormous expense,

and perhaps scarcely possible to be accomplished. But, if the plots are to be of larger size and unequal value, it must be again asked, How is the state to be guided in selecting the individuals to whom its special favours are to be given? And if it be said that the state would exact a rent proportioned to the value, and thus confer no favour, there would then arise the further question whether the rent is to be fixed in perpetuity, which means a gift to the lessees of all capability of improvement in the land, or whether it is to be adjustable by valuation at intervals, which merely leaves the lessees in the same position as the present lessees are. In the latter case nothing would be gained except that some would be dispossessed in order that others might be put in possession.

It is, however, insisted that in any case the state would have the advantage of drawing the rental of the land, and it is argued that this would do no wrong to the lessees, because it would be only the rental derived from the original value of the soil, and would not affect their profits from the capital and labour they employ on it. This principle, if sound, might, however, be applied with equal force to every other species of material wealth. The state would be quite as fully entitled to acquire, by purchase or by annexation on death of the owner, factories and consols, as it is to acquire land for which it has suffered the former owner to pay a price. But there is a greater disadvantage in the state becoming the universal landlord. A farm is dependent not only on the soil but on the seasons and the markets, and its profits cannot be guaranteed. A rent for the use of the mere soil may be far on an average of years, but occasionally there comes a series of years in which no rent at all can be paid without bankruptcy of the tenant. Private landlords can and do meet these bad times by concession and agreement, but the state can only act by laws, and in justice to the community it must be hard to its debtors. It is in fact the system which has been tried to be carried out in India, with a considerable variety of method, but with uniformity of failure,—a failure to be attributed mainly to the fact that state taxation, necessarily inflexible, is disastrous when applied to income so fluctuating as that from land must be. In fact a tenant, paying full value for the unimproved land to the state, would be in precisely the position occupied at present by an owner who is mortgaged up to the ears; and, since the rent is to be in perpetuity also, he would be unable ever to redeem himself from the burden. An occupant so situated is the most unhappy of men, and the worst of cultivators, and that the state should hold the mortgage over him would only make his position the harder.

These considerations apply also to the recommendations ^{the un-} which have been made that the land tax should be increased ^{correct} and that the "unearned increment in the value of land" ^{increment} should be appropriated by the state. Including tithe and local rates, land is taxed at present on an average of about 30 per cent. on its net profits. An additional tax on land would operate to prevent investment of capital on its improvement, since capital will not be invested where its returns are below the average. The "unearned increment in value of land" is often strikingly apparent in and near towns; but it does not exist in the bulk of agricultural districts. Corn has not risen in price within the last hundred years, and, if meat has, so has the cost of raising and importing the food of cattle. The rise in the value of agricultural land generally is not on the whole more than a fair return for the capital that has been invested in improvements, and for the immense sums that have been lost in the experiments out of which the improvements have sprung. The cases in which it is more than this would be incapable of being discriminated, and would not be worth the trouble if it were possible. The idea would probably

not have been started had it not been for the spectacle of the enormous fortunes accruing to those who have had the good luck to inherit or to purchase land useful for building purposes. If limited to such cases, the principle of the right of the community to resume the benefit arising from its own concentration in particular spots may be supported by different and very good reasons, due regard being had to the reimbursement to the private owner of all sums actually expended by him in purchase or building.

Mineral
wealth.

The right of the public to mineral wealth under the soil stands on as clear a footing. By the common law gold and silver mines belong to the crown, no matter who is the owner of the soil. The principle obviously applies equally to all minerals. They are a part of the country itself, not merely material from which profit can be extracted, and when they are gone they cannot be replaced. As the law forbids the selling of land to foreigners, it might with equal justice forbid the selling of coal for foreign exportation. The discovery of valuable minerals is often due to mere accident, and they resemble treasure-trove, which by law belongs to the crown. Nor would difficulty arise in working mines by crown leases or under crown superintendence. Where they already are worked it would be right to pay the estimated value to the private owner, since hitherto they have been deemed subject of private property, but all future increase or all new discoveries might justly be held to belong to the nation, without compensation to the owner of the surface who had no knowledge of their existence.

Regulation
of
distribution
of
land.

Approaching now the question how the state without actual resumption of the land may so regulate its possession as to encourage the maximum production from it, we are in the beginning met with the dispute between the advocates of large and small estates, the former cultivated by tenants, the latter by the owners. But we may first disembarrass this question from one source of confusion. Large estates are never cultivated in a block. They are invariably broken up into farms, sometimes indeed extending to several thousand acres, but far more generally ranging between the limits of 500 and 50 acres. Below 100 acres the tenant is usually himself the cultivator, with more or less assistance, and below 50 acres he will seldom require any assistance outside his own family. Now, as there is no advantage accruing from one landlord holding a number of such farms, we may state the question as regards cultivation as not being between large and small estates, but as being between farms of which the tenant does the work and those in which he only superintends the work of others.

Advantages
of
small
farms

Thus stated, the answer admits of no dispute. It has been already discussed in the article AGRICULTURE; but it may suffice to advert here to the conclusive argument derived from the superior efficiency and therefore cheapness and productiveness of the labour given by a man in working entirely for his own behoof, as compared with that which he pays others to do for him. It would scarcely be too much to say that capital in the form of personal labour will yield twice the return of capital employed in hired labour. It applies not merely to the man but to his wife, sons, and daughters, and not only to the total amount of work done, but to the zeal and care with which it is directed.

Against this advantage on the part of the small cultivator there is only to be set in favour of the large that he can better employ machinery. But, though he may be the first, he is not necessarily the only one to employ machinery. Reaping and mowing machines may be (and often are) employed on the smallest holdings; threshing machines are now made to be worked by hand or by one or two horses; even steam-engines are made with power down to one horse

or half a horse. Those very small machines are slightly more wasteful of coal for the power they give out; but on a small scale this is quite unappreciable, and is far more than balanced by the greater economy induced by their being driven by the owner himself. A very elementary resort to combination among small cultivators affords them in any case the same advantages as the large cultivator. Their energy and aptitude are not less, and with the advance of education may be directed with the same knowledge. Most persons connected with land know of many instances in which even at present the small cultivator is as advanced in his scientific practice as the larger. It is generally admitted that during the recent disastrous seasons the smaller farmers have been better able to meet their engagements than the larger. The reason is, not merely that their outlay is smaller in cost of labour, but that by close attention and the power of availing themselves of every opportunity they have suffered less actual loss than the farmer on a more extensive scale.

It is of course understood that, to enable a farmer of a small acreage to produce the same result as a larger holder, he must have the same advantages provided to him by investment of owner's capital. He needs the same buildings for farm purposes, the same drains and fences, in proportion to his extent of farm. But he does not need more; and, as his own house is only an equivalent for the labourer's cottage, which must in any case be provided, there is the saving of the more expensive residence which a farmer cultivating several hundred acres thinks himself entitled to. Again, the tenant's capital invested must also be as much in the one case as in the other. The small tenant ought to have as much and as good stock on the farm in proportion to its extent as the large. But he saves much capital in the item of wages, because, till profits come in, his own labour costs him only his own food, and even the rent of his house is postponed, so that it is probable that he will be able to spend on the land a capital larger in proportion than the extensive farmer at a greatly less actual outlay of money. Those who argue that the capital invested by the larger tenants is greater than that invested by the small cultivator forget that capital in agriculture must be measured not solely by expenditure of money but in a great measure by expenditure of labour to which a whole family may cheaply but effectively contribute.

The importance of encouraging investment of capital forms perhaps the main argument in favour of the system of cultivation by the joint interests of landlord and tenant. In this combination the landlord furnishes the land and (in Scotland always, in England frequently) the buildings, &c. The tenant's capital is therefore limited in its application to operations of tillage and manuring. The landlord's contribution is commonly estimated at five-sixths, the tenant's at one-sixth of the total capital employed, and while the landlord's yields less than 3 per cent interest, the tenant's has, by Mr Caird, been estimated as bringing in 10 per cent per annum. This, however, on an average of years and of farmers is probably too high an estimate. The conclusion, however, is drawn that the system is beneficial to the farmer because the capital required for permanent investment is advanced by the landlord at a low rate of interest, while the whole of the tenant's capital is invested at a high rate of interest. But in this argument it seems to be forgotten that the tenant's 10 per cent. includes not merely interest on capital subject to risk, but salary for time and skill, and is, therefore, not really 10 per cent. on capital. Now, undoubtedly, if any one desires to risk his whole capital in trade, he is entitled to at least 10 per cent. on it, and he makes, while prosperous, a large income. But if he prefers to invest five-sixths of it in a secure investment, yielding only 3 per cent., and to risk only one-sixth,

while at the same time giving his personal labour and skill, his income may be considerably smaller, but it will be to the same extent the more secure. It is entirely a question for each person to solve for himself, and it would be no national loss if a certain number of farmers were to elect to purchase farms of only one-sixth the extent of those which they occupy as tenants, and to cultivate them with their own labour. Or, if the present tenants should be reluctant to exchange their higher incomes, subject to the greater risk, for smaller but more secure incomes, it cannot be said that there is any national gain in their occupying land which in the hands of small owners would yield crops as large and at no greater cost, though with a different distribution of profits.

What is true in the argument appears to be this. It would be a distinct loss to the nation if landlords were to withdraw their capital from the land before other persons are prepared to put as much in. At present tenants in general cannot put in more capital, because they have not got more. They could not, therefore, buy their present farms. But they could buy farms of smaller extent, and on these raise crops fully as good. And if there were enough of other persons prepared to buy the remainder of the land, and to cultivate it themselves with equal skill, there would be equal advantage in their doing so. But, since skill in farming needs both education and practice, there are not enough of persons as yet possessed of these qualifications and also of the needful capital. Hence any sudden break in the present system of tenure by landlord and tenant would be hurtful to the country, leading to abstraction of capital, and worse cultivation and less produce. But a gradual process of change, permitting all persons who had capital (however small) and aptitude, to become owners and cultivators, would be a national benefit, since it would not diminish the capital employed, but would render it on the contrary more productive through the stimulus of being applied wholly for the benefit of the cultivator himself.

There is no doubt that the system of division of capital and rights between landlord and tenant is intrinsically bad. Neither is full owner, nor can do even with his own share exactly what is best for himself and the public. The landlord is generally short of means with which to make permanent improvements; in any case he can make none without the tenant's sanction, and of course he makes none unless the tenant agrees to pay him at least 3 but more often 5 per cent. The tenant, on the other hand, having only a temporary interest, spends nothing except when he sees a certainty of being repaid before the end of his term. Land, however, yields only slow returns, and much is thus left undone because the full profit cannot be reaped till after a lapse of years. The system of leases, universal in Scotland, palliates but does not remedy the mischief. It is recognized that the tenancy, usually of nineteen years, is in practice divided into three equal portions. The first is spent in restoring the exhaustion of the soil by the preceding tenant, the second gives a full profit, the third is (if no renewal of lease be expected) devoted to the gradual withdrawal of capital, with corresponding reduction of fertility. Compensation for unexhausted outlay is an excellent principle; but it has not yet been found so trustworthy in application as to afford sufficient security to induce the continuous application of capital till the end of the lease. It is very doubtful whether any form of legislative interference, passing beyond a mere enactment of equitable presumptions in absence of express contract, would improve the relation between the two parties, because such enactments when not agreeable to both parties can always be indirectly broken through. It is only cultivation by the actual owners that gives at once the freedom and security

necessary for full development of the capacity of the land and the adoption of the results of modern science.

The history of land tenure in Ireland illustrates these principles, and they in turn afford a standard by which to judge recent legislation. Leaving out of view a certain number of estates on which the landlord supplied, in addition to the land, the capital represented by buildings, drains, &c., in the greater part of Ireland he supplied nothing. The tenant, under a general custom of permanence of holding, in many cases did a great deal, but, as the custom was not enforced by law, the occasional seizure of his improvements caused a sentiment of alarm and distrust which seriously limited them. The Act of 1870 aimed at giving him additional security by not merely recognizing his right to compensation for his own outlay if he should be removed, but by imposing a fine on the landlord if he should evict a tenant. But, as it avoided to prohibit the landlord from raising the rent, the insecurity was just as great as before, while the introduction of a legal relation between the two parties led many landlords to restrict more than ever their expenditures on improvements. The Act of 1881, therefore, proceeded to the necessary consequence of fixing the rent, by means of a court of valuation, and of giving to the tenant a positive right to permanent occupancy, subject to a revaluation every fifteen years. But it is obvious that this scheme also, though valuable as an immediate palliative, fails to have the elements of a permanent settlement. The landlord will be less and less inclined to spend on improvements; and even if he desired to do so the tenant can, and in nearly every case will, prevent him, for the plain reason that he will not desire the landlord's share in the joint property to be increased. Yet the tenant will on his part be impeded from full confidence in making improvements, even when he has the means, lest at the next valuation his own outlay may be valued against him. The interests are no longer joint but conflicting. Thus far the remedial legislation has only succeeded in reaching the stage in which Prussia stood before the reforms of Stein and Hardenberg were proposed, when nobles and serfs had both certain legal rights, which neither could attack, but which neither could convert into independent property. But the Prussian method of reform by apportioning the land to each party in absolute property, but in fractions representing their respective interests, could not be applied in Ireland, both because the holdings are in general too small to bear partition, and because the landlords have not, as in Prussia, been in the habit of cultivating their own domain, and they would, therefore, again introduce the vicious system of letting to tenants even that part which might be assigned to them in unencumbered fee. The state will, therefore, have to become the intermediary of transfer, but the better course would probably have been that it should at the first have assumed this function on the over-rented and ill-managed estates, leaving those which were fairly rented and liberally managed unaffected by legislation which they did not need.

The legal basis of the recent land legislation in Ireland is, however, as it was in Prussia, the recognition that prescriptive possession, even under a title of mere tenancy, confers a right to continuance of such possession. The same principle formed the basis of the conversion of copyholds in England from being tenancies at will into tenancies in perpetuity. It might justly be applied still in cases in Great Britain in which tenancies have continued without change for a long period. Especially it might be applied to check the system of "clearances" in the Highlands, where the right of the crofters to continue in possession rests on the original community of possession by the tribe, and is fortified by an almost immemorial continuance of possession by each family.

Owners should be cultivators.

North-
gers
objec-
tionals

In any view of ownership, however, whether on a large or small scale, it is obviously of prime importance that the owner should be possessed of cash sufficient to make the improvements required. This is a situation in which an owner who is already in debt cannot possibly be. To hold land subject to a mortgage is, therefore, to hold it under conditions disadvantageous to the owner, the tenant, and the nation. The evil is intensified by the fact that an owner so burdened possesses an apparent estate far in excess of his real means, and occupies a social station involving an expenditure that exhausts his resources in every way. It would be greatly for his pecuniary advantage if the law were such as would compel him to sell sufficient land to pay off his debts, for he would thus relieve himself of interest at the rate of 4 to 5 per cent. by selling property which gives only 2 or 2½ per cent. on the price that would be obtained. His net income would then not only be greater, but as his apparent estate would be smaller he would not be tempted to live in so expensive a style, and he would thus have the means of gaining larger returns from his property by improving it. It has, therefore, been proposed to abolish mortgages by prohibiting land from being made security for special debts. It would then form part of the general assets of the owner, liable equally for all his debts; and any one who desired to raise money would practically be obliged to do it by sale instead of by pledge. Land would be confined to its proper purpose as a means of production, instead of being injured for that purpose by being used as a means of credit.

Life in-
terests
objec-
tionals

The same principle forbids that life interests in land should be permitted. The mere tenant for life or holder under settlement or entail has actually in frequent instances a motive against cultivating his estate to the best advantage. If he is not on good terms with the next in succession, or if, as so often happens, the next successor is a distant relative, while the present tenant has only daughters, his motive, and often indeed his duty, must be to impoverish the estate in order to save money for those whom he loves best. In a less degree, if he has a large family, he must save money out of the rents of the estate to provide for his younger children, and he is correspondingly disinclined to lay out money on improvements which must accrue only to the benefit of his eldest son.

All these considerations are equally applicable to small as to large estates in land. It is as injurious to the peasant cultivator as to the extensive landowner to be hampered by a burden of debt, or to be deprived of the power of directing who shall be his successor. In France, in Germany, in Switzerland, in America, and in India, indebtedness is the great curse of the small farmer. The money-lender is a far harder master than the landlord, for he has less mercy and less interest in being merciful.

Devotion
of land
to pur-
poses of
luxury

It has been assumed throughout these observations that land is to be applied to its natural use, the production of the materials of food and clothing. In the hands of rich persons it is, however, sometimes devoted to purposes of luxury and enjoyment, such as the formation of large parks, game preserves, and deer forests. Within moderate limits such purposes may be defended on the plea that man does not live by bread alone but by all the enjoyments which he is framed for appreciating, and which in moderation contribute to mental health. But they are most defensible when open to the most general enjoyment, and it is peculiarly to the credit of many of the English nobility that they open their parks to the resort of the neighbouring villagers and townspeople, often at some inconvenience to the owners themselves. On the other hand, the conversion of large tracts of ground to the object of preserving game, which implies at the same time exclusion of the public, and diminution of production of food, for the sole recreation

of one or two individuals, is a use of national resources which has, since the formation of the New Forest by William the Conqueror, been generally reprobated. The latest phase of its development has been in the conversion of immense areas of the Highlands of Scotland into grouse shootings and deer forests, a process which involves the removal of the small tenantry, and even, in the case of deer forests, the ceasing to graze cattle and sheep. The landowners find that the game rents are much more profitable to them than the farming rents, but it is at the cost of the nation, which suffers a diminution in the employment of labour and in the production of food, and which consequently must see its inhabitants emigrate and pay for imported grain, wool, and meat grown by foreign labour. The ultimate remedy of this abuse will probably be found in measures tending to break up large estates into small ones, for the system requires the reservation of extensive areas free from the presence of man, and the interposition of small cultivated holdings would effectively destroy it.

It may, however, be well to notice here an argument *Gruing*, which has been sometimes pushed to excess. It has been urged that even grazing should be prohibited on the ground that from the same area a much larger production of food can be obtained in the shape of corn than of meat. The difference is indeed very striking. An acre of good land will yield 40 bushels of wheat, weighing 2600 lb, while in grass it would yield only 250 lb of meat, and it is still more striking if we deduct the water from each, when we have 2200 lb of dry grain against 188 lb of dry flesh and fat. But man being semi-carnivorous must have a proportion of flesh, and the value he assigns to meat as compared with corn shows very correctly its relative importance in the human economy. The fact is that the cost of market prices, which are now regulated by the production and demand of the whole world, assigns to dry meat and fat a value just about twelve times as great as that of corn, and consequently an acre of grass land gives a profit quite equal to that of an acre of wheat. Nor could the equality be impaired even if we were all to become vegetarians. For the most ardent disciples of that faith admit the necessity of using milk, and about 2 pints of milk is a necessary addition to a daily allowance of 2 lb of grain for health and the performance of work. But to furnish this quantity of milk throughout the year nearly an acre of ordinary land would be required, or as much as would give about half a pound of meat per day, so that there are no means by which we can dispense with the use of a considerable extent of land for the feeding of animals, by which its produce is converted into the proximate products demanded by the human constitution, and the amount to be so used is best determined by the demand of the public.

The conclusion to be drawn from the review of the whole questions relating to tenure of land is that they are best solved by freedom of action of individual owners, guided by self-interest and family affection, and only restrained by law when the special circumstances of a high civilization introduce abnormal conditions. Since these motives operate most fully and healthily when land is held in small estates, it only remains to glance at the methods which in different countries and by different authorities have been suggested to encourage subdivision.

The most general method is that of equal division of the *Methods* inheritance among children. It is compulsory in the *of sub-division* Channel Islands, in France, and several other European countries, and it forms the rule of intestacy under the law of gavelkind in Kent, in most of the British colonies, and in the United States. To its existence in the latter form no reasonable objection can be taken. To its compulsory enforcement there applies, though in a modified degree, the same objections that apply to a compulsory rule of

primogeniture, with the additional objection that it tends to limit the growth of population. Parents who are compelled to give an equal portion to every child avoid the risk of subdivision by not having many children, a course which, if commendable when the Old World seemed in peril of over-population, is a source of national impoverishment when the world affords profitable employment for hundreds of millions more than exist. Among the children themselves the certainty of succession abates the sentiment of filial duty, and the desire to bestow a special bounty on one child who is favoured above the rest may sometimes induce the parents to spend less than they otherwise would in the improvement of the whole estate.

Subdivision of property may, however, be gradually effected by prohibiting excessive bequests. It has always been recognized that the state has an unquestionable right to deal with property at the moment of its transmission from the dead to the living, and no objection could be made to a rule that no one should leave by will or through intestacy more than a certain sum, or land of equivalent value, to one individual. This would not generally affect the desire during life to amass and improve property, because the improved value would still be available for division among all whom the owner wished to benefit. But it would in one generation reduce all estates of abnormal size to properties of such dimension as in the opinion of parliament would be most serviceable for cultivation, and consequently most conducive to national benefit.

The abolition of the right to raise money by mortgage of land would also tend to promote its subdivision, since an owner in debt would be obliged to sell a portion of his estate in order to pay his debts. The improvement of conveyancing, which would follow from the general abolition of all interests in land except that of simple and absolute ownership, would also facilitate the sale of land. The leading principle which should guide legislation is in short that land should be made capable of the easiest transmission from one owner to another, and of the fullest use by him to whom for the time it belongs. The ordinary motives of human nature will then occur in transferring it from those who are least to those who are most capable of making it productive, and of inducing each successive owner to bestow on it the labour and outlay by which the maximum of beneficial production will be secured.

See Mommsen, *History of Rome*; Von Maurer, *Geschichte der Markverfassung in Deutschland*, 1d., *Geschichte der Dorfverfassung*, 1d., *Geschichte der Städteverfassung*, 1d., *Geschichte der Provinzialverfassung*, 1d., *Geschichte der Hofverfassung*; Nassau, *Über die Mittelalterliche Feldgemeinschaft in England*; Landen, *Die Territorien in Bezug auf ihre Bildung*; Von Hartmann, *Über die Agrarverfassung in Norddeutschland*; Lovelock, *Primitive Property*; Maine, *Village Communities in the East and West*; Cobden, *Union, Synthesis of Land Tenure*; Reports of H.M. Representatives in France of Land; Pail, *Papiers*, 1800-1; *Société de la France*; Marx, *Das Capital*; Herbert Spencer, *Social Statics*; George, *Progress and Poverty*; Brodriek, *Land in England*; Boyd Kinnear, *Principles of Property in Land*.

LANDAU, the chief town of an official district in the Palatinate of the Rhine, Bavaria, is situated on the Queich, about 18 miles north-west of Carlsruhe. Among its various interesting buildings are the Gothic church, dating from 1285, and the monastery, founded in 1276, and now converted into a brewery. There is a considerable trade, and some manufacture. The population in 1875 was 7579.

Landau was taken no less than seven times in the Thirty Years' War. At the peace of Westphalia it was ceded to the French, and was generally held by France till 1816, when it was restored to Germany; in 1816 it was annexed to Bavaria. In 1871 its fortifications were finally destroyed.

LANDEN, JOHN, a distinguished mathematician of the 18th century, was born at Peckirk near Peterborough in Northamptonshire in 1719, and died 15th January 1790, at Milton in the same county. Most of his time was spent

in the pursuits of active life, but he early showed a strong talent for mathematical study, which he eagerly cultivated in his leisure hours. In 1762 he was appointed agent to the Earl Fitzwilliam, and held that office to within two years of his death. He lived a very retired life, and saw little or nothing of society; when he did mingle in it, his dogmatism and pugnacity caused him to be generally shunned. He was first known as a mathematician by his essays in the *Ladies' Diary* for 1744. In 1766 he was elected a Fellow of the Royal Society. He was well acquainted and *au courant* with the works of the mathematicians of his own time, and has been called the English D'Alembert. In his *Discourse* on the "Residual Analysis," in which he proposes to substitute for the method of fluxions a purely algebraical method, he says, "It is by means of the following theorem, viz.,

$$\frac{x^m - a^m}{x - a} = x^{m-1} + \frac{a}{x} + \left(\frac{a}{x}\right)^2 + \dots + \left(\frac{a}{x}\right)^{m-1} \quad (n \text{ terms})$$

(where m and n are integers), that we are able to perform all the principal operations in our said analysis; and I am not a little surprised that a theorem so obvious, and of such vast use, should so long escape the notice of algebraists." The idea is of course a perfectly legitimate one, and may be compared with that of Lagrange's *Calcul des Fonctions*. His memoir (1775) on the rotatory motion of a body contains (as the author was aware) conclusions at variance with those arrived at by D'Alembert and Euler in their researches on the same subject. He reproduces and further develops and defends his own views in his *Mathematical Memoirs*, and in his paper in the *Philosophical Transactions* for 1785. But Landen's capital discovery is that of the theorem known by his name (obtained in its complete form in the memoir of 1775, and reproduced in the first volume of the *Mathematical Memoirs*) for the expression of the arc of an hyperbola in terms of two elliptic arcs. To find this, he integrates a differential equation derived from the equation

$$t - \pi \sqrt{\frac{m^2 - a^2}{m^2 - x^2}},$$

interpreting geometrically in an ingenious and elegant manner three integrals which present themselves. If in the foregoing equation we write $m = 1$, $a = k$, and instead of t consider the new variable $y = t + (1 - k)$, then

$$y = (1 + k)x \sqrt{\frac{1 - x^2}{1 - k^2}},$$

which is the form known as Landen's transformation in the theory of elliptic functions; but his investigation does not lead him to obtain the equivalent of the resulting differential equation

$$\frac{dy}{\sqrt{1 - y^2} \sqrt{1 - k^2 y^2}} = \frac{(1 + k)dx}{\sqrt{1 - x^2} \sqrt{1 - k^2 x^2}}, \quad \text{where } k = \frac{1 - k'}{1 + k'},$$

due to what appear to Legendre, and which (over and above Landen's own beautiful result) gives importance to the theorem as leading directly to the quadric transformation of an elliptic integral in regard to the modulus.

The list of his writings is as follows:—*Ladies' Diary*, various communications, 1744-1780; papers in the *Phil. Trans.*, 1764, 1780, 1788, 1771, 1775, 1777, 1785; *Mathematical Tractations*, 1786; *A Discourse concerning the Residual Analysis*, 1788; *The Residual Analysis*, book I., 1784; *Amusements on Dr. Sturges's Method of computing the Sun's Distance from the Earth*, 1771; *Mathematical Memoirs*, 1780, 1788.

LANDER, RICHARD (1804-1884) and JOHN (1807-1889), two brothers, African explorers, were natives of Cornwall. Richard Lander accompanied the Niger expedition of 1825-27 as Clapperton's attendant, and on the death of his master at Sokoto on the Niger in April 1827,

returned to England, and published an account of the expedition in 1830. He exhibited such capacity for the work of African exploration that the British Government decided to send him out to determine the course of the lower Niger, which was then unknown. In the expedition he was accompanied by his brother John, who was better educated than Richard, and who went as an unsalaried volunteer. Leaving England in January 1830, the brothers landed at Badagry on the Guinea coast on March 23. They then travelled north-east to Boco on the Niger, and after a trip north as far as Yaorie they proceeded down the river in canoes. At Kirree they were taken prisoners by the natives, and after some delay were conveyed down the river and managed to escape in a brig, the river journey lasting about five months. The Landers were thus able to lay down with approximate correctness the lower course of the Niger, and to prove that it discharged by a delta into the Gulf of Guinea. They lost many of their records at Kirree, but published a detailed narrative of their exploration in three volumes, in 1832 (*Journal of an Expedition to explore the Course and Termination of the Niger*, by John and Richard Lander). In 1832 Richard went out again at the head of a well-equipped expedition, organised by Liverpool merchants for the purpose of opening up trade in the Niger, and founding a commercial settlement at the junction of the Benue with the main river. After making several successful journeys, he was again on his way up the river in January 1834, when on the 20th the party were attacked by natives, and Lander was wounded. He died of his wounds at Fernando Po on February 6. John Lander died November 16, 1839.

LANDES, a department in the south-west of France, formed of portions of the ancient provinces of Guyenne, Béarn, and Gascony, lies between 43° 30' and 44° 32' N. lat., and 0° 8' E. and 1° 30' W. long., and is bounded on the N. by Gironde; on the E. by Lot-et-Garonne and Gers; on the S. by the Basses Pyrénées; and on the W. (for 68 miles) by the Bay of Biscay. Its greatest length, from the mouth of the Adour in the south-west to Arr on the border of Lot-et-Garonne in the north-east is 89 miles; its greatest breadth from east to west is about 62 miles, and the area 3599 square miles. The department takes its name from the *landes*, sandy plains formerly covered by the sea, which occupy its greatest portion, and extend into the departments of Gironde and Lot-et-Garonne. South of the Adour, the chief river of the department, the country changes in character, and is called *La Chalosse*,—a hilly region, which the various rivers coming down from the Pyrénées intersect like the rays of a fan. The Gabas, Lay, and Gave de Pau are the principal tributaries of the Adour on the left. On the right it is joined by the Midouze, formed by the junction of the Douze and the Midou. North of the Adour the plain of Landes slopes gently to the north-west, and empties its waters partly by the Leyre which flows into the Aracchon basin, partly by brooks which run into the lakes at the foot of the dunes which fringe the coast. The soil of this plain is naturally sterile. It is composed of a mixture of sand, clay, and organic debris, and rests on an embol of tufa (*dioze*) which is impermeable to water; for three-quarters of the year, consequently, the waters, settling on the almost level surface and unable to filter through, transform the country into marshes and morasses, while in summer the heat of the sun, drying up the marshes, produces malarious fevers. But during the last twenty-five years much labour has been expended in draining operations. More than 1850 miles of ditches have been dug, and of the 1,112,000 acres which were unutilized in 1850 two-thirds have now been reclaimed, or planted with forest trees. The coast, for a breadth of about 4 miles, is bordered by a succession of

dunes or sand hills, in several ranges parallel to the shore, and from 150 to 800 feet in height. Driven by the west wind, which is most frequent in these parts, the dunes were slowly advancing year by year towards the east, burying the cultivated lands and even the houses. Brémontier, towards the end of the last century, devised the plan of arresting this scourge by planting the dunes with maritime pines. At the present time upwards of 98,000 acres have been thus treated, and the forests already supply some fine timber to the navy. In the south-west, cork trees take the place of the pines. On the eastern side of the dunes is a series of lakes (Cazan or Sanguinet, Biscarosse, Aurellian, St Julien, Léon, and Soustons), which have been separated from the sea by the heaping up of the sand. The salt water has escaped by filtration, and they now are quite fresh. The climate of Landes is the Gironde, which prevails from the Loire to the Pyrénées. Snow is almost unknown, even in winter; the spring is rainy, the summer warm and stormy. The prevailing wind is the south-west, and the mean temperature of the year is 53°·6 Fahr., the thermometer hardly ever rising above 82° or falling below 14° Fahr. The annual rainfall in the south of the department in the neighbourhood of the sea reaches 56 inches, but diminishes by more than half as we proceed to the north-east. Most of the department is still in the condition of *landes*, traversed by flocks of sheep, which are kept by shepherds perched upon stilts. These *landes* are gradually giving place to forests, and in extent of forest land this department occupies the first place in France. In the *Chalosse*, the richest portion of the department, the vine, maize, wheat, millet, tobacco, vegetables, hemp, and flax are cultivated; yet, small though the population is, the department does not produce corn enough for its own consumption. The exploitation of the forests forms the chief industry. The resin obtained from the maritime pine furnishes by distillation essences of turpentine, and from the residue we have various qualities of resin, which serve to make varnish, tapers, sealing-wax, and lubricants. Tar, and an excellent charcoal for smelting purposes, are also obtained from the pine-wood. From the numerous iron furnaces in the department there was, in 1878, an output of 17,000 tons smelted with charcoal, and 8139 tons during the first six months of 1881. The cultivation of the cork tree is also very important; its produce is much sought after both by French and by foreign manufacturers. There are also a number of brick and tile works, and potteries. The department has several mineral springs, the most important being those of Dax, which were frequented even in the time of the Romans. The population of Landes in 1876 was 303,508, or 84 inhabitants to the square mile. In 1801 the population was only 224,272. The department includes three arrondissements (Mont-de-Marsan, Dax, and St Sever), 28 cantons, and 333 communes. Mont-de-Marsan is the capital of the department. It is noticeable that in its long extent of coast it has no considerable port. Opposite Cape Breton, however, where the Adour formerly entered the sea, there is, close to land, a deep channel where there is safe anchorage. It was from this once important harbour of Cape Breton that the discoverers of the Canadian island of that name set out.

LANDLORD AND TENANT. It has been explained in the article *LAND* that in the United Kingdom no such thing as the absolute private ownership of land is recognised. The absolute and ultimate owner of all land is the crown, and the highest interest that a subject can hold therein is a tenancy. The largest estate known to the law, that in fee simple, is after all only a holding in which the owner of the fee stands to the lord in the relation of a tenant. All estates in land would therefore fall under this heading, but on the present occasion, as in common parlance, it is

restricted to those holdings which amount to the hiring of land. That tenure has nowhere the same importance as in the British Isles,¹ where practically the whole agricultural land of the community is cultivated by persons who merely hire it for a limited time from the owners. The social and political bearing of this fact does not fall within the scope of the present article, but it shows the important application of the rules of law which we proceed to state.

Dismissing the tenant character of the landlord, and regarding him as owner pure and simple, we have to deal with him as contracting to give up the occupation of his land to another person, the tenant, for a consideration. In Roman law, the tenure of *emphyteusis* (a kind of perpetual lease originally used by corporations but afterwards by private owners), and *precarium* (or tenancy-at-will) occupied to some extent the place of the law of landlord and tenant in our system. The proper contract of letting and hiring (*locatio-conductio*) as applied to land had the following incidents. The *conductor* (tenant) was not technically regarded as possessor; i.e., he had not the aid of the interdicts in case of eviction either by the landlord or by strangers. The *locator* alone could sue in respect of the land, but the *conductor* had a personal action against the *locator* on the contract. The landlord was bound to make delivery to the tenant and permit him to occupy for the term agreed upon, and to keep the premises in proper repair. The landlord was answerable for any injury arising to the tenant from the defective condition of the premises. Finally, "the landlord must permit the tenant to carry away not only movables but even fixtures placed by the tenant, provided the tenant did not injure the house." A tenant of land was entitled to compensation for unexhausted improvements except such as he had specially agreed to execute in consideration of a lower rent" (see *Hunter's Introduction to Roman Law*, p. 121). On the other hand, the *conductor* had to pay the rent subject to deductions for the total or partial loss of the crops, to exercise due care during his term, and give up possession at its expiration.

In English law the following terms are of fundamental importance. The landlord so contracting is said to *demise* his lands, and the instrument by which the contract is expressed would be a *demise or lease*. The word *lease* is very generally limited to the writing in which the agreement to let is expressed, but any contract of letting is as on the side of the landlord a *demise*, and so between the parties a *lease*. A lease or demise means a grant of the exclusive possession of the thing in question for a definite time; permission merely to use the thing for a particular purpose or on a particular occasion is a licence and not a lease. A lease further implies that the lessor intends to give up possession to the defendant for a determinate time, no matter how it may be expressed, and is so distinguishable from a mere agreement contemplating that the parties shall on some future occasion enter into the relations which a lease creates. The consideration promised by the tenant or lessee is termed the *rent*. The period of occupation prescribed is the *term*.

The Statute of Frauds (29 Car. II. c. 3) enacts that "all

¹ In the United States the law is substantially the same as in England. The remedy by distress is said to be "becoming unpopular in the United States, as giving an undue advantage to landlords over other creditors. In New England the law of attachment on mesne process has superseded the law of distress. In New York, North Carolina, Georgia, Ohio, Alabama, Tennessee, Mississippi, and Louisiana, it is modified or abolished (see *Bouvier's Law Dictionary*, art. "Distress"). On the other hand, a speedier remedy than ejectment has been provided for landlords, by which they may be "reinstated, upon notice of a day or two, in case where a tenant abandons the premises before the end of the term without surrendering the lease, leaving rent in arrear, continue to hold over after the expiration of his term, or has become unable or unwilling to pay for the use of the premises" (*Bouvier*, art. "Landlord and Tenant").

leases, estates, interests of freehold, or terms of years, not put in writing by the parties so making or creating the same or their agents thereunto lawfully authorized by writing, shall have the effect of leases or estates at will,"—except leases for a term not exceeding three years, whereon the reserved rent amounts to two-thirds of the improved value. When rent is accepted by the landlord, the tenancy-at-will is enlarged into a tenancy from year to year. By a later Act, 8 & 9 Vict. c. 106, a lease required by law to be in writing must now be made by deed.

A lease, like other written contracts, should clearly indicate the parties to and the effect of the contract. A date is not necessary, and in the absence of a date, it will take effect from the day of delivery. But it must contain the names or other sufficient description of the parties, a description of the premises to be demised, words appropriately expressing the fact of a present demise (*demise or lease* being the usual words), the date at which the term is to begin and end, and the rent. The rent or other services created in favour of the landlord by the lease are said to be *reserved*. And when things that would otherwise belong to the tenant under the lease, as woods, timber, trees, minerals, &c., are expressly withheld, they are said to be *excepted*. But these expressions do not apply to conditions giving to the landlord the right of shooting, fishing, and so on over the land, or any right of way or other easement thereon. That can be vested in the landlord only by a re-grant from the tenant, no matter by what expression the right is created. Such grant must be by deed; and, where a lease of the land would be effectual without a deed, a reservation of such rights as we have mentioned would not. There is a good deal of misconception on this point, for landlords are not generally understood to hold their right to game on grant from their tenants.

In point of length of term tenancies are distinguishable as being either at sufferance, or at will, or from year to year, or for a term of years. A tenancy by sufferance exists where a person having obtained possession on a lawful title holds over after the title has determined, e.g., a tenant on lease for a term of years after the expiration of the lease. It has been said that this is not an estate at all but a fiction to prevent the continued possession being regarded as a trespass. It is not created by contract, but arises by implication of law; it is not assignable; and possession of the land can be resumed without previous demand to the so-called tenant. A tenancy-at-will exists when the tenant holds by agreement with the landlord, determinable at the will of either. Any signification of a desire to terminate the tenancy, whether expressed as "notice" or not, will bring it to an end. A tenancy from year to year is a tenancy for one year certain, and is determinable only by a six months' notice to quit, such notice terminating on an anniversary of the date of the beginning of the tenancy. A tenancy from year to year must last at least one year, but may be determined then, if a six months' notice has been given; if not so determined it must endure for another year, again determinable in like manner, and it will so endure until terminated by such a notice. Apart from express agreement, it will be implied in law when, for example, the landlord accepts rent yearly or by parts (e.g., quarters) of a year. Similarly monthly tenancies, chiefly of furnished houses or lodgings, would be implied from the fact of rent being paid once a month. But that is a matter of presumption only. If it were proved that the parties agreed to a tenancy-at-will only, payment of rent by the quarter or any other period would not enlarge the nature of the tenancy. Lastly, a lease may be for a specified term, and the tenancy in that case comes to an end by the lapse of time, without notice to quit or any other formality.

These are the agreements by which the relations of

landlord and tenant, as the phrase is generally understood, are created, and they are the agreements under which most of the buildings and nearly the whole of the agricultural land are held by their occupiers. These are tenancies, however, in which the grantor would not be spoken of as the landlord. Such is the position of the person to whom land is granted for his own life, or, it may be, for the life of another, called in technical language tenant for life and tenant *per autre vie*. These are not cases of letting and hiring—to which the relation of landlord and tenant is confined—but are modes of holding property. The same may be said of the terms for long periods of years created for carrying out trusts in the settlement of estates. The tenant in such cases is the person who, when we come to the agreement of letting and hiring, stands in the place of the landlord. It may be observed that the law-books distinguish in point of dignity between estates for life, the lowest kind of freehold estates, and estates for any term of years however long, which are only leasehold estates.

Reverting to the agreement of letting and hiring, it may be laid down that any person having an interest in land may, to the extent of that interest, create a valid tenancy. A tenant for years or even from year to year only may stand in his turn as landlord to another tenant. If he profess to create a tenancy for a period longer than that to which his own interest extends, he does not thereby give to his tenant an interest available against the reversioner or remainder man. The subtenant's interest will expire with the interest of the person who created it. But as between the subtenant and his immediate lessor the tenancy will be good, and, should the interest of that lessor become greater than it was when the subtenancy was created, the subtenant will have the benefit of it. In the same way, as between lessor and lessee—landlord and tenant—the latter has no right to look beyond the grant of the former so as to call in question his title. Be that title what it may, the tenant, by accepting that position, is *estopped* from denying that it is good. It may be notoriously bad, but that is nothing to him. The landlord is not obliged to prove his title as against the tenant or any person claiming through his tenant. In an action of ejectment (for the recovery of land) the person claiming possession must in general prove his own title—mere possession being a *prima facie* sufficient defence, until a better title be shown. But a landlord seeking to secure possession of land from his tenant is not obliged to prove anything, except his right to resume possession under the agreement. The tenant, however, may, without disputing the validity of the title under which he entered, show that it has since been determined by lapse of time or by operation of law.

A large portion of the land of the country being held under settlements whereby the person in possession for the time being had only the legal interest of a tenant for life, there were until recently great difficulties in the way of letting such land advantageously. The Leases and Sales of Settled Estates Act, 1856, now empowers any person entitled to the rents and profits of a settled estate to demise the same by deed for any term not exceeding twenty-one years to take effect in possession and at the best rent obtainable. Settlements containing express directions to the contrary will, however, avoid the statute; and on the other hand a settlement may contain powers to the tenant for life to grant leases for even longer terms.

The legal rights and duties of landlord and tenant respectively are in most cases defined by the contract of tenancy. The policy of the law has hitherto been to allow the landlord, who is virtually if not technically absolute owner of the land, to do as he pleases with it. The contract of tenancy has hitherto been a free contract, and, although in the absence of contract the law itself defines

the rights of the parties, there is hardly one of these which may not be displaced or modified by the agreement. This, it may be said in passing, is the seat of the very widespread dissatisfaction that exists in all the three kingdoms with what are vaguely termed the land laws. A small class has been allowed to acquire absolute dominion over the land of the country, and may impose what terms it pleases on the rest of the community for the right to use the land. The law governing the devolution of land is intricate and perplexing no doubt, and by making conveyances expensive hinders the free distribution of the land among a larger class of owners. But that is not the real root of the present discontent. Its real root is the absolute dominion of the class of owners who are not cultivators, but who, having the monopoly of the land, may load the cultivators with what burdens they please. As for the law of landlord and tenant, it is still greater misconception to suppose that to be in fault. It is what the landlord or tenant chooses to make it. There is very little of it, independently of contract, and what little there is may be altered as the parties please. No law can be better than one which allows men to make their own contracts and limits itself to enforcing them. That is what the law of landlord and tenant does. If its effects are bad, it must be because the original conditions of the contracting parties are other than they ought to be. We shall have to show that practical evils have led to a demand for an alteration on the law of landlord and tenant in the direction of limiting the power of the landlord to impose terms on the tenant.

One privilege imposed by the law on this landlord must be excepted from what has just been said. The right to distrain for rent is a special interference of the law for the protection of the landlord. Besides suing for his rent as a man may for any other right, besides taking advantage of whatever covenants he may have made for entry on default of payment, a landlord may enter upon the demise premises and help himself to whatever articles of personal property he may find there, to an amount sufficient to satisfy his claim. Distress as a general rule extends to all movable property found on the premises, whether belonging to the tenant or not; but there are certain well-defined exemptions, as, for example, goods sent to a man publicly carrying on a trade to be worked at or dealt with in the way of his trade. And some things have the benefit of a conditional exemption, as horses employed to work the ground, which should not be taken so long as there is any other property to satisfy the distress. This privilege is an injurious interference with the property and rights of third persons. It exposes persons dealing with the tenant to the danger of losing whatever property of their own they may permit to be on his premises, and of having their claims against him postponed to those of the landlord. This is a wide departure from the general principle of the law, which is to leave the parties alone; but even here the right to distress may be expressly abolished in the contract of tenancy if the parties please.

Again, this land, on the expiration of the tenancy, becomes the absolute property of the landlord, no matter how it may have been altered or improved during the occupation. In certain cases the law has discriminated between the contending claims of landlord and tenant. (1) In respect of *fixtures* (which may be shortly defined as movables so affixed to the soil as to become part thereof), the tenant may sometimes remove them, e.g., when they have been brought on the premises for the purpose of being used in business. This, it is said, is done by way of encouraging trade, but it is curious that no similar principle has been admitted for the encouragement of agriculture. (2) In respect of *emblements*, i.e., the profits of sown land, a tenant may be entitled to these whose term

comes to an end by the happening of an uncertain contingency. (3) A similar right is very generally recognized by custom in tenants whose term expires in the ordinary way. The custom of the district, in the absence of stipulations between the parties, would be imported into their contract—the tenant going out on the same conditions as he came in. But with these exceptions the land in its improved condition passes over to the landlord. The tenant may have added to its value by buildings, by labour applied to the land, or by the use of fertilizing manures, but, whatever be the amount of the additional value, he is not entitled to any compensation whatever. This again is a matter which the parties may, if they please, regulate for themselves. As a matter of fact, landlords never allow a compensation clause to be inserted in their leases.

The Agricultural Holdings Act, 1875, attempts to remedy this injustice by enacting that compensation shall be paid to tenants for improvements the benefit of which has not been exhausted at the end of the lease. These are of three classes:—(1) Drainage of land, erection or enlargement of buildings, laying down permanent pastures, making and planting osier beds, making water meadows or works of irrigation, making gardens, roads, or bridges, water-courses, ponds, wells, or reservoirs, making fences, planting hedges, planting orchards, reclaiming waste lands, and warping land. The tenant to establish a claim for compensation must have the landlord's consent in writing to the improvements. The compensation is a sum equal to the amount originally expended, less one-twentieth for every year that has elapsed since, and the whole benefit of the improvement is taken to be exhausted in twenty years. (2) Boning lands with undissolved bones, chalking land, clay bonring, claying, liming, and marling land, after notice in writing given to the landlord. They are deemed to be exhausted at the end of seven years, and the compensation is the sum expended, less one seventh for every year. (3) Artificial or other purchased manure applied to the land, and cake or other feeding stuff consumed thereon by cattle, &c. Exhausted in two years, compensation to be a sum representing its fair value to an incoming tenant. The Act, however, has no application if the parties agree in writing, either on the contract of tenancy or otherwise, that it shall not apply. In point of fact, landlords insist upon the renunciation of the Act as a condition of granting a lease. The Act has accordingly become a dead letter.

The mutual rights of the parties are, as we have already said, regulated to a large extent by special provisions or covenants in the lease. The most usual of these are the following:—(1) The landlord covenants that the tenant shall have quiet enjoyment of the premises for the time agreed upon, and in the absence of such a proviso a covenant to this effect will be implied from the fact of letting. The obligation makes the landlord responsible for any lawful eviction of the tenant during the term, but not for wrongful eviction unless he is himself the wrongdoer, or has expressly made himself responsible for evictions of all kinds. (2) The tenant is presumed to undertake to use the property in a reasonable manner according to the purposes for which it was let, and to do reasonable repairs. The landlord is not presumed to have undertaken to put the premises in repair, nor to execute repairs. But the respective obligations of parties where repairs are, as they always are in leases for years, the subject of express covenant may vary indefinitely. The obligation is generally imposed on the tenant to keep the premises in "good condition" or "tenant-like repair," and it will be construed with reference to the character of the premises demised, their age, and their condition. A covenant to repair, unless limited specially, makes the tenant liable to rebuild houses destroyed by accident. A covenant to keep in repair

requires the tenant to put the premises in repair if they are out of repair, and to maintain them in that condition up to and at the end of the tenancy. A breach of the covenant gives the landlord an action for damages, which will be measured by estimated injury to the reversion if the action be brought during the tenancy, and by the sum necessary to execute the repairs if the action be brought later. (3) The improper use of the premises to the injury of the reversioner is waste. *Voluntary waste* is when the tenant by some positive act of his own has injured the premises; *permissive waste* is when the injury is caused by some omission. Tenants-at-will or from year to year are not liable for the latter. What is or is not waste is in some instances dependent on the custom of the country, but in general anything which damages the freehold or alters its nature is waste. Even the erection of new buildings would, strictly speaking, be waste unless the lease could be construed as authorizing them. Besides these general conditions implied in law, the use of the premises may be restricted indefinitely by special provisos. Covenants against using the premises for the carrying on of particular trades or businesses are the most usual. In this category may be placed the rules as to cultivation to be found in agricultural leases, in which also an obligation to cultivate in conformity with the custom of the district would be implied. (4) Covenants by the tenant to insure and keep insured the premises are also common, and if the premises are left uninsured for the smallest portion of the term, although there may be no damage by fire, the covenant is broken. (5) The rates and taxes are generally the subject of special covenants. One tax, the property tax, is specially excepted. It must be paid by the landlord, and if the tenant should pay it the landlord must deduct it from the rent. The parties cannot by contract make any different arrangement. Another charge on lands—the rent-charge fixed under the Tithes Commutation Acts in lieu of tithes—is not a personal charge against either landlord or tenant, but is leviable by distress. Apart from agreement, the charge, if paid by the tenant, may be deducted from the rent. Other rates and charges, whether primarily imposed on landlord or tenant, may be imposed by the contract upon one or other as the parties may agree. (6) The incidents of rent—its amount, whether fixed or fluctuating, its nature, whether in money or otherwise, time and mode of payment, &c.—are fixed by the agreement of the parties. When the land has been occupied without a letting, the owner has an action against the occupier for compensation for use and occupation, an undertaking to pay being implied from the fact of occupation. But in other cases the rent due is a matter of agreement between the parties, the law interpreting the terms when necessary. Thus an agreement to pay a rent of £100, no times of payment being mentioned, would be construed as an agreement to pay that rent annually. Rent is said to be *due* at the first moment of the day appointed for payment, and in arrear at the first moment of the day following. It has already been said that, in addition to the right of action as for an ordinary debt, the landlord has a special right of distress. The covenant may also give him the right to enter and eject the tenant on non-payment.

Covenants are said to "run with the land" when the liabilities and rights created by them pass to the assignees of the original parties. At common law it was said that covenants "ran with the land" but not with the reversion, the assignee of the reversioner not having the rights of the original lessor. But the assignees of both parties have been on the same footing since the statute 32 Henry VIII. c. 84. The following covenants "run with the land":—(1), all implied covenants; (2) all express covenants concerning something in being at the time of the covenant

and "parcel of the demise", (3) covenants relating to things not in being but to be built or done on the premises, and the covenant be for the covenantor himself and "his assigns." But things merely collateral do not bind the assigns even if they be named.

The right of the tenant to assign his lease—as well as his right to make an underlease—may itself be restricted by agreement, and covenants to that effect are not uncommon. Sometimes the tenant covenants not to assign or underlet without consent, and it may be provided that such consent will not be refused except on reasonable grounds. The lessee is not discharged from liability by the assignment unless the landlord accepts the assignee as his tenant, and even then the original lessor will remain liable on his own express covenants.

The tenant may be forfeited either for breach of some condition on which his lease was granted, or in virtue of a specific provision for re-entry on breach of any covenant. Such a proviso is generally attached to the covenants, and the effect of a breach of a covenant so protected is to make the lease voidable at the option of the landlord. The tenant cannot take advantage of his own default to terminate the tenancy. The landlord must signify his intention to avoid the lease by some specific act. If he accepts rent, or, it seems, if he even asks for it after notice of an act of forfeiture, he waives any breach of covenant up to that time, but not forfeiture for future or continuing breaches. The condition of forfeiture on breach may be attached to any covenants the parties choose to make, and may therefore in many cases press hardly on the tenant, who for a trifling default may lose the whole value of his term. The courts in some few instances will relieve a tenant from forfeiture. Thus they may relieve once against a forfeiture for breach of covenant to insure, when no damage has occurred and an insurance is in effect at the time of application. Relief will also be given for forfeiture by non-payment of rent, if the arrears be paid up. And on the ground of fraud, accident, or mistake forfeitures may be relieved against in other cases. The determination of a lease by forfeiture has the same effect as its determination in any other way, in destroying substantialities or other rights created under it.

It will be seen that with a few insignificant exceptions the contract is left by law to be regulated by the parties. In one particular an important change has been made by a recent Act. The right to the game, as we have already pointed out, can only be taken out of the tenant by an express grant made by him. The Ground Game Act, 1880, enacts that "any occupier of land shall have as incident to and inseparable from his occupation of the land the right to kill and take ground game thereon, concurrently with any other person who may be entitled to kill and take ground game on the same land,"—subject to certain conditions which need not be recited here. And "every agreement, condition, or arrangement which purports to divest or alienate the right of the occupier, so declared, given, and reserved to him by this Act, or which gives to such occupier any advantage in consideration of his forbearing to exercise such right, or imposes upon him any disadvantage in consequence of his exercising such right, shall be void." Another clause provides that, when the right to kill and take ground game is at the passing of the Act vested in any person other than the occupier, under a *bona fide* contract, the occupier's rights under the Act shall not come into existence until the determination of that contract. "Ground game" means "hares and rabbits."

Scotland.—In Scotch law, the contract of location is consensual and in its own nature merely personal; but by statute it is made real against singular successors* (*i.e.*, purchasers). A lease for any greater term than one year must be in writing. The lessor and his representatives are bound by a written lease which is "authentic

in terms of the statutes and delivered, or fortified by a *res interdicta*," or sanctioned by homologation,¹ or is an offer, followed by real evidence of acceptance, or written articles or conditions proved by written evidence to have been adopted by the parties, or even a written obligation to grant a lease. The singular successors of the lessor will be bound where he is bound, provided (1) that the lease is definite as to subject, rent, and term of duration, and (2) that possession shall have followed as a badge of real right under the statute (1449, c. 17). Thus, while a lease of any duration will be good against the lessor and his heirs, as against singular successors it must in general have a definite term of duration, unless it be specially warranted and homologated. The usual term in agricultural leases is nineteen years, and longer terms are common for building and mining leases, but there appears to be some uncertainty as to whether any and what limit must be imposed on the length of a term. So, as to rent, it may be as against the grantor a merely nominal sum, or may be retained by the lessee for debt; but as against singular successors it must stand payable. Rent, it is said, may be either in money, grain, or service, but it must not be illusory. Rent in money is generally payable at the "legal terms" Whitsunday and Martinmas. The obligation to pay rent is extinguished by the destruction of the subject, and this principle appears to have been applied to the partial destruction of the subject occasioned by the disastrous failure of a particular season. "When the destruction is partial, the point is more doubtful, and the distinction seems to be that, if it be permanent though partial, the failure of the subject lot will give relief by entitling the tenant to rescind the lease unless a deduction be allowed, but that, if it be merely temporary and occasional, it will not suffice to entitle the tenant to relief. In the decisions, however, relief has been given to a greater extent than that distinction would authorize; thus devastation of the crop by storms, &c., *et plus quam tolerabile*, has been admitted as a ground of abatement; but as the tenant takes the risk of the season it must at least be some extraordinary event that will justify such a demand" (Bell's *Principles*). And it would appear that the tenant has no relief against such partial destruction of the subject lot as may be occasioned by a subsequent law, as for example in the case of a fishing lease, by an Act extending the close time. Rent may be recovered either by process of debt or by the equivalent of distress, *viz.*, by *hypothec* (see *HYPOTHEC* in the Scotch law there is not, as in English, a *prima facie* right in the tenant to assign the lease or sublet the premises. On the principle of *delectus personarum*, the landlord is presumed to have excluded all save those whom he has expressly admitted, at least in ordinary cases, though a different rule prevails in longer leases. The heirs of tenants were at one time excluded, but they now succeed to the lease. The obligations of the parties as to mode of cultivation, amount of rent, length of term, repair, and so on are for the most part regulated as in England by the express provisions of the lease. The tenant is bound to give up the premises at the expiration of the term without compensation for any permanent or unexhausted improvement thereon. "It is implied," says Bell, "in the contract of lease that any buildings, fences, or improvements which the tenant may spontaneously make are made in contemplation of his own interest and for his own use only. And so he has no claim for such meliorations at the end of his lease without special stipulation. But, if the tenant's possession be terminated abruptly and prematurely, he ought in equity to be entitled to recompense."

Ireland.—The law of landlord and tenant has been until recently substantially the same as that which has already been described for England, and it will only be necessary to notice here the more important changes that have been made in Ireland by legislation. It may be pointed out, without touching at all on the vexed Irish land question, that the uncongeniality of the situation in which a limited class own the soil, and let it out on hire on what terms they please to cultivators, has been felt with particular force in Ireland. Agriculture is the one industry of the country, and that industry was carried on under conditions which made it all but impossible. The Irish tenant was, equally with the English tenant, at the mercy of his landlord. If he made improvements he did so at the risk of losing them by eviction or by being taxed for them by an increased rent. The insecurity of his tenure gave him the alternative of doing nothing to better his farm or bettering his farm without bettering himself. At the same time there existed in Ireland, in consequence of circumstances peculiar to the people, an excessive competition for land such as has never been witnessed in England. The natural outcome of this condition of things was a demand for some change in the law which could give tenants a reasonable security for their industry. And the way was paved for such changes by the existence in Ulster of a local custom having virtually the force of law, which did provide such a security. This was a custom of which the tenant was to take notice, and any landlord who chose to do so might insist upon

¹ This is inferred from the fact that the grantor has knowingly permitted sales "not unimportant to be done by the lessor on the faith of the contract."

ignoring it in his dealings with his tenants. Nor was the custom in itself everywhere clear or uniform. "It is a strange thing to say," says Mr Butt, "but it would be impossible to frame any statement as to the nature and meaning of the custom which would be universally accepted as a correct description of the character." The Ulster custom had, however, two main features—fixity of tenure, and free right of sale by the tenant of his interest. "So long as the tenant pays his rent the landlord will not use his legal powers to put an end to the tenancy," says Judge Longfield, describing the system, and the same authority adds that "the sale by an outgoing tenant of his tenant right is to be with the approbation of the landlord." This approbation is not to be capriciously refused, but on the other hand the tenant is not at liberty to select any substitute that he thinks proper irrespective of his character and possession of sufficient means for the efficient cultivation of the land.¹ The strength of the custom may be estimated from a statement made by one of the witnesses before the Devon commission:—"If systematic attempts were made amongst the proprietors of Ulster to invade tenant right, I do not believe Ulster is a force at the disposal of the Home Guard sufficient to keep the peace of the province." And Mr Butt estimates that the sum which tenants under the Ulster custom would receive on the sale of their tenant right would amount to more than £200,000,000.

The Landlord and Tenant (Ireland) Act, 1870, enacts, section 1, that "the usages prevalent in the province of Ulster (in this Act intended to be included under the denomination of the Ulster tenant right custom) are hereby declared to be legal, and shall in the case of any holding in the province of Ulster proved to be subject thereto be enforced in the manner provided by this Act." By section 2 like usages elsewhere than in Ulster are in like manner legalized. And a tenant who is not entitled to compensation under sections 1 and 2 is nevertheless declared to be entitled to the following rights—(1) if holding under a tenancy created after the passing of the Act he is disturbed in his holding by the landlord, he shall be entitled to compensation for the loss which the court shall find to have been incurred by him, subject to a scale of maximum amounts varying from seven years' rent on holdings of the annual value of £10 and under to one year's rent on holdings of the value of £100 and over, and in no case exceeding £250; and (2) he may, on quitting his holding, claim compensation in respect of improvements made by himself or his predecessors in title, subject to certain considerable exceptions, as regards tenancies and improvements. The second part of the Act contains provisions to facilitate the purchase of the tenant's free simple of their holdings, and the third part enlarges the commissions of public works in Ireland to advance moneys both to landlords for payment of compensation for improvements and to tenants for the purchase of their holdings. Section 44 enacts that the board, if they are satisfied with the security, may advance to any tenant for the purchase of his holding, in pursuance of the Act, any sum not exceeding two-thirds of the price of such holding, and upon an order being made by the board such holding shall be deemed to be charged with an annuity of five pounds for every one hundred pounds of such advance, and so in proportion for any less sum, such annuity to be limited in favour of the board, and to be declared to be repayable in the term of thirty-five years. Section 46 requires the Landed Estates Court on the sale of estates to afford as far as may be consistent with the interests of the persons concerned facilities for such purchases by tenants, whether by selling the estate in suitable lots or otherwise. The principle of transferring the occupying tenants into peasant proprietors which these clauses are intended to carry out is associated with the name of Mr Bright. The Bright clauses have not had the practical success that was hoped for,—a result which is attributed to the unfitness of the Landed Estates Court for working them. And it may be added that the Act of 1870 failed to diminish the value of the Irish people, reackrenting and eviction being still possible, and the process for obtaining compensation being tedious and expensive.

The Land Law (Ireland) Act, 1881, was accordingly passed. Section 1 provides that the tenant for the time being of every holding not specially excepted to shall have his tenancy for the term that can be obtained, subject to certain conditions and provisions specified in sixteen subsections. A tenant from year to year is not permitted to subdivide or sublet his holding without permission of the landlord. A person to whom a tenant has bequeathed the tenancy is in the same position as a purchaser after sale. When a landlord demands an increase of rent from a present or future tenant, then (1), if the tenant submits, his tenancy shall become a statutory tenancy, subject to statutory conditions for the period of fifteen years; (2) a future tenant not accepting increase but selling shall be entitled to receive such amount as a court may fix for depreciation of the selling value by the increased rent; (3) a tenant, not accepting but not

selling, is entitled to compensation as for disturbance; (4) and a present tenant may apply to the court to have a rent fixed. A tenant during a statutory term shall not be compelled to pay a higher rent than the rent payable at the commencement, and shall not be compelled to quit except on breach of the statutory conditions, some of which are as follows:—the tenant must pay rent at the appointed time, must not commit persistent waste, must not subdivide or sublet or erect a dwelling-house otherwise than is provided in the Act. Agistment, or letting for pasture, and letting on consacre for growing potatoes or other green crop are not within this provision. The landlord retains the right to enter for the purpose of taking minerals, stone, timber, making roads, having, shooting, fishing, and so on. The tenant may not open a public house without the landlord's consent. The section is not to prejudice any objection for non-payment of rent in respect of rent accrued due for a holding before the commencement of the statutory term.

Sections 6 and 7 amend the law as to compensation for disturbance and compensation for improvements as contained in the Act of 1870. Section 8 authorizes the court (to be created by the Act) to fix a fair rent on the application of either party, and such judicial rent shall be the rent of the tenancy for the statutory term of fifteen years as above specified. The court is to determine what is a fair rent after hearing parties, having due regard to their respective interests and to the circumstances of the case, holding, and district. A new statutory term shall not begin until the expiration of a preceding one, and an alteration of judicial rent shall not take place at less intervals than fifteen years. Two important subsections deserve to be specially noticed. It is provided (subsection 2) that the court may disallow the tenant's application if it is satisfied that "the permanent improvements" on the holding, which if executed by the tenant would have entitled him to compensation under the Acts of 1870 and 1881, have been made and maintained by the landlord and his predecessors in title and not made or acquired by the tenant or his predecessors. On the other hand, no rent shall be allowed or made payable in respect of improvements made by the tenant or his predecessors in title for which, in the opinion of the court, they shall not have been paid by the landlord or his predecessors. When application is made to the court for a judicial rent on a holding not subject to the Ulster tenant right or other analogous custom, the parties by agreement or the court may fix a value on the tenancy, and, if during the term the tenant should give notice to the landlord of his intention to sell, the landlord shall purchase the tenancy at the value so fixed, subject to addition for subsequent improvements and deductions for outgoings. Subsection 10 provides that "the amount of money or money's worth that may have been paid or given for the tenancy of any holding by a tenant or his predecessors in title, otherwise than to the landlord or his predecessors in title, shall not of itself, apart from other considerations, be a ground for reducing or increasing the rent of such holding."

The Act may be excluded by agreement as follows. The landlord and tenant may agree to a "judicial lease" for thirty-one years and upwards, which if approved by the court will take effect, and the holding will be regulated by the lease and not be deemed subject to the Act. The parties may agree to a "fixed tenancy," which shall not be deemed subject to the Act, which shall be held upon such conditions as parties may agree upon, and with reference to which the court shall consider the interest of persons entitled to an estate or interest in the land, present limited owners. In such a case the tenant shall pay a fixed rent, which may or may not be subject to revaluation by the court, and shall not be compelled to quit his holding except on breach of some of the conditions previously declared to be statutory.

These are the main provisions of the Act, establishing more or less completely what are known as the three "fair rents," "fixed tenures," and "free sale." Miscellaneous provisions supplementary to these can only be briefly noticed. Section 20 enacts that the "tenancies to which the Act applies shall be deemed to have determined whenever the landlord has resumed possession of the holding either on the occasion of a purchase by him of the tenancy or on the death of the tenant in selling or by operation of law or otherwise." But a tenant holding under an Ulster or other analogous custom shall be entitled to the benefit of such custom, notwithstanding the determination of his tenancy by breach of a statutory condition. Section 21 deals with existing leases, which are to remain in force, but at the expiration of such leases the tenants shall be deemed to be tenants under the ordinary tenancies from year to year, and therefore subject to the Act. Section 22 allows a tenant whose holding is of the annual value of £150 to contract himself out of this or the previous Act, and there is a special clause dealing with the case in which a landlord has before the Act purchased the Ulster tenant right, but otherwise any provision contained in any lease or contract of tenancy inconsistent with the provisions of this Act shall be void. Part 5 relates to the acquiescence of the tenant.

¹ The right of alienation for non-payment of rent was conferred on landlords by previous legislation. It is unknown to English law, where a tenant only gives a right of re-entry if protected by a special proviso to that effect in the lease.

¹ *Practical Treatise on the Law of Compensation to Tenants in Ireland*, by James Butt, Q. C., Dublin, 1871.

² An excellent account of the origin and results of the Ulster custom is given in *The Irish Land Question from 1580 to 1880*, by T. Barry O'Brien, London, 1880.

³ See O'Brien's *Irish Land Question*, chap. vii.

tion of land by tenants, reclamation of land, and emigration. Part 6 describes the forms of proceedings to be taken under the Act. In addition to the civil bill court of the county which has "jurisdiction in respect of all disputes arising between landlord and tenant under the Act," a special land commission has been constituted, in which proceedings may be commenced or to which if commenced in the civil bill court they may be transferred. Three commissioners are named in the Act, and an indefinite number of assistant commissioners is authorized. The land commission is vested with the general powers of the Act, but it is directed to grant an appeal to the court of appeal, in proper cases, not including decisions as to fair rent or other matters left to the discretion of the commissioners. (R. R.)

LONDON, CHARLES PAUL (1760-1826), French painter and art-author, was born at Nonant in 1760, entered the studio of Regnault, and carried off the first prize of the Academy in 1793. After his return from Italy, disturbed by the Revolution, he seems to have abandoned painting for letters, but he began to exhibit in 1795, and continued to do so at various intervals up to 1814. His *Leda* obtained an award of merit in 1801, and is now in the Louvre. His *Mother's Lesson*, *Paul and Virginia Bathing*, and *Dædalus and Icarus* have been engraved; but his works on painting and painters, which reach nearly one hundred volumes, now form his chief title to be remembered. In spite of a complete want of critical accuracy, an extreme carelessness in the biographical details, and the feebleness of the line engravings by which they are illustrated, London's *Annales du Musée*, in 33 vols., form a vast repertory of compositions by masters of every age and school, which will always have value for the writer on art. Besides this work and many others of less importance, London published *Lives of Celebrated Painters*, in 22 vols.; *An Historical Description of Paris*, 2 vols.; *A Description of London*, with 42 plates; and descriptions of the Luxembourg, of the Gustavian collection, and of the gallery of the Duchesse de Berry. He died at Paris in 1826.

LONDON, LUCETTA ELIZABETH (1803-1838), a writer of poetry and fiction, better known by her initials L. E. L. than as Miss London or Mrs Maclean, was descended from an old Herefordshire family, and was born at Chelsea, 14th August, 1803. Her father, an army agent, succeeded in amassing a large property, which he lost by speculation shortly before his death. By this time the daughter by her contributions to the *Literary Gazette* and to various Christmas annuals, as well as by some volumes of verse, had acquired a wide literary fame. Probably her position in society contributed to the interest they awakened, but the gentle melancholy and romantic sentiment her writings embodied would in any case have secured her the sympathy and approval of a wide class of readers. Though deficient in condensation and finish, they occasionally display a richness of fancy and an aptness of language which might have ripened, by more sedulous culture, into true poetical worth. In June 1838 she married George Maclean, governor of Cape Coast Castle, but she only survived her marriage a few months, dying from an overdose of prussic acid, which, it is supposed, was taken accidentally.

For some time L. E. L. was joint editor of the *Literary Gazette*. Her first volume of poetry appeared in 1820 under the title *The Fate of Adeline*, and was followed by other collections of verses with similar titles. She also wrote several novels. Various editions of her *Poetical Works* have been published since her death, the last being that with an introductory memoir by W. B. Scott, 1880. *The Life and Literary Remains of Letitia Elizabeth London*, by Leman Blanchard, appeared in 1841, and a second edition in 1866.

LONDON, WALTER SAVAGE (1775-1864), born at Warwick, January 30, 1775, died at Florence, September 17, 1864. In the course of this long life he had won for himself such a double crown of glory in verse and in prose as has been won by no other Englishman but Milton. And with that special object of his lifelong veneration he

had likewise in common other claims upon our reverence to which no third competitor among English poets can equally pretend. He had the same constancy to the same principles, the same devotion to the same ideal of civic and heroic life, the same love, the same loyalty, the same wrath, scorn, and hatred, for the same several objects respectively; the same affection and kinship to the spirit of the Romans, the same natural enjoyment and mastery of their tongue. Not accident merely but attraction must in any case have drawn them to enlist in the ranks and serve under the standard of the ancient Latin army of patriots and poets. But to Landon more than to Milton the service of the Roman Muse was a natural and necessary expression of his genius, a spontaneous and just direction of its full and exuberant forces. At the age of twenty he published an eloquent and elegant vindication of her claims upon the service and devotion of modern writers,—the first sketch or suggestion of a longer essay, to be published in its final form just fifty-two years later. In 1795 appeared in a small volume, divided into three books, *The Poems of Walter Savage Landon*, and, in pamphlet form of nineteen pages, an anonymous *Moral Epistle, respectfully dedicated to Earl Stanhope*. No poet at the age of twenty ever had more vigour of style and fluency of verse; nor perhaps has any ever shown such masterly command of epigram and satire, made vivid and vital by the purest enthusiasm and most generous indignation. Three years later appeared the first edition of the first great work which was to inscribe his name for ever among the great names in English poetry. The second edition of *Geor* appeared in 1803, with a text corrected of grave errors and improved by magnificent additions. About the same time the whole poem was also published in a Latin form, which for might and melody of line, for power and perfection of language, must always dispute the palm of precedence with the English version. In 1808, under an impulse not less heroic than that which was afterwards to lead Byron to a glorious death in redemption of Greece and his own good fame, Landon, then aged thirty-three, left England for Spain as a volunteer to serve in the national army against Napoleon at the head of a regiment raised and supported at his sole expense. After some three months' campaigning came the affair of Cintra and its disasters; "his troop," in the words of his biographer, "dispersed or melted away, and he came back to England in as great a hurry as he had left it," but bringing with him the honourable recollection of a brave design unselfishly attempted, and the material in his memory for the sublimest poem published in our language between the last masterpiece of Milton and the first masterpieces of Shelley—one equally worthy to stand unchallenged beside either for poetic perfection as well as moral majesty—the lofty tragedy of *Count Julian*, which appeared in 1812, without the name of its author. No comparable work is to be found in English poetry between the date of *Samson Agonistes* and the date of *Prometheus Unbound*; and with both these great works it has some points of greatness in common. The superhuman isolation of agony and endurance which encircles and exalts the hero is in each case expressed with equally appropriate magnificence of effect. The style of *Count Julian*, if somewhat deficient in dramatic ease and the fluency of natural dialogue, has such might and purity and majesty of speech as elsewhere we find only in Milton so long and so steadily sustained.

In May 1811 Landon had suddenly married Miss Julia Thuillier, with whose looks he had fallen in love at first sight in a ball-room at Bath; and in June they settled for awhile at Llanthony Abbey in Wales, from whence he was worried in three years' time by the combined vexation of neighbours and tenants, lawyers and lords-tenantant; not

before much toil and money had been nobly wasted on attempts to improve the sterility of the land, to relieve the wretchedness and raise the condition of the peasantry. He left England for France at first, but after a brief residence at Tours took up his abode for three years at Como, "and three more wandering years he passed," says his biographer, "between Pisa and Pistoia, before he pitched his tent in Florence in 1821." In 1824 appeared the first series of his *Imaginary Conversations*, in 1826 "the second edition, corrected and enlarged"; a supplementary third volume was added in 1828; and in 1829 the second series was given to the world. Not until 1846 was a fresh instalment added, in the second volume of his collected and selected works. During the interval he had published his three other most famous and greatest books in prose. *The Citation and Examination of William Shakespeare*, 1834; *Pericles and Aspinu*, 1836; *The Pentameron*, 1837. To the last of these was originally appended *The Pentatopia*, containing five of the very finest among his shorter studies in dramatic poetry. In 1847 he published his most important Latin work, *Poemata et Inscriptiones*, comprising, with large additions, the main contents of two former volumes of idyllic, satiric, elegiac, and lyric verse, and in the same golden year of his poetic life appeared the very crown and flower of its manifold labours, *The Hellenics of Walter Savage Landor*, enlarged and completed. Twelve years later this book was reissued, with additions of more or less value, with alterations generally to be regretted, and with omissions invariably to be deplored. In 1853 he put forth *The Last Fruit of an Old Tree*, containing fresh conversations, critical and controversial essays, miscellaneous epigrams, lyrics, and occasional poems of various kind and merit, closing with *Five Scenes* on the martyrdom of Beatrice Cenci, unsurpassed even by their author himself for noble and heroic pathos, for subtle and genial, tragic and profound, ardent and compassionate insight into character, with consummate mastery of dramatic and spiritual truth. In 1856 he published *Antony and Octavius—Scenes for the Study*, twelve consecutive poems in dialogue which alone would suffice to place him high among the few great masters of historic drama. In 1858 appeared a metrical miscellany bearing the title of *Dry Sticks Fagoted by W. S. Landor*, and containing among other things graver and lighter certain epigrammatic and satirical attacks which involved him in the troubles of an action for libel; and in July of the same year he returned for the last six years of his life to Italy, which he had left for England in 1835. Embittered and distracted by domestic dissensions, if brightened and relieved by the affection and veneration of friends and strangers, this final period of his troubled and splendid career came at last to a quiet end on the 17th of September 1864. In the preceding year he had published a last volume of *Heroic Idylls*, with additional poems, English and Latin,—the better part of them well worthy to be indeed the "last fruit" of a genius which after a life of eighty-eight years had lost nothing of its majestic and pathetic power, its exquisite and exalted loveliness.

A complete list of Landor's writings, published or privately printed, in English, Latin, and Italian, including pamphlets, fly-sheets, and occasional newspaper correspondence on political or literary questions, it would be difficult to give anywhere and impossible to give here. From nineteen almost to ninety his intellectual and literary activity was indefatigably incessant, but, herein at least like Charles Lamb, whose cordial admiration he so cordially returned, he could not write a note of three lines which did not bear the mark of his "Roman hand" in its matchless and inimitable command of a style at once the most powerful and the purest of his age. The one charge which

can ever seriously be brought and maintained against it is that of such occasional obscurity or difficulty as may arise from excessive strictness in condensation of phrase and expurgation of matter not always superfluous, and sometimes almost indispensable. His English prose and his Latin verse are perhaps more frequently and more gravely liable to this charge than either his English verse or his Latin prose. At times it is well nigh impossible for an eye less keen and swift, a scholarship less exquisite and ready than his own, to catch the precise diction and follow the perfect course of his rapid thought and radiant utterance. This apparently studious pursuit and preference of the most terse and elliptic expression which could be found for anything he might have to say could not but occasionally make even so sovereign a master of two great languages appear "dark with excess of light", but from no former master of either tongue in prose or verse was ever the quality of real obscurity, of loose and nebulous uncertainty, more utterly alien or more naturally remote. There is nothing of cloud or fog about the path on which he leads us; but we feel now and then the want of a bridge or a handrail; we have to leap from point to point of narrative or argument without the usual help of a connecting plank. Even in his dramatic works, where least of all it should have been found, this lack of visible connexion or sequence in details of thought or action is too often a source of sensible perplexity. In his noble trilogy on the history of Giovanna queen of Naples it is sometimes actually difficult to realize on a first reading what has happened or is happening, or how, or why, or by what agency,—a defect alone sufficient, but unhappily sufficient in itself, to explain the too general ignorance of a work so rich in subtle and noble treatment of character, so sure and strong in its grasp and rendering of "high actions and high passions," so rich in humour and in pathos, so royally serene in its commanding power upon the tragic mainstays of terror and of pity. As a poet, he may be said on the whole to stand midway between Byron and Shelley,—about as far above the former as below the latter. If we except Catullus and Simonides, it might be hard to match and it would be impossible to overmatch the flawless and blameless yet living and breathing beauty of his most perfect elegies, epigrams, or epitaphs. As truly as prettily was he likened by Leigh Hunt "to a stormy mountain pine which should produce lilies." His passionate compassion, his bitter and burning pity for all wrongs endured in all the world, found only their natural and inevitable outlet in his lifelong defence or advocacy of tyrannicide as the last resource of baffled justice, the last discharge of heroic duty. His tender and ardent love of children, of animals, and of flowers, makes fragrant alike the pages of his writing and the records of his life. He was as surely the most gentle and generous as the most headstrong and hot-headed of heroes or of men. Nor ever was any man's best work more thoroughly imbued and informed with evidence of his noblest qualities. His loyalty and liberality of heart were as inexhaustible as his bounty and beneficence of hand. Praise and encouragement, deserved or undeserved, came yet more readily to his lips than challenge or defiance. Reviled and ridiculed by Lord Byron, he retorted on the offender living less readily and less warmly than he lamented and extolled him dead. On the noble dramatic works of his brother Robert he lavished a magnificence of sympathetic praise which his utmost self-estimate would never have exacted for his own. Age and the lapses of time could neither heighten nor lessen the fulness of this rich and ready generosity. To the poets of his own and of the next generation he was not readier to do honour than to those of a later growth, and not seldom of deserts far lower and far lesser claims than theirs. That he was not

unconscious of his own, and avowed it with the frank simplicity of nobler times, is not more evident or more certain than that in comparison with his friends and fellows he was liable rather to undervalue than to overrate himself. He was a classic, and no formalist, the wide range of his just and loyal admiration had room for a genius so far from classical as Blake's. Nor in his own highest mood or method of creative as of critical work was he a classic only, in any narrow or exclusive sense of the term. On either side, immediately or hardly below his mighty masterpieces of *Peaces and Aspasia*, stand the two scarcely less beautiful and vivid studies of mediæval Italy and Shakespearean England. The very finest flower of his immortal dialogues is probably to be found in the single volume comprising only "Imaginary Conversations of Greeks and Romans", his utmost command of passion and pathos may be tested by its transcendent success in the distilled and concentrated tragedy of *Teberius and Vipsania*, where for once he shows a quality more proper to romantic than classical imagination,—the subtle and sublime and terrible power to enter the dark vestibule of distraction, to throw the whole force of his fancy, the whole fire of his spirit, into the "shadowing passion" (as Shakespeare calls it) of gradually mounting insanity. Yet, if this and all other studies from ancient history or legend could be subtracted from the volume of his work, enough would be left wherewith to rest the foundation of a fame which time could not sensibly impair.

(A. C. S.)

LANDSBERG-AN-DER-WARTHE, chief town of a circle in the government district of Frankfort, in the province of Brandenburg, Prussia, is situated at the confluence of the Warthe and Kladow, 80 miles north-east of Berlin by rail. It has a gymnasium of the first class, a hospital, and a poorhouse, besides the other ordinary educational, charitable, and administrative provisions. The productive industry of Landsberg centres in the engine and boiler works and iron-foundries; but the other manufactures include a considerable miscellany, whose chief items are tobacco, cloth, carriages, woods, and spirits. An active trade is carried on in the manufactures of the town, and in the produce of the surrounding country. Landsberg dates its origin from about the middle of the 13th century. In 1875 its population was 21,379.

LANDSEER, SIR EDWIN HENRY (1802-1873), third son of John Landseer, A.R.A., a well-known engraver and able writer on art, was born in London, March 7, 1802. His mother was Miss Potts, who set to Reynolds as the gleemer, with a sheaf of corn on her head, in Macklin's Family Picture, or the Cottagers.¹ Edwin Henry Landseer began his artistic education under his father so successfully that in his fifth year he drew fairly well, and was acquainted with animal characters and passions. Richings of his, at South Kensington, dated by his father, attest that he drew excellently at eight years of age; at ten he was an admirable draughtsman, and his etchings show considerable sense of humour. At thirteen he drew a majestic St Bernard dog so finely that his brother Thomas engraved and published the work. At this date (1815) he sent two pictures to the Academy, and was described in the catalogue as "Master E. Landseer, 33 Foley Street." Youth forbids his being reckoned as an artist in full, and caused him to be considered as the "Honorary Exhibitor" of "No. 443, Portrait of a Mule," and "No. 584, Portraits

of a Pointer Bitch and Puppy." Adopting the advice of Haydon, whose pupil he was not otherwise, he studied the Elgin Marbles, the "Wild Beasts" in the Tower and Exeter Change, and dissected every animal whose carcass he could obtain. In 1816, in which year he exhibited with the Society of Painters in Oil and Water Colours, Landseer was admitted a student of the Royal Academy. In 1817 he sent to the Academy a portrait of Old Brutus, a much-favoured dog, which, as well as his son, another Brutus, often appeared in subsequent pictures. Even at this date Landseer enjoyed considerable reputation, and had more work than he could readily perform, because his renown had been zealously fostered by his father in Elmas's *Annals of Art*. At the Academy he was a diligent student and a favourite of Fuseli's, who would look about the crowded antique school and ask, "Where is my little dog boy?" The prices of his pictures at this time were comparatively small, ten guineas was, in 1818, considered enough for a whole length figure of a horse on a canvas of 27 by 35 inches, which now belongs to Lady C. Wellesley.

In 1818 Landseer exhibited at Spring Gardens Fighting Dogs getting Wind, a picture from which his future might have been predicted. The sale of this work to Sir G. Beaumont vastly enhanced the fame of the painter, who became "the fashion" in a way disclosed by Haydon's account of his own and Wilkie's positions under similar circumstances nearly at the same date. This picture is now at Coleorton, and it illustrates the culmination of the studies of Landseer's youth and the prime strength of his earlier style. Unlike the productions of his later life, this masterpiece of his boyhood exhibits not an iota of sentiment, but it is, in its way, a proof of astonishing vigour in design, and richer in animal character than anything produced since the death of Snyder. Perfectly drawn, solidly and minutely finished, bold in tone, and carefully composed, the execution of this picture attested the skill that had been acquired during ten years' observation from nature, and the learning with which diligent study of the best antiquaries and of Raphael had endowed the painter. Looking at the work as a whole, and valuing it on technical grounds, the critic feels that Landseer never produced anything better or so manly. On this level he stood until 1824, when he removed from his father's residence, and set up for himself in the house No. 1 (afterwards 18) St John's Wood Road, where he lived nearly fifty years, and in which he died. In 1818 it was little more than a cottage, with a barn attached, which was converted into a studio. Between 1818 and 1825 Landseer did a great deal of work, but on the whole gained little besides facility of technical expression, a greater zest for humour, and a larger style. The work of this stage ended with the production of Lord Essex's painting called the Cat's Paw, which is well known by an engraving. It was the price of this picture, £100, that enabled Landseer to set up for himself. He had to borrow a second hundred pounds to pay a premium for the house, and repaid this sum by twenty pounds at a time. Between 1818 and 1825 Landseer's pictures were such as proved the severity of his studies; among them the principal were the Cat Disturbed, which was lately in the possession of Sir P. de Malpas Grey Egerton, Alpine Mastiffs reanimating a Distressed Traveller, a famous work engraved by John Landseer; the Ratcatchers, which is now at Lambton Castle, Pointers to be; the Larder invaded, and Neptune, the head and shoulders of a Newfoundland dog. The Cat's Paw was sent to the British Institution in 1824, and made an enormous sensation. In this year Landseer and C. B. Leslie made a journey to the Highlands—a momentous visit for the former, who thenceforward rarely failed annually to repeat it in search of studies and subjects.

¹ John Landseer died February 29, 1853, aged ninety-one. Sir Edwin's eldest brother Thomas, an A.R.A. and a famous engraver, whose interpretations of his junior's pictures have made them known throughout the world, and will represent them when they have perished, was born in 1795, and died January 20, 1880. Charles Landseer, R.A., and Keeper of the Royal Academy, the second brother, was born in 1799, and died July 22, 1879. John Landseer's brother Henry was a painter of some reputation, who emigrated to Australia.

In 1826 Landseer was elected an A.R.A. In 1827 appeared the Monkey who had seen the World, a picture which marked the growth of a taste for humorous subjects in the mind of the painter, and had been evoked by the success of the Cat's Paw. Taking Buck, 1835, was the painter's first Scottish picture. Its execution marked a change in his style which, in increase of largeness, was a great improvement. In other respects there was a decrease of solid qualities; finish, searching modelling, and elaborate draughtsmanship rarely appeared in Landseer's work after 1835. The subject, as such, soon after this time became a very distinct element in his pictures; ultimately it dominated, and in effect the popularity of the artist was extended to a greater degree than technical judgment justified. Sentiment ruled in Landseer's works, which had previously depended on the expression of animal passion and character, and the exhibition of noble qualities of draughtsmanship. Sentimentality ruled in not a few pictures of later dates, and *gentle* human humour, or pathos, superseded that masculine animalism which noted in its energy, and enabled the artist to rival Spylers, if not Velasquez, as a painter of beasts. After High Life and Low Life, pictures of 1831, now in the National Gallery, Landseer's dogs, and even his lions and bulls, were more than half civilized. It was not that these later pictures were less true to nature than their forerunners, but the models were chosen from different grades of animal society. As Landseer prospered he kept finer company, and his new patrons did not care about rat-catching and dog-fighting, however vigorously and learnedly those subjects might be depicted. It cannot be said that the world lost much when, in exchange for the Cat Disturbed and Fighting Dogs getting Wind, came Jack in Office, the Highland Shepherd's Chief Mourner, and the Swannery invaded by Sea-Eagles, three pictures which are types of as many diverse moods of Landseer's art, and each a noble one.

Four years after his election as A.R.A. Landseer was chosen an R.A. (1830). Chevy Chase (1826), which is at Woburn, and the Illust Whiskey Still (1829), appeared in the interval, and were followed by High Life and Low Life (1831), and Spaniels of King Charles's Breed (1832); the last is a wonder of brush handling. Landseer had by this time attained such amazing mastery that he painted Spaniel and Rabbit in two hours and a half, and Rabbits, which was at the British Institution, in three-quarters of an hour; and the fine dog-picture Odin (1836) was the work of one sitting, i.e., painted within twelve hours. He began and finished a whole-length, life-size study of a fallow deer while Mr Wells of Redleaf was at church. A more remarkable feat consisted in drawing simultaneously, a stag's head with one hand and a head of a horse with the other. Harvest in the Highlands, and that masterpiece of humour, Jack in Office, were exhibited in 1833. In 1834 a noble work of sentiment was given to the world in Suspense, which is now at South Kensington, and shows a dog watching at the closed door of his wounded master. Many think this to be Landseer's finest work, others prefer the Highland Shepherd's Chief Mourner (1837). The over-praised and unfortunate Bolton Abbey, a group of portraits in character, was shown in the same year, and was the first picture for which the painter received £400. A few years later he sold Peace and War for £1500, and for the copyrights alone obtained £6000. Man Proposes (1864) was resold in 1881 for 6300 guineas, and a cartoon for 5000 guineas. A Distinguished Member of the Humane Society, a dog reclining on a quay wall (1838), was succeeded by Dignity and Impudence (1839). The Lion Dog of Malta, and Laying down the Law appeared in 1840. The Defeat of Comus was painted in the summer-

house of Buckingham Palace garden in 1843. In this year was finished the capital Highland Shepherd's Home (Sheepshanks Gift), together with the beautiful Eos, a portrait of Princes Albert's most graceful of greyhounds, to which Thomas Landseer added an ineffable charm and solidity not in the painting. The Challenge, and Coming Event cast their Shadows before, were accompanied (1844) by Shooing (Bell Gift), and followed by Peace, and War, and the Stag at Bay (1846). Alexander and Diogenes, and a Random Shot, a kid dead on snow, came forth in 1848. This year Landseer received a national commission to paint in the Houses of Parliament three subjects connected with the chase. Although they would have been worth three times as much money, the House of Commons refused to grant £1500 for these pictures, and the matter fell through, more to the artist's profit than the nation's gain. The Sanctuary, and Night and Morning, romantic and pathetic deer subjects, came in due order. For the latter a French jury of experts awarded to the artist the great gold medal of the Exposition Universelle, Paris, 1855.

The Dialogue at Waterloo (1850) commemorated Landseer's first visit to the continent, and showed how he, like nearly all English artists of original power and considerable fertility, owed nothing to French or Italian training. In the same year he received the honour of knighthood. The Monarch of the Glen (1851) was succeeded by Geneva, a group of asses, a mule, and a bull, Titania and Bottom, which comprises a charming queen of the fairies, and the dramatic scene of the Combat, or Night and Morning, as above. Then came the Children of the Mist (1853), Deer in Repose, Saved (1856), Bismarck, a noble stag, Rough and Ready, Uncle Tom and his Wife for Sale (1857), The Maid and the Magpie, the extraordinarily large cartoon called Deer Browning, the Two Dogs, and one or two minor paintings, were equal if not superior to any previously produced by the artist. Nevertheless, signs of breaking health were remarked in Doubtful Crumbs, and a Kind Star (1859). The immense and profoundly dramatic picture called a Flood in the Highlands (1860) more than renetated the painter before the public, but friends still saw ground for uneasiness. Extreme nervous excitability manifested itself in many ways, and in the choice (1864) of the dreadful subject of Man Proposes God Disposes, bears clumsily clambering among relics of Sir John Franklin's party, there was occult pathos, which some of the artist's intimates suspected, but did not avow. In 1862 and 1863 Landseer produced nothing, but with Man Proposes came a Piper and a Pair of Nutcrackers. The last triumph of Landseer's career was the Swannery invaded by Sea-Eagles (1869). After four years more, mainly of broken art and shattered mental powers, he died 1st October 1873. He was buried in St Paul's. See *Sir J. Landseer*, by F. G. Stephens, 1880. (P. O. S.)

LANDSHUT, chief town of a government district in Lower Bavaria, is situated on the right bank of the Isar, about 40 miles north-east of Munich. As the seat of government for the district, it contains all the appropriate administrative offices, and it is well supplied with educational and charitable institutions, besides having a convent and several nunneries. Of its numerous ecclesiastical buildings the most interesting are the churches of St Martin (with a spire 463 feet high), St Ludovics, and the Holy Ghost, all begun before 1411, and the old Dominican convent, now used as Government offices. The town-house, the former provincial buildings, and the palace are also noteworthy. On a hill commanding the town is the castle of Trausnitz, an ancient stronghold of the dukes of Lower Bavaria. The original castle was built in the 12th century, but the oldest part now extant dates from about 1304. In 1872-73 the upper part was put into habitable order by the king of

Davaria. The manufactures of Landslut are not important, they include beer, cloth, and tobacco. Market gardening and, to a really considerable extent, trade in grain are carried on. From 1300 to 1826, when the university, formerly at Ingolstadt and now at Munich, was located at Landslut, the town woke up to a temporary importance. The name Dreihelm Stadt is sometimes given to Landslut from the three helmets that form its arms. The population in 1875 was 14,780.

LANDSKRONA, one of the principal seaport and garrison towns in Sweden, is situated in the district of Malmö (in Skania) on the Sound (Öresund), about 55 miles west of Christianstad and 15 miles by water from Copenhagen. It is connected by a branch line with the south Swedish railway system. The harbour, protected by the island of Gråten, is the deepest and best on the Skanian coast, and possesses excellent quays. A Swedish line of steamers runs regularly to Lubeck. Wood, grain, and clay are largely exported. In 1880 the number of foreign vessels entering the port was 1554, with a total burden of 135,894 register tons. Landskrona is one of the chief industrial towns of Sweden, the largest manufacture being sugar refining. The population was 7323 in 1868, and 9913 in 1880.

Landskrona, originally called Landora or Landor, owes its first importance to King Erik XIII., who introduced a body of Carmelite monks from Germany in 1410, and bestowed on the place the same privileges as those enjoyed by Malmö. In 1423 it was plundered by the forces of the Wendish towns, and during the wars of the 16th and 17th centuries it played too conspicuous a part for its own prosperity. Horn took the town by storm in 1644; Ruyter blockaded the Swedish fleet in its harbour in 1677; and in 1676 was fought in the neighbourhood the great battle of Landskrona, which saved Sweden from the Danish invaders.

LANE, EDWARD WILLIAM (1801-1876), one of the greatest of European Arabists, was the son of Dr Theophilus Lane, a prebendary of Hereford. He lost his father in boyhood, and his character was mainly formed by the influence of his mother, a woman of strong and beautiful nature. He was designed for Cambridge and the church, and became proficient in mathematics, but, abandoning the purpose of proceeding to the university, gave himself for some time to the study of engraving. Weak health, aggravated by intense application to Eastern study, compelled him to throw aside the burn, and in 1825 he started for Egypt, where he spent three years, twice ascended the Nile, proceeding as far as the second cataract, and composed a complete description of Egypt, with a portfolio of one hundred and one drawings. This work was never published, but the account of the modern Egyptians, which formed a part of it, was accepted for separate publication by the Society for the Diffusion of Useful Knowledge. To perfect this work Lane again visited Egypt in 1833-35, residing mainly in Cairo, but retiring to Luxor during the plague of 1835. An interesting journal of this visit to Egypt is included in the memoir by his grand-nephew prefixed to the sixth part of his great *Lexicon*. Perfected by the additional observations collected during these years, the *Modern Egyptians* appeared in 1836, and at once took the place which it has never lost as the best description of Eastern life and an Eastern country ever written. In accuracy, completeness, and graphic simplicity of description the book approaches ideal perfection. It was followed from 1838 to 1840 by a translation of the *Arabian Nights*, with a mass of valuable notes and illustrations, designed to make the book a sort of encyclopædia of Eastern manners, and rivaling the merit of his first work. The translation itself is an admirable proof of scholarship, but is characterized by a somewhat stilted mannerism, which is not equally appropriate to all parts of the motley-coloured original. The character of some of the tales, and the tedious repetitions of the same theme which are found in

the Arabic collection, induced Lane to leave considerable parts of the work untranslated. In 1840 Lane married a Greek lady. A useful volume of *Selections from the Kur-an* was published in 1843, but before it passed through the press the indefatigable author was again in Egypt, where he spent seven years (1842-49) collecting materials for a great Arabic lexicon, which the munificence of Lord Pimlico (afterwards duke of Northumberland) enabled him to undertake. The most important of the materials amassed during this sojourn (in which he was accompanied by his wife and by his sister, Mrs Poole, authoress of the *Englishwoman in Egypt*, with her two sons, after wards well known in Eastern letters) was a copy in 24 thick quarto volumes of Sheikh Mutadî's great lexicon, the *Tuy et Arâs*, which, though itself a compilation, is so extensive and exact that it formed the main basis of Lane's subsequent work. The author, who lived in Egypt in last century, used more than a hundred sources, interweaving what he learned from them with the *Kutûb* of Firuszâdî in the form of a commentary. By far the larger part of this commentary was derived from the *Lisân el 'Arab* of Ibn Makarram, a work of the 13th century, which Lane was also able to use while in Cairo.

Returning to England in the year 1849, Lane devoted the whole remainder of his life to the task of digesting and translating his Arabic material in the form of a great thesaurus of the lexicographical knowledge of the Arabs. In spite of weak health he continued this arduous task with unflagging diligence till a few days before his death, which took place at Worthing 10th August 1876. The work remains unfinished; five parts appeared during his lifetime (1863-1874), and two smaller parts have since been published from his papers. Even in its imperfect state the *Lexicon* is an enduring monument, the completeness and finished scholarship with which it is executed making each article an exhaustive monograph. All Lane's work has the stamp of masterly perfection. He produced no occasional writings, and two essays contributed to the magazine of the German Oriental Society complete the record of his publications. Lane was not an original mind; his powers were those of observation, industry, and sound judgment. He had singular tact in accommodating himself to the Eastern character, he lived in the East as an Oriental; and his familiarity with Eastern life and ways of thought was unique. His personal character was elevated and pure, his strong sense of religious and moral duty being of the type that characterized the best circles of English evangelicalism in the early part of this century.

LANFRANCO (c. 1005-1089), thirty-fourth archbishop of Canterbury, and first after the Conquest, one of the ablest churchmen and scholars of his time, was the son of Hambald or Hambold, one of the principal citizens of Pavia, and was born there about the year 1005. Deprived of his father at an early age, he seems to have been educated at Pavia with a view to taking his hereditary place in the governing class, but to have developed a love of learning for its own sake, which induced him to visit other schools; on his return, after a long absence, he became teacher of jurisprudence in his native town. About 1039, driven from home by the disturbances then prevalent in Italy, and attracted by what he had heard of the need and demand for a supply of competent scholars in Normandy, he with some learned companions migrated thither and set up a school at Avranches, which met with great success. Some three years afterwards (1042), having formed the resolution to become a monk, he suddenly withdrew from his promising career as a secular teacher. The causes which led to this change in the plan of his life are not known. Hook thinks it was suggested by the death of his wife, which

there is some reason to believe happened about this time; but, however it may have been occasioned, the fact that a man of his energy and strength of will should, although somewhat late in life, have transferred himself to a career which not only was universally supposed to involve great spiritual advantages, but must also have been seen to offer a peculiarly favourable field for the exercise of his special talents and acquirements, need cause no surprise. After a lengthened novitiate of ascetic humiliation and seclusion in the Benedictine monastery of Bec, then under the presidency of abbot Herluin, Lanfranc was at last called upon to resume the work of teaching; his fame speedily attracted numerous pupils, and it became necessary to enlarge the conventual buildings. He now became prior, with full control of the internal discipline of the establishment (1046). Among those who became his pupils about this time are mentioned Witmund (afterwards bishop of Aversa), Anselm of Aosta (afterwards of Canterbury), and Anselm of Lucca (afterwards Pope Alexander II.). It was during his priorship at Bec that Lanfranc began to figure somewhat prominently in the eucharistic controversy associated with the name of Berengarius of Tours. This able but unfortunate controversialist, while maintaining the doctrine of a real presence of Christ in the Eucharist, had denied that presence to be one of essence, or the change effected to be one of substance. In doing so he had placed himself in an attitude of opposition not so much to the lately formulated theory of Paschasius Radbertus as to the entire current of ecclesiastical opinion then prevalent. The earliest extant letter of Berengarius to Lanfranc implies a previous friendship, but is written in a tone of remonstrance, beseeching the latter not to treat as heretics those who had Scripture on their side and could also claim the support of Ambrose, Augustine, and Jerome. It is to be regretted that we are not in possession of more of the correspondence, and especially that we are left entirely to conjecture with regard to the circumstances which occasioned it. It seems to have been somewhat compromising to Lanfranc, for at the Easter synod held at Rome in 1050, which he had been summoned to attend, the prior of Bec was, after the condemnation of the absent Berengarius, called upon to vindicate his own orthodoxy by a public confession of his faith. He had no difficulty, however, in thus purging himself of all suspicion of heretical privacy, and was afterwards present in September, by special request, at the synod of Vercelli, where Berengarius, again absent, was excommunicated. A personal controversy was renewed by Berengarius from time to time, but, so far as we know, Lanfranc's share in it came to an end with the composition (probably some time between 1063 and 1069) of his *Liber de Corpore et Sanguine Domini Nostri contra Berengarium*. Other events of much more exciting and absorbing personal interest to him had meanwhile intervened. In 1053 William of Normandy, in spite of the express prohibition of the council of Rheims (1049), had married his cousin Matilda, daughter of Baldwin, duke of Flanders,—a defiance of ecclesiastical authority which involved the highest ecclesiastical censures. The now powerful prior of Bec was not slow to express his condemnation, which he further accentuated by his contemptuous treatment of Herfast, the duke's chaplain, who had been sent on some errand of conciliation. Peremptorily ordered to leave the duchy, Lanfranc, when setting out on his journey into exile on an excessively lame horse, whether by accident or design came across the path of William; some genial touch of humanity and good humour suddenly converted them (such is the import of the Chronicles) into firm friends, the prior accompanied the duke to his castle, and shortly afterwards undertook a mission to Rome for a papal dispensation which should legalize the obnoxious

marriage. This was obtained in 1059, Lanfranc's influence with William and Matilda steadily increased, and soon the abbey of St Stephen and of the Holy Trinity at Caen—part of the price of the papal grace—began to rise. In 1063 the former building was sufficiently far advanced to be fit for use, and, at the urgent request of the founder, Lanfranc became its first abbot. In this position he was one of the most intimate advisers of William during the anxious times which immediately preceded and followed the Conquest. Already destined for the more splendid if more arduous see of Canterbury, he, doubtless with the royal approval, declined that of Rouen, which had been put within his reach in 1067. In 1070 he was, at the Whitsungmot held at Windsor, chosen to the primacy of England, vacant by the deposition of Stigand; and, at a synod in Normandy where the legates of the pope were present, he was constrained to accept, vainly pleading "his weakness and unworthiness, his ignorance of a foreign tongue, and the barbarism of the nations he was thus compelled to visit." His consecration took place on August 29, 1070, in a temporary structure raised on the site of the cathedral which had been destroyed by fire three years before; and in the following year he went to Rome to receive the pallium from his former pupil Alexander II. The pope received him with great cordiality, giving him a second pallium for old friendship's sake, but he did not thereby succeed in attaching the new archbishop to the ultramontane policy; during the nineteen years of the primacy of the brilliant Lombard it became ever more apparent that neither Hildebrand's, nor Lanfranc's, but William's was the master mind in England. Lanfranc ably seconded the Conqueror in the line of action which resulted in the subordination of York to Canterbury, and also in the gradual removal from power of all English prelates and abbots, and their replacement by foreigners, until at last Wolfstan of Worcester was the only Anglo-Saxon left undisturbed; but, if these measures were fitted in some ways to denationalize the English Church, and bring it into closer relation with the central authority at Rome, any such tendency was more than counterbalanced by the legislation, also supported by Lanfranc, which placed the royal supremacy on a footing which it had never before attained. Thus it was enacted that bishops, like barons, were to pay homage to the crown, and the clergy were to acknowledge no one as pope until the royal consent had first been obtained, that no letters from Rome were to be published till approved by the king, that no council was to pass laws or canons except such as should be agreeable to the king's pleasure; that no bishop was to be implicated or punished any of the king's vassals without the king's precept; and that no ecclesiastic was to leave the country without leave obtained. As regarded church discipline the Hildebrandine reforms were followed, but with wisdom and moderation; thus strict regulations against simony were enforced, but with respect to clerical celibacy a distinction was drawn between the parochial and the capitular clergy, the former being permitted to retain their wives. A striking illustration of the recognized ecclesiastical independence of England under William and his able minister is furnished in the fact that, in the very year (1076) of the synod of Winchester at which so important a modification of the decrees of a Roman council had been resolved on, Lanfranc along with Thomas of York and Remigius of Dorchester presented themselves at the holy see in a mission from the king to seek a confirmation of certain ancient privileges, and that they were successful in their application. No less eloquent is the fact that, after William's rejection of Gregory's demand for his homage, Lanfranc had the courage to refuse the papal summons to appear at the threshold of the apostles. After his return

from Rome in 1076 and the consecration of the new buildings at Bes in which he took part in 1077, he does not appear to have again left England. As regards his administration of his own diocese, Lanfranc's principal achievements were the rapid rebuilding of the metropolitan church (1073-79), the reforms he introduced among the monks of Christ Church, and his successful recovery of the estates of the see, which had been encroached on by the king's brother bishop Odo, earl of Kent. Lanfranc died at Canterbury in 1089.

The extant works of Lanfranc are not voluminous. The *Enchiridion Liber* contains fifty-five of his own letters, many of them of considerable interest and importance, as well as some of those of his distinguished correspondents, — Beconatus, William, Pope Alexander II. and Gregory VII. The short *Oratio in consilio habita* represents his argument before the synod of Winchester in 1072 in support of his claims to the primacy. *Statuta pro ordine Beneficiorum* are an adaptation and expansion of the ordinary Benedictine rules, written, when he was primate, especially for his own monks. *Sermo ante Scripturam* also relates to the duties of monks. *Libellus de orationis confessione* has no special interest. *Commentarius in D. Pauli epistolam* seems rather to be a collection of some student's notes than to have been prepared for publication by himself. *Expositum seu dialogus de summa fidei Christianae theologiae*, the most voluminous of all the works assigned to him, is of more than doubtful genuineness, but it certainly is an adequate sketch of the scholastic theology in its infantile stage. Most important is the *Tractatus de Corpore et Sanguiue Domini*, a vigorous and even violent defence of the dogma of transubstantiation, for which it helped to secure currency and permanency, but it adds little to what had already been said by Paschasius Radbertus.

The Benedictine edition of the works of Lanfranc by D'Achéry, in one folio volume (Paris 1648), was republished at Lyons in 1877. A new edition by Gilks appeared at Oxford in two octavo volumes in 1884. The authorities for the life and times of Lanfranc are the *Chronicon Berconense*, and *Vita Alstorum Berconensis* (which are printed in the *Scriptores in usum Scholasticum* of Ordine Cisterciensis. See also, *Acts of the Archbishops of Canterbury* vol. II, and Freeman's *New Man Conquest*, vols. II-IV. (J. S. B.L.)

LANFREY, PIERRE (1828-1877), the historian who has done the most to destroy the Napoleonic legend of M. Thiers, was born at Chambéry, the capital of Savoy, on the 26th October 1828. His father came of a warlike race, which had been noble for four centuries, and had himself served in the army of Napoleon as a captain of hussars. On the fall of Napoleon he had left the French army, and retired to Chambéry, where he married a milliner. When young Pierre was but six years old, his father died, cursing the priest who came to bring him consolation, and his education was left to his mother. She sent him first to the Jesuit college of Chambéry, from which he was expelled for writing an attack on the Jesuits, then to another ecclesiastical seminary, which equally disgusted him, and at last to the Lycée Bourbon at Paris. After completing his studies at Paris he went to Grenoble in 1847 to study law, and while there took the keenest interest in the Revolution of 1848 at Paris. Even at that age he shows in his letters the hatred of democracy which was always to characterize his sincere love of liberty, and above all his intense feeling that Paris should not always dominate the provinces. His law studies finished at Grenoble, he went to Turin, and qualified himself to act as *avocat* in his native country; but, on the news of the coup d'état, his passion to go to Paris and take his part in the inevitable struggle which he saw must arise between the second empire and the spirit of liberty was not to be restrained, and in 1853 he once more took up his abode in Paris. He at first tried in vain to get work on various newspapers, and then to get his first book, which had been sketched out for some years, published. No publisher was to be found, and *L'Église et les Philosophes au XVIII^{ème} Siècle* was printed eventually at his own expense. It appeared in 1855, and at once achieved a great success, and introduced its author to some of the best literary society in Paris. It was followed in 1857 by an *Essai sur la Révolution française*, and in 1860 by the *Histoire politique des Papes*, and the *Lettres d'Évergard*. The latter are a revelation of what Lanfrey thought and

felt at this time, of his despair that France would ever get free from the enervating rule of the second empire, of his disgust at the literary sterility of the time in confining itself to vague philosophy and vaguer criticism; and through them he first became known outside the literary world. He had hitherto been intimate with such choice spirits as Ary Scheffer, Gleyre, and the Comtesse d'Agoult, better known as Daniel Stern, but the *Lettres d'Évergard* introduced him to the most fashionable Parisian society of the time, and the position he held in it is best to be found in the description of him contained in the souvenirs of his friend, Madame Clara Joubert. In 1860 also he was appointed by M. Charpentier editor of the new *Revue Nationale*, in which he wrote the fortnightly chronicle of affairs for four years, besides various articles and reviews, collected in 1864 under the title of *Études et Poésies politiques*. After resigning his editorship in 1864 he set to work on his great *Histoire de Napoléon I.*, in which he intended to overthrow the monument M. Thiers had erected to Napoleon in his *Histoire du Consulat et de l'Empire*, and to show the demigod uncle of Napoleon III to have been but an immoral man and bad politician. The fourth volume of his history had not been published three months when the war of 1870 broke out. At first Lanfrey knew not what view to take, but on the defeats of the French, and the declaration of the republic, he enlisted as a simple volunteer, and marched to Lyons with his battalion. While there he heard first that his vigorous opposition in the press to the powerful influence of M. Gambetta had lost him his election to the Constituent Assembly in his native province, and next that he had been elected by the department of the Bouches du Rhône, in which he had never set foot. In the Assembly he warmly supported the Government of M. Thiers, and opposed the radical party as vehemently as he had opposed the empire, saying that both savoured of tyranny. In 1871 M. Thiers appointed him French minister in Switzerland, where he remained till 1874, when he insisted on his resignation being accepted by the Duc de Broglie, and once more took his seat as a moderate republican. In 1875 he published the fifth volume of his *Histoire de Napoléon*, and in 1876 was elected a life senator; but his strength was fast failing, and, before he could give his sixth volume the careful revision he considered indispensable, he died at Pau on the 16th November 1877.

The first predominant idea of Lanfrey, both as a politician and an historian, was a love of liberty which was perpetually putting him in opposition to all parties in turn. In his first book he attacked the church, not because of its doctrines so much as because of its attempts to stifle liberty of thought. In his *Essai sur la Révolution*, on the other hand, he assailed Robespierre and the democrats because they defended attempts on individual liberty with the assertion that they were necessary for liberty in general. His second leading idea was a belief in strictest morality in politics; by this standard in his *Études* he condemns M. Thiers for slurring over the political immorality of Napoleon, Danton for giving up his old Girondin standpoint to defend the consular, and Carnot for putting his name to measures of the committee of public safety which he abhorred, in order to maintain himself in power. These two ideas, love of liberty, involving a hatred alike of despotism and democracy, and a stern standard of political morality, are to be seen throughout Lanfrey's great work on Napoleon. No military success ever to him seems to compensate for immoral means to gain an end, no glamour is for him cast over evil actions by glory or fine words; no sarcasm is too severe for the man who cared not for truth but only for effect. Before such a judge Napoleon appears but a small man, and, if at times the judgment seems almost too severe, it must be remembered that the author lived through a time when an emperor ruled entirely owing to the influence that the great deeds of his uncle had thrown over the minds of the French people, and that he wrote with the intention of for ever breaking down that influence by exhibiting the naked truth, and destroying for ever the Napoleonic legend.

For Lanfrey's life consult three articles by the Comte d'Haussonville in the *Revue des Deux Mondes* for September, October, and November 1881, the biographical notice of M. de Presnac, prefixed to the last edition of his works; and the numerous letters from him contained in the *Souvenirs* of Madame Joubert.

LANGENSALZA, chief town of a circle in the government district of Erfurt, in the province of Saxony, Prussia, is situated on the Salza, about 20 miles north-east of Erfurt. It has an old castle, several schools of various grades, and three hospitals, and near it are the remains of the old monastery of Homburg. The manufacture of cloth is the chief industry, but lace, starch, and chemicals are also produced. The population of the town in 1875 numbered 9855. There is a sulphur bath in the neighbourhood. Near Langensalza the Prussians and Hanoverians had a long and bloody engagement, June 27-29, 1866, which ultimately resulted in the capitulation of the latter.

LANGLAND, or *LANGLEY, WILLIAM*, the author of a remarkable poem belonging to the close of the 14th century, of which the full title is—*The Vision of William concerning Piers the Plowman, together with Vita de Do-wel, Do-bet, et Do-best, secundum Wit et Resoun*.¹

The author's name is not quite certain, and the facts concerning his life are few and scanty. As to his Christian name we are sure, from various allusions in the poem itself, and the title *Piers Willem*, &c., in many MSS., and we may at once reject the suggestion that his name may have been Robert. In no less than three MSS. occurs the following colophon:—"Explicit visio Willelmi W. de Petro le Plowman." What is here meant by W it is difficult to conjecture; but it is just possible that it may represent Wychwood (of which more presently), or Wigornensis, i.e., of Worcester. As to the surname, we find the note that "Robert or William Langland made pers ploughman," in a handwriting of the 15th century, on the fly-leaf of a MS. copy belonging to Lord Ashburnham, and in a Dublin MS., is the note:—"Memorandum, quod Stacy de Rokyle, pater Willelmi de Langland, qui Sciacus fuit generosus, et morabatur in Schiptons-under-Widewode, tenens domini le Spenser in comitatu Oxon., qui predictus Willelmus fecit librum qui vocatur Piers Ploughman." Nevertheless, it would seem that Langland should rather be Langley, since there is no trace of any Langland family in the midland counties, while the Langley family were wardens of Wychwood forest in Oxfordshire between the years 1278 and 1362. The question has been fully discussed by Professor Pearson in the *North British Review*, April 1870, p. 244. According to Bale, our author was born at Cleobury Mortimer, which is quite consistent with the supposition that his father may have removed from that place to Shipton in Oxfordshire, as there seems to have been a real connexion between the families in those places. It must not be omitted that in the parish of Shipton-under-Wychwood there is a hamlet named Langley, from which he may have received his name.

The internal evidence concerning the author is fuller and more satisfactory. By piecing together the various hints concerning himself which the poet gives us, we may compile the following account. His name was William (and probably Langley), and he was born about 1332 perhaps at Cleobury Mortimer in Shropshire. His father, who was doubtless a franklin or farmer, and his other friends put him to school, made a "clerk" or scholar of him, and taught him what Holy Writ meant. In 1362, at the age of about thirty, he found himself wandering upon the Malvern hills, and fell asleep beside a stream, and saw in a vision a field full of folk, i.e., this present world, and many other remarkable sights which he duly records. From this supposed circumstance he named his poem *The Vision of William*, though it is really a succession of visions, since he mentions several occasions on which he awoke, and

afterwards again fell asleep; and he even tells us of some adventures which befel him in his waking moments. In some of these visions there is no mention of Piers the Plowman, but in others he describes him as being the coming reformer who was to remedy all abuses, and restore the world to a right condition. It is remarkable that his conception of this reformer changes from time to time, and becomes more exalted as the poem advances. At first he was no more than a ploughman, one of the true and honest labourers who are the salt of the earth, but at last he is identified with the great reformer who has come already, the regenerator of the world in the person of Jesus Christ. We may, in fact, consider Piers the Plowman as representing Christ himself, or, in the author's own phrase—"Petrus est Christus." If this be borne in mind, it will not be possible to make the mistake into which so many have fallen, of speaking of Piers the Plowman as being the author, not the subject, of the poem. The author may best be called William, or we may even give him the nickname of Long Will, which, as he himself tell us, was bestowed upon him from his tallness of stature,—just as the poet Gascoigne was familiarly called Long George. Though there is mention of the Malvern hills more than once near the beginning of the poem, it is abundantly clear that the poet lived for "many years in Cornhill (London), with his wife Kitte and his daughter Calote." He seems to have come to London not long after the date of the first commencement of his work, and to have long continued there. He describes himself as being a tall man, one who was loath to reverence lords or ladies or persons in gay apparel, and not deigning to say "God save you" to the sergeants whom he met in the street, unsomuch that many people took him to be a fool. He was very poor, wore long robes, and had a shaven crown, having received the clerical tonsure. But he seems only to have taken minor orders, and earned a precarious living by singing the *placebo, dirige*, and seven psalms for the good of men's souls. The fact that he was married may explain why he never rose in the church. But he had another source of livelihood in his ability to write out legal documents, and he was extremely familiar with the law courts at Westminster. His leisure time must have been entirely occupied with his devotion to his poem, which was essentially the work of his lifetime. He was not satisfied with rewriting it once, but he actually rewrote it twice; and from the abundance of the MSS., which still exist we can see its development from the earliest draught, written about 1362, to its latest form, written after 1390. It is remarkable that the intermediate form, written later than 1370, is perhaps, taken upon the whole, the best of the three.

In 1399, just before the deposition of Richard II., appeared a poem addressed to the king, who is designated as "Richard the Redeles" i.e., devoid of counsel. This poem, occurring in only one MS., in which it is incomplete, breaking off abruptly in the middle of a page, may safely be attributed to the same author, who was, at the time, passing through Bristol. As he was then about sixty-seven years of age, we may be sure that he did not long survive the accession of Henry IV. It may here be observed that the well-known poem entitled *Piers Ploughman's Creed*, though excellently written, is certainly an imitation by another hand, viz., by the anonymous author of *The Plowman's Tale*, which is inserted in the black-letter editions of Chaucer, though it is none of his. The *Piers Ploughman* of the *Crede* is very different in conception from the subject of William's vision.

As regards the poem itself, it has been already said that it exists in three forms. If we denote these by the names of A-text, B-text, and C-text, we find, of the first, twelve MSS.; of the second, sixteen; and of the third, also sixteen MSS. A few of these show confusion between the different types, but they may roughly be

¹ The title is usually given in Latin as *Vision Willelmi de Petro Plowman*, &c., and the whole work is sometimes briefly described as *Liber de Petro Plowman*.

classed as above, and it will be seen that we thus have abundance of material, a circumstantiality which proves the great popularity of the poem in former times. Owing to the frequent expressions which indicate a desire for information in religion, it was, in the time of Edward VI., considered worthy of being painted. Three imitations were printed by Robert Crowley in 1550; and one of these was badly reprinted by Owen Rogers in 1561. In 1813 the best MS. of the C-text was printed by D. Whitham in an expensive form. In 1842 Mr Thomas Wright printed an edition from an excellent MS. of the D-text in the library of Trinity College, Cambridge (second edition, 1856). A complete edition of all three texts was undertaken, for the Early English Text Society, by the Rev W. Skeat, but is not yet finished (1881). Vols. i., ii., and iii., containing the three texts, and the poem of *Richard the Redeless*, appeared in 1886, 1890, and 1873 respectively, and a part of vol. iv., containing full notes to all three texts, with some indexes, in 1877.

The general contents of the poem may be inferred from a brief description of the latest text. This is divided into twenty-three passages, usually comprising four parts, called respectively *Visio de Petro Plowman*, *Visio de Do-vel*, *Visio de Do-bet*, and *Visio de Do-best*. Here *Do-bet* signifies "do better" in modern English, and the author's own explanation of the names is that he who does a kind action *does well*, he who touches others to act kindly *does better*, but he who combines both practice and theory, both doing good himself and teaching others to do the same, *does best*. But the visions by no means closely correspond to these descriptions, the poet really gives as a set of eleven visions, which may be thus enumerated:—(1) *Visio of the Seven Tails of Folk*, of Holy Church, and of the Lady Meek (passus i-v.); (2) *Visio of the Seven Deadly Sins*, and of Piers the Plowman (pass. vi.-x.); (3) *Wit, Sturdy, Clergy, and Scripture* (pass. xi., xii.), (4) *Fortune, Nature, Reason, and Reason* (pass. xiii., xiv.), (5) *Visio of Imaginative* (pass. xv.); (6) *Conscience, Patience, and Active-Vite* (pass. xvi., xvi.), (7) *Free-will*, and the *Tree of Charity* (pass. xviii., xix.), (8) *Fortitudo*, Hope, and Charity (pass. xx.), (9) *The Triumph of Piers the Plowman*, i.e., the Crucifixion, Burial, and Resurrection of Jesus Christ (pass. xxi.), (10) *The Vision of Grace* (pass. xxii.); (11) *The Vision of the Seven Deadly Sins*.

This bare outline gives but little idea of the real nature of the poem. The general plan of it is slight and somewhat vague, but the execution is vivid and remarkable. The author's object was to afford himself opportunities by the way (of which he has amply availed himself) of describing the life and manners of the poorer classes; of inveighing against the worldliness and the abuses of the friars, of representing the miseries caused by the great pestilences then prevalent and by the hasty and ill-considered marriages consequent thereupon, and of denouncing lazy workmen and sham beggars, the corruption and bribery then so common in the law courts, and all the numerous forms of falsehood which are at all times the fit subjects for satire and indignant exposure. In describing, for example, the seven deadly sins, he gives so exact a description of Glutton and Sloth that the readers feel that these are no mere abstractions, but drawn from the life, and it becomes hardly more difficult to realize Glutton than it is to realize Sir John Falstaff. The numerous allegorical personages so frequently introduced, such as Scripture, Clergy, Conscience, Patience, and the like, are all mouthpieces of the author himself, uttering for the most part his own sentiments, but sometimes speaking in accordance with the character which each is supposed to represent. The theological disquisitions which are occasionally introduced are somewhat dull and tedious, but the earnestness of the author's purpose and his energy of language tend to relieve them, and there are not many passages which might have been omitted without loss. The poem is essentially one of those which improve on a second reading, and is a linguistic monument of very high value. As extracts from the poem, even if rather numerous and of some length, fail to give a fair idea of it. The whole deserves, and will repay, a careful study. Indeed, there are not many single works from which a student of English literature and of the English language may derive more substantial benefit.

The metre is alliterative, and destitute of final rhyme. It is not very regular, as the author's earnestness led him to use the fittest words rather than those which merely served the purpose of rhythm. The chief rule is that, in general, the same letter or combination of letters should begin every second syllable in the same line, for example, in the line which may be modernized thus: "Of all manner of men, the mean and the rich." Sometimes there are but two such rhyme-letters, as: "Might of the commons made him to reign." Sometimes there are four, as: "In a summer season, when soft was the sun, the sun was in invariably a pause, more or less distinct, in the middle of each line."

See the edition already referred to; the *Deportment of Richard II.*, ed. T. Wright (London Society), which is the same poem as *Richard the Redeless*; *Warton, Hist. of Eng. Literature*, vol. i., p. 100; *Johnson, Lives of the Poets*, vol. i., p. 100; *Lectures on English Literature*, by H. Morley, English Writers, &c. A long and careful summary of the whole poem is given in *Illustrations of English Literature*, by H. Morley, &c., iii.

(W. W. L.)

LANGRES, a town in the département of Haute-Marne, France, 136 miles south-east from Paris, stands at a height of some 1550 feet, upon a jutting promontory of the table-land to which it gives its name (Plateau de Langres), and overlooks, eastward and westward respectively, the valleys of the Marne and its tributary the Bonnelle. Its situation involves a rigorous climate, but also gives it strategic importance. The citadel stands to the south of the town, where it joins the table-land. From the ramparts and the cathedral tower there is an extensive view over the valley of the Marne, the Vosges, and the Côte d'Or; and in clear weather Mont Blanc (160 miles distant) is visible. Several detached forts and numerous batteries make Langres one of the strongest fortified camps of the country. The cathedral, the choir and nave of which date from the 12th and 13th centuries, possesses some fine features, but has been debased by a front in the style of the 17th century. The church of St Martin possesses a Christ, which is one of the finest wood-carvings known. The Gallo-Roman gate, one of four entrances to the town in the time of the Romans, is conjectured to have been intended as a triumphal arch to some victorious emperor, perhaps Marcus Aurelius. The gate "des moulins" is now the most noteworthy in the town. Langres possesses an antiquarian museum and a rather important library, as well as a picture gallery. The cutlery which bears the name of Langres is manufactured in the neighbourhood. Population, 10,878.

The town takes its name from the *Langones*, who occupied it in the time of Caesar. Under the Capets its bishop was an ecclesiastical peer of the kingdom, and held the sceptre at royal coronations.

LANGTON, STEPHEN (c. 1160-1228), cardinal, fourth archbishop of Canterbury, was born about the middle of the 12th century; the place of his birth is unknown, but his family almost certainly belonged to Yorkshire. He had already been made a prebendary of York, most probably at an early age, when he went to France and entered the university of Paris; there he soon rose to distinction alike in philosophy and theology, and ultimately, it is said, became chancellor or at least attained high rank in the governing body. One of his fellow students and intimate friends in Paris was Lothario, the nephew of Clement III., who when he in 1198 succeeded Celestine III. as Innocent III. forthwith appointed Langton to a post in his household. In 1206 he became cardinal priest of St Chrysogonus, a promotion on which he received the written congratulations of his sovereign King John. It was shortly after this that he first became involved in the great constitutional struggles with which his name is so honourably associated. In 1205 Hubert Walter of Canterbury had died, and there were urged at Rome the claims of two rival candidates for the vacant see,—Reginald the subprior of Christ Church, Canterbury, who had been the sudden and unauthorized choice of a majority of the monks, and John de Gray, bishop of Norwich, whom the dissenting minority had subsequently elected with the royal sanction. Setting aside both claims, and also the appeal of the suffragans of Canterbury with the chapter, who maintained that the right of election was theirs, Innocent commanded the monks then present in Rome to proceed to a new election in his presence, Langton being the candidate set before them. Elected he accordingly was, and afterwards consecrated by the pope himself at Viterbo in June 1207. John immediately retaliated by banishing the monks of Canterbury, afterwards writing an angry and threatening letter to the pope. Innocent replied with firmness, but finding John immovable, ultimately declared his resolution to enforce submission to his will by laying England under an interdict, a resolution which was carried into effect in March 1208. For the next few years, all negotiations for his admission to his see having failed, Langton had his

home in the Cistercian monastery of Pontigny near Sens in France, which thus became a principal resort of English malcontents and refugees. In the summer of 1212 he accompanied the bishops of London and Ely to Rome, and it was in consequence of their representations that deposition was passed upon John, the same prelates were also present at the great assembly of Soissons (April 1213), where a crusade against the king of England was set on foot, under the leadership of Philip of France. In the following May John made his peace, agreeing to recognize Langton, receive the exiled clergy, and restore the property which he had confiscated. Langton did not actually reach England till July, when (July 30, 1213) he performed his first episcopal act by pronouncing the absolution of the excommunicated John, who swore that all the laws of his grandfather Henry I. should be kept by all throughout the kingdom, and that all unjust laws should be utterly abolished. This oath the king was held by the archbishop to have violated almost immediately in levying war irregularly against the barons who had, not illegally, deserted him at Portsmouth, and at the meeting held in St Paul's, London, on August 25, 1214, it was Langton who produced the old charter of Henry I., and suggested the demand for its renewal, a suggestion which in the following year issued in the concession of Magna Charta at Runnymede. Soon afterwards the archbishop left England for Rome to attend the fourth Lateran council, but not before he had by the commissioners of the pope been pronounced contumacious, and declared to be suspended for his refusal to publish the excommunication of the English barons who had joined in obtaining the great charter. At Rome, where the sentence of his suspension was confirmed, he remained from November 1215 till May 1218; in September of the latter year he presided in the council held at London, where Magna Charta was solemnly confirmed; and on May 17, 1220, he officiated at the re-coronation of Henry III. In the same year the "translation" of St Thomas of Canterbury took place. Among the fragmentary notices we possess of the remainder of Langton's life are mentioned his demand in name of the barons for royal confirmation of the charter at London in 1223. He died at Slindon on July 9, 1228.

The principal authority for the events of the life of Langton is the *Chronicle* of Roger of Wendover. See Hook's *Lives of the Archbishops of Canterbury*, vol. II.; Pearson's *History of England*, vol. II., and Paul's continuation of Leppenberg's *Geschichte von England*, vol. III.

LANGUAGE. See PHILOLOGY.

LANGUEDOC, a province of France, which lay between the Garonne on the west and the Rhone on the east, with the Pyrenees and the Mediterranean on the south. It was divided into the three *sénéchaussées* of Toulouse, Carcassonne, and Beaucaire; and it comprised, besides the province proper, the districts of Gavaudan, Vellai, Vivarez, Cevennes, and Foix. It contained the important cities of Toulouse, Carcassonne, Narbonne, Montpellier, Nismes, Cette, Viviers, Alby, and Foix. The south-western spurs of the Cevennes run across the province from the north-east to meet the first slopes of the Pyrenees. In spring and early summer no part of France possesses a more delightful climate than Languedoc, while Montpellier and its neighbourhood, in spite of the mistral, was up to recent times considered as an excellent retreat for consumptive patients. The Roman remains of Nismes, the lagoons and decayed towns of the Gulf of Lyons, the historical associations of Montpellier, the fine mediæval fortress of Carcassonne, the old towers and the *hôtels* da ville of Narbonne, the little known scenery of the eastern Pyrenees, with the castles of Foix and Tarascon, and Toulouse with its churches, fairs, floral games, and winding streets, make the country one of the most interesting in the

whole of France. Here may still be heard the soft accents of the *Langue d'Oc*, a language which has not, even yet, spoken its last word in the poetry of the world.

Gallia Narbonensis, one of the seventeen provinces into which the empire was divided at the death of Augustus, occupied nearly the same extent as the province of Languedoc. It was rich and flourishing, crowded with great towns, densely populated, with schools of rhetoric and poetry, theatres, amphitheatres, and splendid temples. From Narbo Martius came the rhetorician and poet Montanus, who was exiled by Tiberius to Majorca; from Nismes came Domitius Afer; and the emperors Carinus and Numerianus were also natives of Narbonne. The planting of Christianity, though doubtless the Greeks of Massilia heard of it before, was accomplished, according to tradition, by St Trophimus of Arles, St Paul of Beziers, and Saint Saturnin of Toulouse. It is characteristic of the country that its ecclesiastical historians lament even in the earliest ages a tendency to heresy among its people. At the break up of the Roman empire the Visigoths founded the kingdom of Toulouse (412 A.D.), and in a few years spread their conquests over Narbonensis, Novempopulana (Gascony), and Aquitania in France, as well as over the whole of the Spanish peninsula. They were driven out of France by Clovis, but retained "Septimania," the country of the seven cities—Narbonne, Carcassonne, Elne, Beziers, Maguelonne, Lodève, and Agde—that is, very nearly the area occupied later by the province of Languedoc. At the council of Narbonne (589) five sorts of people are mentioned as living in the province—the Visigoths, then the ruling race, Romans, Jews, of whom there were a great many, Syrians, and Greeks. It was not until the year 759, when Pippin took their chief town, Narbonne, that the Visigoths were forced across the Pyrenees, and the country became part of the great empire bequeathed by Pippin to his great son Charles. Septimania became part of the kingdom of Aquitaine, but was separated from it and constituted a special duchy in the year 817. Two or more invasions of the Saracens took place in the 9th century, and the Normans made a descent upon the coast in the year 856. Early in the 10th century we find this whole province in the power of the counts of Toulouse, and one of the great fiefs of the crown of France. While the Normans were ravaging the north of France and laying siege to Paris, the Saracens from the mouths of the Rhone were plundering and harrying the county of Toulouse. Neither in the south nor in the north of the country was there during the terrible 10th and 11th centuries any peace or comfort. A frightful pestilence desolated Aquitaine and Toulouse in the year 1000; and in 1032 a famine began which lasted for three years. Yet the court of Toulouse was already remarkable for its "luxury," as the ecclesiastical writers call it,—rather for its love of art and literature, combined with extravagance of dress and fashions. Constance, wife of King Robert, and daughter of the count of Toulouse, gave great offence to the monks by her following of gallant countrymen. They owed their tastes, not only to their Roman blood and the survival of their old love for rhetoric and poetry, but also to their intercourse with the Saracens, their neighbours and enemies, and their friends when they were not fighting. On the preaching of the crusade, no part of France responded with greater enthusiasm than the south. A hundred thousand men followed Raymond de Saint Gilles. A century later their own country was to be the scene of another crusade even more bloody than that against the Saracen.

The heresies which were the cause of so much bloodshed may, perhaps, be said to have begun with Peter de Bruys, who preached in Languedoc for twenty years, until he was silenced by the usual method. He denied

infant baptism, respect for churches, the worship of the cross, transubstantiation, and prayers for the dead. His follower, Henry the Deacon, most eloquent of preachers, denied a great deal more. Wherever he taught he left deserted churches and contempt for the clergy. Although Bernard himself was invited to lend his persuasive powers to restore the cause of the church, he succeeded for a time only. Toulouse, for instance, was brought back to orthodoxy, yet when the great preacher went away the citizens relapsed. Again, there were the poor men of Lyons, the followers of Peter Waldo, of whom there were many in Languedoc, and there were the Manichæans, under the name of Puritans, Paternes, or Populans. In Languedoc and Provence the ground was ready for the seed of heresy. The towns were wealthy and free, the people had been in continual intercourse with Saracens of Palestine and Moors in Spain; they had never entirely rid themselves of pagan customs; their poetry taught the joys of life rather than the fear of death, their restless inquiring minds prompted them to ask whether there were any other solution of the problem of life than that offered by the church. The whole province—the county of Toulouse, with its fiefs of Narbonne, Beziers, Foix, Montpellier, and Quercy—was in open and scornful secession. It seems incredible, but it is doubtless true, that the churches were universally deserted, sacraments denounced, and clergy despised. The history of the crusade, in the reign of Raymond VI, against the heretics of Languedoc contains every element of cruelty and horror. The count made haste to submit, but it was of no avail. Bishops, papal legates, and ecclesiastics of all ranks headed the vast armies which were gathered together against the freethinkers. All the cities, one after the other, the castles, and the strongholds of Languedoc were taken by the crusaders. Raymond was made to submit to the lowest abasement; the country was wasted; the people were destroyed by fire and sword. When all was over, when Raymond and Simon de Montfort were dead, and King Louis VIII. had led a vast army of conquest through the country, the council of Toulouse was held, in order to subject the people to total spiritual submission. They chose the method, which seems so easy but is so difficult, of universal espionage and delation. They succeeded in enforcing apparent submission; but the spirit of religious freedom lingered among the people, and yet survives, for nearly half the Protestants in France belong to the south. The pacification of Languedoc was completed by the annexation of the county to the crown of France. In 1229 Count Raymond VII. renounced his claim to seven provinces, and swore fealty to the king.

Languedoc had, for two centuries, no other history apart from that of France. The long war with the English affected the country little. The province, comparatively safe from war, continued to increase and prosper in wealth. When it begins again to have a history of its own, it appears to be the home of the most bigoted orthodoxy. The university of Toulouse burns a professor, Caturet, for supposed heresy, and exiles a scholar, Dolet, for daring to sympathize with him. At the east of the province, however, Rabelais, who carries with him an atmosphere of free thought, is lecturing and dissecting, and in the west of the province Gerard Roussel is already preaching the doctrines of a purer faith. In the wars of religion, the great recruiting ground of Coligny was in those southern provinces against which Simon de Montfort had led his crusade. The insurrection of the Camisards belongs to the history of Languedoc, but the struggle was confined to the north part of the province. The pacification by Villars and the duke of Berwick, the horrible cruelties practised upon the people, and the singular story of Cavalier are noticed elsewhere.

A special interest attaches to the history of two towns, at least, of Languedoc. Both Montpellier and Toulouse present very remarkable features of interest to the student of municipal histories. The literature of the country is the literature called after its neighbour *PROVENÇAL (q.v.)*. Probably no great future remains for the literature of a dialect slowly dying out, yet examples have not been wanting of late to prove that there is still vitality in the language of the people. (w. 22)

LANGUET, HUNER (1518-1581), diplomatist, and one of the boldest political writers of the 16th century, was born in 1518 at Viteaux, near Autun in Burgundy, where his father held a good official position. He early manifested an inclination for study, and his tastes were encouraged by able masters; at Poitiers he devoted himself not only to law but also to natural science, history, politics, and theology. On leaving that university, after a sojourn at Leipzig, where he became the friend of Camerarius, he visited Padua and Bologna, and saw many other parts of Italy. Having been introduced in the course of his Italian journey to the *Lozi Theologi* of Melancthon, he in 1549 set out for Wittenberg to make the acquaintance of that author, and thus originated a friendship which terminated only with the death of the latter in 1560. Between 1551 and 1557 Languet travelled extensively in Germany, Denmark, Sweden, Finland, and Lapland, and in 1559 he entered the diplomatic service of the elector of Saxony, where he remained until his death. During the greater part of this period he was employed chiefly in negotiations with France and in the interest of the Huguenots. He was present in Paris on St Bartholomew's Day (1572), and was the means of saving his friends Wechel the printer, and Duplessis-Mornay; but his efforts drew on him the attention of the mob, and he himself in turn became indebted for his life to the chancellor Morvilliers. From 1573 to 1576 his mission lay chiefly at the imperial court, here he gained the acquaintance and ultimately the close friendship of Sir Philip Sidney. About 1578 he went to Ghent on the invitation of John Casimir, whom he accompanied to England, and the rest of his days he spent chiefly in the Low Countries, watching the course of political events. There seems to be no ground, however, for the assertion that in 1577 he had resigned his connexion with the court of Saxony, and formally attached himself to the prince of Orange. Languet died at Antwerp on September 30, 1581.

His correspondence with Augustus of Saxony (three hundred and twenty-nine letters, from November 17, 1565 to September 8, 1581), and with Mordeisen, the chancellor of the duchy (one hundred and eleven letters, from November 1560 to the summer of 1565), were published by Ludovius at Halle in 1606 under the title *Arxana secreti X.P. Huberti Langueti Epistolæ politicae et historice ad Philip. Augustum* (twenty-six letters, from April 59, 1578 to October 28, 1580), appeared at Frankfurt in 1633, and have since been reprinted. *Langueti Epistolæ ad Joh. Camerarium, patrem et filium* (one hundred and eight letters) were published by L. Camerarius at Groningen in 1646. The *Historia Descriptio* of the siege and capture (1567) of Gênes appeared in 1685. The work by which Languet is best known is pseudonymous, and its authorship has not been undisputed. It is entitled *Pandectæ contra tyranniam, sive de principis in populum populique in principem legitima potestate*, Stephano Anno Bruto Cella auctore, and bears to have been published at Edinburgh in 1579. By Edinburgh is most probably to be understood Basel. A French translation appeared in 1581; the original has been frequently reprinted, most recently at Leipzig in 1840. The work, which discusses with much freedom various points connected with the then familiar doctrine of passive obedience, attracted much attention, but its author was very successful in concealing the somewhat dangerous secret of his identity. It has been ascribed to Beaumont, Camerlun, and Duplessis-Mornay, by divers writers on various grounds—to the last-named on the very respectable authority of Grotius. The grounds on which Bayle (who has been followed almost unanimously by later writers) assigned it to Languet will be found in the form of a supplement to the *Dictionnaire*. The *Apologie ou défense de Bruto Cellæ, Prince d'Orange, contre le bon et*

'*celit du roi d'Espagne* (Antwerp, 1681) is sometimes attributed to Auguet. There seems little doubt, however, that it was really the work of the prince himself, with the help either of Pierre de Villiers (see Motley, *Rise of Dutch Republic*) or of Languet (Green in Pinaster, *Archives*).

LANNES, JEAN (1769-1809), marshal of France, was born at Lectoure, 11th April 1769. He was the son of a very stables keeper, and was himself in early life apprenticed to a dyer. He had had but little education, but notwithstanding this his great strength and proficiency in all manly sports caused him in 1792 to be elected sergeant-major of this battalion of volunteers of Gers, which he had joined on the breaking out of the war between Spain and the French republic. He served through the campaigns in the Pyrenees in 1793 and 1794, and in the latter year was elected chef de brigade. However, in 1796, on the reform of the army introduced by the Thermidorians, he was dismissed from his rank. Not discouraged by this check, he re-enlisted as a simple volunteer in the army of Italy. In the famous campaign of 1796 he again fought his way up to high rank, being eventually made once more chef de brigade by Bonaparte. He was distinguished in every battle, and was wounded at Arolo. He was chosen by Bonaparte to accompany him to Egypt as general of one of Kleber's brigades, in which capacity he greatly distinguished himself, especially on the retreat from Syria. He went with Bonaparte to France, assisted at the 18th Brumaire, and was appointed general of division, and commandant of his consular guard. He commanded the advanced guard on the crossing of the Alps in 1800, was instrumental in winning the battle of Montebello, from which he afterwards took his title, and bore the brunt of the battle of Marengo. In 1801 Napoleon tried his favourite general as a diplomatist, and sent him as ambassador to Portugal. Opinions differ as to his merits in this capacity, but it may be presumed that Napoleon did not believe in them, as he never made such use of him again. On the establishment of the empire he was created a marshal of France, and commanded once more the advanced guard of a great French army in the campaign of Austerlitz. At Austerlitz he commanded the left, at Jena the centre, and at Friedland the centre of the French army, showing himself a general of division of the greatest merit, carrying out the orders given him to the letter, and never thinking them impossible. He was now to be tried as a commander-in-chief, for Napoleon took him to Spain in 1808, and gave him a corps d'armée, with which he won a victory over Castaños on November 22. In January 1809 he was sent to attempt the capture of Saragossa, and by February 21 was in possession of the place. Napoleon then created him Duc de Montebello, and once more, for his last time, gave him the command of the advanced guard of an army of invasion. At Aspern he was ordered with two divisions to cut the Austrian army under the archduke Charles in half; he succeeded entirely, though under a heavy fire, but finding himself unsupported by Napoleon, who had been thrown into confusion by the news that his bridges over the Danube had been broken, he had to retreat. During the retreat he exposed himself as usual to the hottest fire, and received a mortal wound as he was being carried from the field to die at Vienna. He is said to have met and reproached his old general for his ambition; but this, to say the least, is a contested statement. Napoleon said of him that "he had found him a pigmy, and made him a giant"; and there can be no doubt of his marvellous ability on the field, and his extraordinary courage. His eldest son was made a peer of France by Louis XVIII.

A *Vie militaire de J. Lannes* was published in 1809 by René Berin, but details can be found in all the military histories of the time.

LA NOUE, FRANÇOIS DE (1531-1591), surnamed Bras-de-Fer, one of the gallant Huguenot captains of the 16th century, was born near Nantes in 1531, of an honourable and ancient Breton family. His first exploit was the capture of Orleans at the head of only fifteen cavaliers in 1567, during the second Huguenot war. At the battles of Jarnac in March 1569 and of Moncontour in the following October, La Noue was taken prisoner, but he was exchanged on the latter occasion in time to resume the governorship of Poitou, and inflict a signal defeat on the royalist troops before Rochefort. At the siege of Fontenay (1570) his left arm was shattered by a bullet, and the iron limb that replaced it won him from his soldiers the sobriquet of Iron-Arm. When peace was made in France in the same year, La Noue carried his sword against the Spaniards in the Netherlands, but was taken at the recapture of Mons by the Spanish in 1572. Permitted to return to France, he was commissioned by Charles IX. to attempt to reconcile the inhabitants of La Rochelle, the great stronghold of the Huguenots, to the king. But the Rochellais were too much alarmed by the recent massacre of St Bartholomew to come to any terms; and La Noue, perceiving that war was imminent, and knowing that his post was on the Huguenot side, gave up his royal commission, and from 1574 till 1578 acted as general of La Rochelle. When peace was again concluded, La Noue once more went to aid the Protestant estates of the Netherlands. Holding a high rank in their army, he took several towns and captured Count Egmont in 1580; but a few weeks afterwards his himself fell into the hands of the Spaniards. Thrust into a loathsome prison at Lumburg, La Noue, the admiration of all, of whatever faith, for his gallantry, honour, and purity of character, was kept confined for five years by a powerful nation, whose reluctance to set him free is one of the sincerest tributes to his reputation. At length, in June 1585, La Noue was exchanged for Egmont and other prisoners of consideration, while a heavy ransom and a pledge not to bear arms against his Catholic majesty were also exacted from him. Till 1589 La Noue took no part in public matters, but in that year he joined Henry of Navarre and Henry III. against the League. He was present at both sieges of Paris, and at several of the chief battles; but at the siege of Lamballe in Brittany he received the wound of which he died some days later at Moncontour, August 4, 1591.

Bontevoghe exaggerates in saying that La Noue was as famous by his pen as by his sword. What writings he has left are of value enough, but it is not by them that he is remembered. He was the author of *Discours Politiques et Militaires*, 1587, *Déclaration pour prise d'armes et la défense de Sedan et Janets*, 1588, *Observations sur l'histoire de Guicciardini*, 2 vols. 1593, and notes on *Pittacus's Laws*, which have not been published. His *Correspondance* was published in 1854. See *La Vie de François, seigneur de La Noue*, by Moysse Amrault, Leyden, 1661; Brantôme's *Vies des Capitaines Français*, C. Vivon's *Les Héros de la Réforme: P. de La Noue* (1878); and Haug, *La France Protestante*.

LANSLOWNE, WILLIAM PETTY FITZMAURICE, FIRST MARQUIS OF (1737-1805), better known as a statesman while earl of Shelburne, was born at Dublin, May 20, 1737. He was a descendant of the lords of Kerry, and his grandfather, who was created earl of Kerry, married a daughter of Sir William Petty. On the death without issue of Sir William Petty's son, the first earl of Shelburne, the estates passed to his nephew John Fitzmaurice (afterwards advanced to the earldom of Shelburne), the father of the subject of the present notice. The latter spent his childhood "in the remotest parts of the south of Ireland," and, according to his own account, when at the age of sixteen he entered Christ Church, Oxford, he had both "everything to learn and everything to unlearn." From a tutor whom he describes as "narrow-minded" he received advantageous guidance in his studies, but he attributes

his improvement in manners and in knowledge of the world chiefly to the fact, that, as was his "fate through life," he fell in "with clever but unpopular connexions." Shortly after leaving the university he served as an officer in Wolfe's regiment during the Seven Years' War, and so distinguished himself at Minden and Kloster-Kampen that he was raised to the rank of colonel and appointed aide-de-camp to the king. Being thus brought into near communication with Lord Bute, he was in 1761 employed by that nobleman to negotiate for the support of Charles Fox. For a few months in the same year he sat in the House of Commons as member of Wycombe, until he succeeded his father as earl of Shelburne in the Irish peerage, and Baron Wycombe in the peerage of Great Britain. Though he declined to take office under Bute he undertook negotiations to induce Fox to gain the consent of the Commons to the peace of 1763. Fox affirmed that he had been duped by the terms offered, and, although Shelburne always asserted that he had acted in thorough good faith, Bute spoke of the affair as a "pious fraud." Shelburne joined the Greenvile ministry in 1763 as president of the Board of Trade, but, failing in his efforts to replace Pitt in the cabinet, he in a few months resigned office. Having moreover on account of his support of Pitt on the question of Wilke's expulsion from the House of Commons incurred the serious displeasure of the king, he retired for a time to his estate. After Pitt's return to power in 1766 he became secretary of state, but during Pitt's illness his conciliatory policy towards America was completely thwarted by his colleagues and the king, and in 1768 he was dismissed from office. In 1782 he consented to take office under the marquis of Rockingham on condition that the king would agree to recognize the United States, and on the death of Lord Rockingham in the same year, he became premier; but the secession of Fox and his supporters led to the famous coalition of Fox with North, which caused his resignation in the following February, his fall being perhaps hastened by his proposed plans for the reform of the public service. He had also in contemplation a bill to promote free commercial intercourse between England and the United States. When Pitt acceded to office in 1784, Shelburne, instead of receiving a place in the cabinet, was created marquis of Lansdowne. Though giving a general support to the policy of Pitt, he from this time ceased to take an active part in public affairs. He died May 7, 1805.

During his lifetime the marquis of Lansdowne was blamed for insincerity and duplicity, but the accusations came chiefly from those who were dissatisfied with his preference of principles to party, and it is beyond doubt that, if he had had a more unscrupulous regard to his personal ambition, his career as a statesman would have had more outward success. His autobiography indicates that he was cynical in his estimates of character, but no statesman of his time possessed more enlightened political views, while his friendship with those of his contemporaries eminent in science and literature must be allowed considerable weight in qualifying our estimate of the moral defects with which he has been credited. See Fitzmaurice, *Life of William, Earl of Shelburne*, 3 vols., London, 1876-78.

LANSING, a city in Ingham county, Michigan, U.S., and capital of the State, is situated at the confluence of the Grand and Cedar rivers, 85 miles W.N.W. of Detroit. In 1847, when it was made the seat of government, forests covered the site. The city has broad streets, arranged in the regular rectangular system; and seven iron and three wooden bridges connect the parts of the city, which lies on both sides of the rivers above mentioned. Lansing is the seat of the State reform school, the school for the blind, and the State agricultural college. The last-named,

opened in 1857, received 240,000 acres granted by Congress for the endowment of a college of agriculture and the mechanical arts, and its income is derived from the interest of the price of part of the land, and from an annual grant from the State legislature. In 1880-81 it had a faculty of 23 members and 221 students. A graded system of public schools and a State library of 40,000 volumes are among the other educational resources of the city. Its most conspicuous building is the new State capitol, erected at a cost of one and a half million dollars. The leading manufacture is of agricultural implements, but there are extensive manufactories of carriages, waggons, wheelbarrows, and steam-engines, and four large flouring-mills. Good water-power is afforded by the Grand river, and four lines of railway offer ample shipping facilities. The city was incorporated in 1859, and in 1880 had a population of 8317.

LANSINGBURGH, a village in Rensselaer county, New York, U.S., is situated on the east bank of the Hudson, close to Troy, and nearly opposite Waterford, to which a bridge extends. The village was organized in 1774. Its staple product is brushes, known all over the States; but oil-cloth and crackers are also made. The population in 1880 was 7437.

LANTARA, SIMON MATHURIN (1729-1778), French landscape painter, was born at Onzy, 24th March 1729. His father was a weaver, and he himself began life as a herdsboy; but, having attracted the notice of M. Gille de Reumont, a son of his master, he was taken by him to Paris, and placed under a painter at Versailles. Endowed with great facility and real talent, his powers found ready recognition; he might have amassed fortune and earned distinction, but he could not divest himself of the habits acquired in early childhood. He found the constraint of a regular life and the society of educated people unbearably tiresome; he painted to please himself, and as long as the proceeds of the last sale lasted lived careless of the future in the company of obscure workmen with whom he had made friends. Rich amateurs more than once attracted him to their houses, only to find that in ease and high living Lantara could produce nothing. Fatal sickness came upon him when in extreme indigence; he entered the hospital of La Charité—in which he had previously been the object of the kindest cares—on the morning of 22d December 1778, and six hours after he was dead. His works, now much prized, are not numerous; the Louvre has one landscape, Morning, signed and dated 1761. As he was not a member of the Academy, his pictures were not admitted to its exhibitions, and notices of his works by his contemporaries are rare. Bernard, Joseph Vernet, and others are said to have added figures to his landscapes and sea-pieces. Engravings after Lantara will be found in the works of Lebas, Piquenot, Durek, Mouchy, and others. In 1809 a comedy called *Lantara, or the Painter in the Pothouse*, was brought out at the Vaudeville with great success.

See K. Bellier de la Chavignerie, *Recherches sur le peintre Lantara*, Paris, 1852.

LANTERN-FLY, a name applied to certain insects belonging to the Homopterous division of the order Hemiptera, which may be broadly placed in the genus *Fulgora*, although this is now subdivided into many genera. They are mostly large insects, and gaily coloured, remarkable for the forehead being produced into the semblance of a snout or muzzle (often upturned at the tip), the so-called "lantern." This snout is hollow, and is merely an inflated production of the head. Much interest, as well as mystery, has surrounded these insects, originating in a statement by Madame Merian in her work on the insects of Surinam (*Metamorphosis insectorum Surinamensium*, &c.), of which the first edition appears to have been published in 1705,

but which subsequently passed through many editions with varying titles and in several languages. Madame Merian stated that the common South American species, now known as *Fulgura lateraria*, L., was highly luminous at night, so much so that she was enabled to read by the light of one only, and that when several were confined together the interior of the box appeared all ablaze. No one doubted these statements, and the illustrious Linnaeus used the words "Promittens fronte noctu lucem vivacissimam spargit" in diagnosing the insect in his *Systena Naturæ*. Moreover, it was believed that, because one species had been asserted to be luminous, others allied thereto must possess the same power; the specific names used by Linnaeus, such as *candelaria*, *phosphorea*, *noctivnda*, *lucenaria*, and *flammea*, may be adduced as instances. Of these one only, the *F. candelaria* of China, has become (with the original *lateraria*) a subject of controversy, for it also was asserted to be luminous. As time wore on many intelligent naturalists and other travellers visited both South America and China, and they concluded that the light must be produced only under very exceptional conditions, or that the original statement was an error, for they could not detect any luminosity, nor, as a rule, was such a property believed in by the natives of the regions. Quite recently many naturalists of undoubted authority have resided for years in the districts where these insects occur without having personally detected luminosity (though directly in search of it), and without obtaining any indications of the existence of such a belief in the minds of the natives. On the other hand, there have been a few travellers who have professed to be able to confirm Madame Merian's statements, both from personal observation and from information derived from native sources. Possibly the last of these was within the last twenty years, and his assertion concerned *F. candelaria*, and upon his statement an entomologist of repute, lately deceased, maintained to the last his belief in the luminous powers. With him all faith in this direction has probably passed away. It is not for us to attempt to define the reasons for Madame Merian's positive and circumstantial statements. The preponderance of negative testimony is so crushingly great that *Fulgura* may be regarded as eliminated from the category of luminous insects.

LANTHANUM. It will be convenient to notice under this heading the group of closely allied metals—**LANTHANUM, CERIUM, and DIDYMIUM.**

In an abandoned copper mine at Riddarhyttan, Westmanland, in Sweden, there occurs a heavy compact mineral, which, though pretty abundant there, is hardly met with anywhere else. This mineral was long mistaken for tungsten (syn. scheelite), until Klaproth of Berlin in 1803 found in it a peculiar earth, which he called *ochroite earth*, as it becomes yellow when heated in air. About the same time Berzelius and Hisinger made the same discovery; and, (rightly) presuming the new earth to be an oxide of a new metal, they called the latter *cerium* (after the planet Ceres, the then latest discovery in astronomy) and the mineral *cerite*, which names have been retained to this day. Only the name "cerium" now has a more specific meaning, it having been shown by Mosander (in 1839-41) that Berzelius's cerium is a mixture of three metallic radicles, namely, cerium proper, lanthanum (from *λανθάνειν*, "to be concealed"), and didymium (from *δίδυμος*, "twin"). These metals are very closely related to one another in their chemical character, and may be conveniently treated together. The extraction from cerite, of the oxide group, offers no difficulty. According to Margnac (*Ann. Chim. Phys.* [3], vol. xxvii.), the powdered mineral is made into a thick paste with oil of vitriol, and the reaction which sets

in allowed to accomplish itself. The remaining dry white powder is placed in a crucible, and kept there for a long time at a temperature below redness, but sufficient to chase away the bulk of the free sulphuric acid. The residue is added in small instalments to a quantity of cold water, and the gangue (ferruginous silica) filtered off. The solution is boiled, when the greater part of the *cerite-oxides* comes down in the form of sulphate almost free from foreign oxides. The sulphates can be purified by redissolving them in the least quantity of water at 5° to 6° C., filtering, and reprecipitating by boiling. What remains in the mother-liquors is recovered by precipitation with sulphate of potash (which must be added as a solid and in sufficient quantity to saturate the solution) as an alum-like double sulphate. The purified sulphates are dissolved in cold water, precipitated as oxalates by means of oxalate of ammonia, and the washed oxalates ignited, when the pure cerite-oxide mixture remains. The separation of the three oxides from one another offers very great difficulties. Comparatively easy is the extraction of approximately pure oxide of cerium—by Berzelius's method. Dissolve the mixed oxide (which must be free of sulphate if the method is to succeed) in nitric acid, evaporate to dryness, ignite the residue, and treat it with nitric acid diluted with one hundred times its weight of water. Only lanthanum and didymium dissolve, impure binoxide of cerium (Ce_2O_3) remaining, which can be further purified by treatment with more concentrated nitric acid, which, however, besides the lanthanum and didymium, dissolves a good deal of the cerium itself. This method (like any of the rest) is founded upon the fact that salts of sesquioxide of cerium (Ce_2O_3) are readily oxidized into salts of the feebly basic binoxide CeO_2 under circumstances which effect no higher oxidation in La_2O_3 or Di_2O_3 .

For the preparation of the oxides of lanthanum and didymium we may utilize the nitric mother-liquors obtained in the extraction of cerium-oxide. These are evaporated to dryness, the residue is ignited, and treated with very dilute nitric acid, which dissolves the lanthanum and didymium with only little cerium (Mosander, Margnac). A more complete elimination of the cerium is effected (Bunsen) by converting the nitrates into sulphates (by evaporation with sulphuric acid to dryness, and igniting the residuum), dissolving these in sulphuric acid water, and boiling with powdered magnesite ($MgCO_3$). From the filtrate the lanthanum and didymium are precipitated (after acidulation by muriatic) with oxalic acid, and the oxalates filtered off, washed, and ignited. By repeating the magnesia and oxalic acid process two or three times, the oxides are obtained cerium-free. They are then made into anhydrous, neutral sulphates; these are dissolved in a minimum of water at 0° to 1° C., and the solution is heated to 30° to 35° C., when lanthanum sulphate chiefly separates out in small crystals, which are filtered off with the help of a filter-pump. A relatively lanthanum-free didymium sulphate remains dissolved (Mosander).

The metals were known only in a powdery form up to 1876, when Hillebrand and Norton succeeded in preparing them in a compact form by the electrolysis of the fused chlorides. The three metals are very similar to one another; they are steel-grey ductile true metals, melting at a somewhat lower temperature than silver. Specific gravities range from 6.1 to 6.6. They are more readily inflammable than magnesium.

The atomic weights of the three elements are now (1882) quoted as Ce = 141, La = 138, Di = 147.

Oxides and Salts.—Cerium has long been known to form two oxides, namely, a lower ("cerous") oxide, which is a pretty strong, and a higher ("ceric") oxide, which is a feeble base. 16 ("O") parts of oxygen are combined, in the former with 62 ("F") parts, in the latter with 28 parts of metal. Formerly Z was looked upon as the atomic weight, and the oxides formulated as FO and F_2O_2 respec-

tively. But Mendeleev on theoretical grounds insisted that the lower oxide must be looked upon as a sesquioxide, Ce_2O_3 , while $\text{Ce} = 3\text{Pr} = \text{Ce} = 3\text{Pr}$ and the higher (necessarily) as a monoxide, Ce_2O_3 , or rather CeO_2 . And he asserted the same in regard to the reputed monoxides of lanthanum and dysprosium. These remarks were little heeded even by the specialists until Hillebrand (partly in conjunction with Norton) succeeded in obtaining the three metals as such, and in a truly metallic condition, which admitted of an exact determination of the specific heats. The specific heats were found to be— for Ce 0.4479, for La 0.4485, for Dy 0.4563, and these numbers must be multiplied with Mendeleev's atomic weight to produce "atomic heats" (6.6; 6.23; 6.4), approximating to values obtaining for other metals of established atomic weight. Hence Mendeleev was right.

Cerous oxide, Ce_2O_3 , is obtained by heating the oxalate in an atmosphere of hydrogen, as a bluish-grey powder. The higher oxide CeO_2 is obtained when any certain salt of a volatilized (e.g., nitric) is ignited in air, it is a white powder, which when cold has only a slight touch of yellow in it, but at high temperatures assumes a deep orange-red color. Cerous chloride, CeCl_3 , is obtained by heating the metal, or a mixture of nitric oxide and charcoal, in dry chlorine gas, as a yellowish-white substance, uniting with water into indistinct crystals $\text{CeCl}_3 \cdot 6\text{H}_2\text{O}$. The cerous sulphate, $\text{Ce}_2(\text{SO}_4)_3$, separates out when its solution is heated. It is soluble in 6 parts of cold, and in about 60 of hot water, and forms a difficultly soluble double salt with sulphate of potash. To obtain the cerous sulphate, when the dioxide is treated with cold concentrated sulphuric acid, and the solution formed by addition of water allowed to evaporate, the salt $\text{Ce}_2(\text{SO}_4)_3 \cdot 6\text{H}_2\text{O}$ or $2\text{Ce}_2\text{O}_3 + 25\text{H}_2\text{O}$ separates out in red crystals looking like leucocrate of potash. The mother-liquor yields yellow crystals of $-\text{Ce}(\text{SO}_4)_3 \cdot 4\text{H}_2\text{O}$.

The most characteristic test for cerium salts is that the colourless cerous solutions, on addition of hypochlorite of soda, give a red precipitate of a ceric chloride.

Dysprosium (Dy_2O_3) solutions have an astringent astringent taste and a rose-red or violet color. But their most characteristic property is their beautiful absorption-spectrum, which comes out distinctly with as little as half an inch deep of a solution containing 1/10th of a per cent of the oxide (Gladstone). Lanthanum (La_2O_3) solutions have a similar taste to those of dysprosium salts. They are colorless. The chloride when volatilized between the poles of an induction coil yields a highly characteristic rich line-spectrum, by means of which the least traces of the metal can be detected (Bunsen).

Of higher oxides of cerium or dysprosium we had hitherto only indications, but quite lately Dr. Brauner (*Chem. News* for 1881, December 53), in Roscoe's laboratory, succeeded in preparing a definite pentoxide, Dy_2O_5 , of dysprosium, and also a hydrate of it, $\text{Dy}_2\text{O}_5 \cdot \text{H}_2\text{O}$.

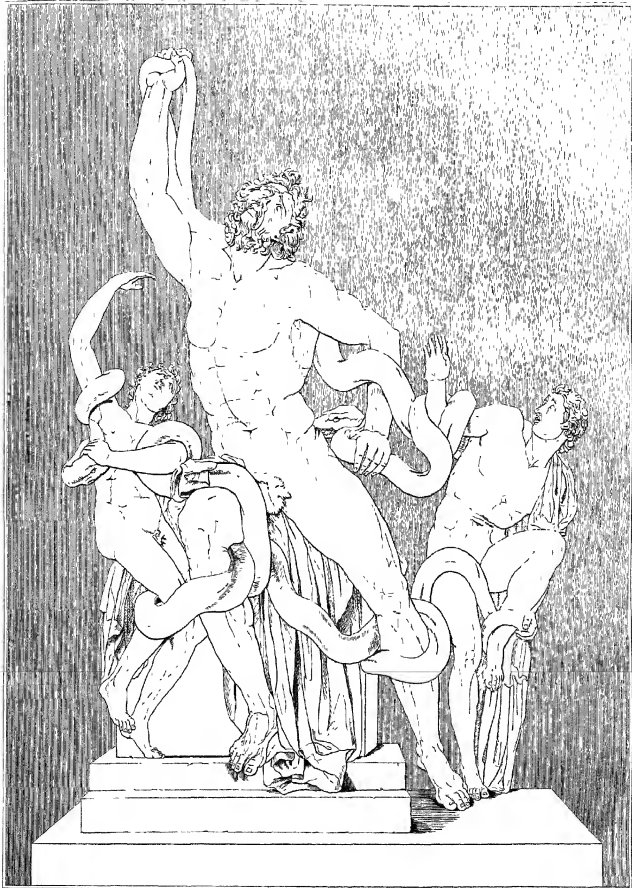
Sources.—Copper, though the most abundant, is not the only native source of cerium, lanthanum, and dysprosium. A. Cosca has found traces of the metals in the ashes of numerous plants, and even in the human body. But it is more important to state that there are a number of rare minerals, of which the chief are known by the names of gadolinite, euxenite, samarskite, which, along with more or less of cerite-metals, contain other rarer earth-metals similar to these. Until lately the handbooks of chemistry quoted only three such rarer members of the family under the names of yttrium, erbium, and terbium, but these reputed individual elements have, during the last few years, been searchingly analyzed by Mangnès, M. Delafontaine, L. F. Nilson, P. T. Clève, J. L. Smith, and others, and under their hands resolved themselves into about a dozen separate elements. The rare earth-metals in fact had far to multiply like the little planets in astronomy; and, although in chemistry no firmly established fact can justly be called unimportant, the minor rare earths, in the meantime, are of no general interest, even to the general chemist.

See V. L. L. *Disquisitiones de Chimia*, 1874, Roscoe and Schodden, *Handbook of Chemistry*, 1870, M. Delafontaine, *Annales de Chimie*, 1868-69, *Progresses des Sciences physiques et naturelles*, *Revue des Sciences*, 1868-69, *Progresses des Sciences*, 1871; *Journal of Practical Chemistry*, 1868-69, *Zeitschrift für Chemie*, 1869. The *Handbook of Chemistry* is the most reliable source of information.

LANZI, LUIGI (1732-1810), a writer on Etruscan antiquities and on the history of Italian painting, was born in 1732, and educated as a priest. In 1775 he was appointed keeper of the galleries of Florence, from which time his attention seems to have been divided between the study of Italian painting and the study of Etruscan antiquities and language. In the one field his labours are represented by his *Storia Pittorica della Italia*, the first portion of which, containing the Florentine, Siennese, Roman, and Neapolitan schools, appeared in 1792, the rest in 1796. The work is translated by Roscoe. In archaeology his great achievement was the work entitled *Saggio di lingua Etrusca*, 1789,

followed by *Saggio delle lingue Ital. Antiche*, 1806. In his memoir on the so-called Etruscan vase (*Dei vasi antichi dipinti volgarmente chiamati Etruschi*, 1806) Lanzi correctly perceived their Greek origin and characters. What was true of the antiquities would be true also, he argued, of the Etruscan language, and the object of the *Saggio di lingua Etrusca* was to prove that this language must be related to that of the neighbouring peoples—Romans, Umbrians, Oscans, and Greeks. It is admitted that he was wanting in critical method after a certain point, though at the same time much of the impulse he gave to study arose from his general method of inquiry. It is a sign of the recognition he received that he was allied with E. Q. Visconti in his great but never accomplished plan of illustrating antiquity altogether from existing literature and monuments. His notices of ancient sculpture and its various styles appeared as an appendix to the *Saggio di lingua Etrusca*, and arose out of his careful and minute study of the treasures then added to the Florentine collection from the Villa Medici. The abuse he has often met with from modern writers in the Etruscan language led Corssen (*Sprache der Etrusker*, 1. p. vi.) to protest in the name of his real services to philology and archaeology. Among his latest productions may be mentioned his edition of Hesiod's *Works and Days*, with valuable notes, and a translation in *terza rima*. It had been begun as far back as 1785, but was ceased and completed in 1808. The list of his works closes with his *Opere Sacre*, a series of treatises on spiritual subjects. Lanzi died of apoplexy, March 30, 1810, in the seventy-eighth year of his age. He was buried in the church of the Santa Croce at Florence, by the side of Michelangelo.

LAOCOON, in Greek legend, was a brother of Anchises, and had been a priest of Apollo, but having married against the will of the god he and the two sons of this marriage were attacked by serpents while preparing to sacrifice a bull at the altar of Poseidon, in whose service Laocoon was then acting as priest. An additional motive for his punishment consisted in his having warned the Trojans against the wooden horse left by the Greeks. But, whatever his crime may have been, the punishment stands out even among the tragedies of Greek legend as marked by its horror—particularly so as it comes to us in Virgil (*Aeneid*, ii. 199 *sq.*), and as it is represented in the marble group in the Vatican (see Plate V). In the oldest existing version of the legend—that of Arcturus of Miletus, which has so far been preserved in the excerpts of Proclus—the calamity is lessened by the fact that only one of the two sons is killed; and this, as has been pointed out (*Arch. Zeitung*, 1879, p. 167), agrees with the interpretation which Goethe in his *Propylæen* had put on the marble group without reference to the literary tradition. He says: "The younger son struggles and is powerless, and is alarmed; the father struggles ineffectively, indeed his efforts only increase the opposition, the elder son is least of all injured, he feels neither anguish nor pain, but he is horrified at what he sees happening to his father, and he screams while he pushes the coils of the serpent off from his legs. He is thus an observer, witness, and participant in the incident, and the work is then complete." Again, "the gradation of the incident is this: the father has become powerless among the coils of the serpent; the younger son has still strength for resistance but is wounded; the elder has a prospect of escape." Lessing, on the other hand, maintained the view that the marble group illustrated the version of the legend given by Virgil, with such differences as were necessary from the different limits of representation imposed on the arts of sculpture and of poetry. These limits required a new definition, and this he undertook in his still famous work, *Laocoon* (see the edition of Hugo Blümner, Berlin,



W. & T. Gillman, Phil. Acad. 1861. 1/2 in.

Long. 1/2 in. 1/2 in. 1/2 in.

1870, in which the subsequent criticism is collected). The marble group in the Vatican was found in 1506 near the baths of Titus, and there is no question of its being the same which Pliny (*Nat. Hist.* xxxv. c. 5) speaks of as in the palace of Titus, and as the work of three Rhodian sculptors Agesander, Polydorus, and Athenodorus. They made it, he says, *de consensu sententia*, which, according to the highest Latin authorities, must refer not to a standing imperial council but to a council selected *ad hoc*. This suits the theory of the sculpture being a work of the time of Titus—not an original conception of that time, but a variant of a conception more or less familiar to Greek art since the time of Alexander, such as may be seen in marble reliefs, on gems, in a painting found at Pompeii (see Blumner's *Laocoon*, pls. 3, 3), and on a terra cotta Etruscan urn in the British Museum. The names of Agesander and Athenodorus have been found repeatedly on bases of sculptures in Italy, and the date of the writing is that of the time of Titus. Still the opinion is very generally held that the Vatican group is altogether a work of the Rhodian school during its supremacy after the death of Alexander, and that the artists named by Pliny had lived then, and were apparently a father and two sons, for which reason Pliny may have thought it necessary to add *de consensu sententia*, in the sense of "according to the decision of their combined thoughts," to prevent any one supposing that the artists had each made one of the figures, selecting them possibly in accordance with their own relationship to each other, the father taking Laocoon, and the sons taking respectively the sons of Laocoon. As yet, however, the characteristics of the Rhodian school are not sufficiently known for a final settlement of this long standing question. In Plate V. the right arm of Laocoon with the coils of the serpent which he holds up is restored, as is also the right arm of the younger son. (A. S. M.)

LAODICEA (Greek *Λαοδικέα*) is the name of at least eight cities, founded or renovated in the later Hellenic period. Most of them were founded by the Seleucid kings of Syria. Seleucus, founder of the dynasty, is said by Appian to have named five cities after his mother Laodice. Many other women of the family bore the same name, which also passed by marriage into the family of the Pontic kings. The victories of Alexander introduced Greek civilization over Asia; the organizing and city-building energy of his successors established and consolidated it. They either founded new cities in favourable situations or reorganized native cities after the Greek model: thus over the immense realm of the Seleucids from the *Ægean Sea* to the borders of India we find numberless cities called Seleucia, Laodicea, &c. So long as Greek civilization held its ground, these were the great commercial and social centres of the country. We find a *Laodicea ad Lycum* in the Meander valley, on the borders of Phrygia, Caria, and Lydia; another surnamed *Combusta* on the borders of Phrygia, Lycaonia, and Pisidia; a third in Pontus; a fourth, *ad mare*, on the coast of Syria; a fifth, *ad Libanum*, beside the Lebanon mountains; and three others in the far east—Media, Persia, and the lower Tigris valley. In the latter countries Greek civilization was overwhelmed in Orientalism after a century or two, and the last three cities disappeared; the other five continued great throughout the Greek and Roman period, and the second, third, and fourth retain to the present day the ancient name under the pronunciation *Ladik*, *Ladikiyeh*, or *Latakia* (see LATAKIA).

Laodicea ad Lycum was founded probably by Antiochus II. Theos (261-46 B.C.), and named after his wife Laodice. Its site, called by the Turks *Eski Hisar*, "the old castle," is now solitary and deserted, but it retains an undying

interest as one of the oldest homes of Christianity and the seat of one of the seven churches of the Apocalypse. Pliny tells us (v. 29) that the town was called in older times *Diospolis* and *Rhoas*, but it is certain that at an early period *Colossæ*, a few miles to the east, and *Hierapolis*, six miles to the north, were the great cities of the neighbourhood, and that *Laodicea* was a place of no importance till the Seleucid foundation (Str., p. 578). A favourable site was found on some low hills of alluvial formation, about 2 miles south of the river Lycus (Churuk Su), and 9 miles east of the confluence of the Lycus and Meander. Smaller rivers of the neighbourhood are the *Asopus*, *Caprus*, and *Cadmus*, the last named after the lofty range of Mount *Cadmus* (*Baba Daghi*), which overhangs the Meander valley on the south. The great trade route from the Euphrates and the interior passed through *Apamea* to *Laodicea*. There it forked, one branch going straight down the Meander valley to *Magnesia* and thence north to *Ephesus*, a distance of about 90 miles, and the other branch crossing the mountains by an easy pass to *Philadelphia* and the *Hermus* valley, *Sardis*, *Thyatira*, and at last *Pergamus*. St Paul (Col. iv. 16) alludes to the situation of *Laodicea* beside *Colossæ* and *Hierapolis*, and the order in which the last five churches of the Apocalypse are enumerated (Rev. i. 11) is explained by their position on the road just described. Placed in this important situation, in the centre of a very fertile district, *Laodicea* became a rich city. It was famous for its money transactions (Cic., *Ad Fam.*, ii. 17, iii. 5), and for the beautiful soft wool grown by the sheep of the country (Str., 278). Both points are referred to in the message to the church (Rev. ii. 17, 18).

Little is known of the history of the town. It suffered greatly from a siege in the Mithridatic war, but soon recovered its prosperity under the Roman empire. The *Zeus* of *Laodicea*, with the curious epithet *Æzus* or *Æzias*, is a frequent symbol on the city coins, and is one of the widest-known deities of western Asia Minor. He is represented standing, holding in the extended right hand an eagle, in the left a spear, the *hasta pueri*. Not far from the city was the temple of *Men Karou*, with a great medical school, while *Laodicea* itself produced some famous *Stoic* philosophers, and gave origin to the royal family of *Ptolemaion* and *Zenon*, whose curious history has been illustrated in recent times (Waddington, *Mélanges de Numism.*, ser. ii.; Mommsen, *Epist. Epigraphic.*, i. and ii.; Bayet, *Mémoires de la Société Latine*, chap. v.). The coinage of *Laodicea* continues in a rich unbroken series to the time of the emperor *Diocletian*. Under the Byzantine rule its greatness remained, but finally the city fell into decay in the frontier wars with the Turkish invaders. Its ruins are of wide extent, but not of great beauty or interest; there is no doubt, however, that much has been buried beneath the surface by the frequent earthquakes to which the district is exposed (Str., 580; Tac., *Ann.*, xiv. 27). For an account of the ruins see the works of *Leake*, *Hamilton*, *Arundel*, *Texier*, &c., and especially the beautiful drawings of *Cockerell* in the *Antiquities of Ionia*, vol. iii. pl. 47-61.

LAON, capital of the département of Aisne, France, is situated 87 miles N.E. of Paris, on an isolated and singularly buttressed hill, which rises some 330 feet above the surrounding plain and the little river of Ardon, which flows into the Lette, a tributary of the Oise. From the railway station, which is situated in the plain to the north, a straight staircase of several hundred steps leads up to the gate of the town, but all the roads connecting Laon with the surrounding district are cut in zigzags on the steep slopes, which are crowned by the old and partly ruinous ramparts. At the eastern extremity of the hill rises the citadel; at the other end is a parade-ground, and on the south stands the ancient abbey of St Vincent. Between the latter and the town is the *Curve St Vincent*, the slopes of which are covered with trees, vegetable gardens, and vineyards. From the promenade along the line of the ramparts there is an extensive view northward to beyond St Quentin, westward to the forest of St Gobain, and southward over the wooded hills of the *Laonnais* and *Soumme*.

The cathedral of Laos is one of the most important creations of the art of the 12th and 13th centuries. It took the place of the old cathedral, burned at the beginning of the communal struggles mentioned below. The building is cruciform, and the choir, instead of being apsidal, terminates in a straight wall. Each of the three *chapelles* formerly had two towers with spires, and there was also a great central tower. Of these only four remain, and, being without spires, they give the building the aspect of a strong castle. The west front ranks next to that of Notre Dame at Paris in purity. The chapter house and the cloister contain beautiful specimens of the architecture of the beginning of the 13th century. The old episcopal palace, contiguous to the cathedral, is now used as a court-house. The front, flanked by turrets, is pierced by great pointed windows. There is also a Gothic cloister and an old chapel of two stories, of a date anterior to the cathedral. The church of St. Martin dates from the middle of the 12th century. The old abbey buildings of the same foundation are now used as the hospital. The old 12th century chapel of the Templars now forms part of the establishment of the Brothers of Christian Doctrine. The church of the suburb of Vaux near the railway station dates from the 11th century. Numerous cellars of two or three stories have taken the place of the old quarries in the hill-sides. The old ramparts have been demolished, but the 13th century gates of Ardon, Royer, and Chenailles have been preserved. The Société Académique de Laos has collected in its museum of arts and antiquities many archaeological treasures, among others a striking Roman mosaic of the 2d century, representing Orpheus charming the animals by his lyre, and some Roman ewers, noticeable for quality of metal and purity of form. The communal library contains 30,000 volumes, mostly from the neighbouring convents, it has also interesting manuscripts and autographs, the most ancient of which, signed by Lothair, bears date 972. Laos owes its rank as capital of the department to its central position and to its age; its numbers only 12,000 inhabitants, and has hardly any trade. The surrounding district produces vegetables and beet-root, the latter crop supplies the sugar-works, which come close to the foot of the hill; but in the town itself the only industries are coöpering and the manufacture of blankets and common woollen stuffs.

In virtue of its geographical position, the hilly district of Laos has always had some strategic importance. Even in the time of Cesar there was Galliaville where the Remi (inhabitants of the country round Rheims) had to meet the onset of the confederated Belgæ. Whatever may have been the precise locality of that battle-field, Laos was fortified by the Romans, and successfully checked the invasions of the Franks, Burgundians, Vandals, Alani, and Huns. St. Remigius, the famous archbishop of Rheims who baptised Clovis, was born in the Lacanais, and was he who instituted the bishopric of the town. Thenceforward Laos was one of the principal towns of the kingdom of the Franks, and the possession of it was often disputed. Charles the Bald had enriched its church with the gift of very numerous domains. After the fall of the Carolingians Laos took part of Charles of Lorraine, their heir, and Hugh Capet only succeeded in making himself master of the town by the connivance of the bishop, who, in return for this service, was made second ecclesiastical peer of the kingdom. Early in the 12th century the communes of France set about emancipating themselves, and the history of the commune of Laos is one of the roughest and most varied. The citizens had profited by a temporary absence of Bishop Gaudri to accept for themselves from his representatives a communal charter, but he, on his return, purchased from the king of France the revocation of this document, and recommenced his oppressions. The consequence was a revolt, in which the episcopal palace was burnt and several of his persons were put to death. The fire spread to the cathedral, and reduced it to ashes. Unceasing as the result of their victory, the rioters went into hiding outside the town, which was anew pillaged by the people of the neighbourhood, eager to avenge the death of their bishop. The king ultimately intervened in favour of the bishop and of the inhabitants till 1239. After that date the liberties of Laos were no more contested. But it retained its strategic importance, and during the

Hundred Years' War it was attacked and taken by the Burgundians, who gave it up to the English, to be retaken by the French after the coronation of Charles VII. Under the League Laos took the part of the Leaguers, and was taken by Henry IV. During the campaign of 1814 Napoleon tried in vain to dislodge Blücher from it. In 1870 an engineer blew up the powder magazine of the citadel at the moment when the German troops were entering the town. Many lives were lost, and the cathedral and the old episcopal palace were damaged by the explosion. At the Revolution Laos permanently lost its rank as a bishopric.

LAOS, or LAWA, a large Indo-Chinese nation, occupying the northern and eastern provinces of Siam known as the Laos states, mainly between 15° and 24° N. lat., 98° and 106° E. long. There are two main divisions—the Lau-pang-kai, or "White Fauché" Laos, and the Lau-pang-dun, or "Black Fauché" Laos, the former between the Deng-Piya-Phai range and the river Mekong, the latter about the middle and upper course of the river Menam, and so called from the habit of tattooing a black pattern about the navel. The Laos are closely related to the physique and speech to the Siamese proper, and are by some writers regarded as the primitive stock of that race. They are an historical people who were formerly constituted in an ancient and powerful kingdom, whose capital Vinh-kiang (Vien-shan) was taken and destroyed by the Siamese about the year 1828. Since then they have been entirely subject to Siam, and are governed partly by khiao, or native hereditary princes, partly by mandarins or governors directly nominated by the Bangkok authorities. The present khiao of the province of Bassak north of Cambodia is the last surviving descendant of the ancient Lao dynasty. The khiao are invested by means of the gold shield, betel-box, spittoon, and teapot which are sent from Bangkok, and returned at their death or deposition. Of all the khiao the most powerful is the prince of Ubon (16° N., 106° E.), whose jurisdiction extends nearly from Bassak on the Mekong northwards to the great southern bend of that river.

The many contradictory accounts of the Laos that have been published by travellers are due to the fact that quite three-fourths of the race have become mixed with the surrounding Khao or aboriginal inhabitants of the peninsula. The half-castes that have thus sprung from alliances with the Bolovens, Thêhs, Redehs, Sui, and other wild tribes of Caucasian stock present every variety between that type and the Mongolian. But those that have preserved the purity of their blood are still distinguished by the high cheek bones, small flat nose, oblique eyes, wide mouth, black lank hair, sparse beard, and yellow complexion of the Tai and other branches of the Mongol family. These are also a semi-civilized people with a knowledge of letters, followers of the Buddhist teachings, settled in small towns and villages, and engaged chiefly in agriculture. They have domesticated the elephant and buffalo, and are peaceful and industrious, being skilled in the production of lacquered wares, and silk and cotton fabrics for local use. Trading relations have also long been established with China, Siam, Burmah, and Cambodia, with which countries their ivory, gold dust, tin, gums, lac, benzoin, raw silk, skins, and sapenwood are bartered for cotton cloth, chintzes, silks, opium, hardware, and porcelain. At present a large portion of this trade is in the hands of itinerant Burmese dealers and hawkers, who are met everywhere between the Irawadi and Mekong valleys, organized in small caravans with a headman and porters all well armed, like the Povidahs of Afghanistan.

The civilized Laos have long been addicted to slave hunting, not only with the sanction but even with the co-operation of the authorities. When times are hard and tribute cannot otherwise be raised, "the Lao mandarins organize regular expeditions against the wild tribes. On some slight pretext a favourable camping ground is chosen,

whence attacks are made in all directions on villages, which they hope to surround or surprise. The savages live only in small hamlets consisting of a few huts, and they are powerless to resist the attacks of men armed with guns. These razias are usually made only against the independent savages who reject the authority of the Lao princes and refuse to pay tribute. But I have noticed that the compact by which the savages consent to surrender a part of their independence, in order to preserve their wives, children, and themselves, is far from being always respected; and the unfortunate Guis-heuns, for example, who dwell within a few leagues of Bassak, are in the greatest terror of the prince, refusing on any consideration to leave their forests or inaccessible villages.¹ The convoys of slaves, purchased chiefly by Chinese and Malay dealers from Cambodia, are forwarded mainly to Bangkok, Korat, and Phnom-penh, the present capital of Cambodia. This organized slave trade is the great cause of the nation, and tends more than all other causes combined to retard the natural development of the Lao country.

The mixed Lao peoples are distinguished from the pure stock chiefly by their more regular features, tall stature, lighter complexion, sub-dolichocephalic crania, and generally lower social condition. Most of them, although nominal Buddhists, are in reality still nature-worshippers, who make offerings of sticks and stones to the local genii, and guard their homes against evil spirits by means of brooms, cotton threads, bunches of herbage, and other curious devices. Some of them are quite as savage as the wild tribes, and, although acquainted with the use of firearms, still use the characteristic crossbow, a formidable weapon, which in skilled hands will kill a buffalo with a simple bamboo arrow at considerable distances. In some parts the confusion of types and usages is so great that the true Khas can be distinguished from the Laos only by the lobe of the ear, which is pierced for the insertion of large bone, ivory, or wooden ornaments like those worn by many of the Oceanic races.

Apart from the passions associated with the infamous slave trade, encouraged by their rulers, the Laos are an inoffensive, unwarlike, and peace-loving race, fond of music, and living chiefly on a diet of rice, vegetables, fruits, fish, and poultry. Pure and mixed, they number altogether perhaps some 1,500,000.

LĀO-TSZE, or LĀO-TSZE, the designation of the author of the celebrated treatise called *Tao Teh King*, and the reputed founder of the religion called *Taoism*. The Chinese characters composing the designation may mean either "the Old Son," which commonly assumes with foreigners the form of "the Old Boy," or "the Old Philosopher." The latter significance is attached to them by the Rev. Dr. Chalmers in his translation of the treatise published in 1868 under the title of *The Speculations on Metaphysics, Polity, and Morality of "the Old Philosopher," Lāo-tse*. The former is derived from a fabulous account of Lāo-tse which appeared in the *Shan Hsien Chuan*, "The Account of Spirits and Immortals," of Ko Hung, in our 4th century. According to this, his mother, after a supernatural conception, carried him in her womb sixty-two years (or seventy-two, or eighty-one—ten years more or fewer are of little importance in such a case), so that, when he was born at last, his hair was white as with age, and people might well call him "the old boy." The other meaning of the designation rests on better authority. We find it in the *K'ia Tsü*, or "Narratives of the Confucian School," compiled in our 3d century from documents said to have been preserved among the descendants of Confucius, and also in the brief history of Lāo-tse given in

the historical records of Sze-ma Ch'ien (about 100 a.c.). In the latter instance the designation is used by Confucius, and possibly originated with him. It should be regarded more as an epithet of respect than of years, and is equivalent to "the Venerable Philosopher."

All that Ch'ien tells us about Lāo-tse goes into small compass. His surname was LĀ, and his name Urh. He was a native of the state of Ch'ü, and was born in a hamlet, which we must place not far from the present prefectural city of Kwei-teh in Ho-nan province. What is of more importance, he was one of the recorders or historiographers at the court of Ch'ü, his special department being the charge of the whole or a portion of the royal library. He must thus have been able to make himself acquainted with all the history of his country and of the men who had played the most distinguished part in its affairs. Ch'ien does not mention the year of his birth, which is often said, though on what Chinese authority does not appear, to have taken place in the third year of King Ping, corresponding to 604 a.c. That date cannot be far from the truth. That he was contemporary with Confucius is established by the concurrent testimony of the *LĀ K'ü* and the *K'ia Tsü* on the Confucian side, and of Chwang-tse and Sze-ma Ch'ien on the Taoist. The two men whose influence has been so great on all the subsequent generations of the Chinese people, and whose views are now more attentively studied by thinking men of other nations than ever they were before—Khung-tse and Lāo-tse—had at least one interview, in 517 a.c., when the former was in his thirty-fifth year. The conversation between them was interesting. Lāo was in a mocking mood; Khung appears to the greater advantage.

If it be true that Confucius, when he was fifty-one years old, visited Lāo-tse, as Chwang-tse says (in the *Thien Yü*, the fourteenth of his treatises), to ask about the *Tao*, they must have had more than one interview. Dr. Chalmers, however, has pointed out that both Chwang-tse and Lāo-tse (a still earlier Taoist writer) produce Confucius in their writings, as the lords of the Philistines did the captive Samson on their festive occasions, "to make sport for them." Their testimony is valueless as to any matter of fact. There may have been several meetings between the two in 517 a.c., but we have no evidence that they were together in the same place after that time. Ch'ien adds—"Lāo-tse cultivated the *Tao* and virtue, his chief aim in his studies being how to keep himself concealed and unknown. He resided at (the capital of) Ch'ü; but after a long time, seeing the decay of the dynasty, he left it, and went away to the Gate (leading from the royal domain into the regions beyond,—at the entrance of the pass of Han-kü, in the north-west of Ho-nan). Yin Hsi, the warden of the gate, said to him, 'You are about to withdraw yourself out of sight; I pray you to compose for me a book (before you go).' On this Lāo-tse made a writing, setting forth his views on the *tao* and virtue, in two sections, containing more than 5000 characters. He then went away, and it is not known where he died." The historian then mentions the names of two other men whom some regarded as the true Lāo-tse. One of them was a Lāo Lāi, a contemporary of Confucius, who wrote fifteen treatises (or sections) on the practices of the school of *Tao*. Subjoined to the notice of him is the remark that Lāo-tse was more than one hundred and sixty years old, or, as some say, more than two hundred, because by the cultivation of the *Tao* he nourished his longevity. The other was "a grand historiographer" of Ch'ü, called Tan, one hundred and twenty-nine (one hundred and nineteen) years after the death of Confucius. The introduction of these disjointed notices detracts from the verisimilitude of the whole narrative in which they occur.

¹ Dr. Harmand, *Tour du Monde*, July 5, 1878.

Finally, Ch'en makes the remark that "Lao-tze was a superior man, who liked to keep in obscurity," traces the line of his posterity down to the 2d century A.D., and concludes with this important statement:—"Those who attach themselves to the doctrine of Lao-tze condemn that of the literati, and the literati on their part condemn Lao-tze, thus verifying the saying, 'Parties whose principles are different cannot take counsel together.' Li Uih taught that transformation follows, as a matter of course, the doing nothing (to bring it about), and rectification ensues in the same way from being pure and still."

Leaving these scanty historical notes, and accepting the *Tao Teh King* as the veritable work of Lao-tze, we must now try to give the reader some idea of its contents. Consisting, it has been seen, of not more than between five and six thousand characters, it is but a short treatise,—not half the size of our Gospel of St. Mark. The nature of the subject, however, the want of any progress of thought or of logical connexion between its different parts, and the condensed style, with the mystic tendencies and poetical temperament of the author, make its meaning extraordinarily obscure,—as native scholars and Sinologists have found to their cost. Divided at first into two parts, it has subsequently and conveniently been subdivided into chapters. One of the oldest, and the most common, of these arrangements makes the chapters eighty-two.

Some Roman Catholic missionaries, nearly two centuries ago, fancied that they found a wonderful harmony between many passages and the teaching of our sacred Scriptures. Montucci of Berlin, who had adopted their views, ventured to say in 1808—"Many things about a True God are so clearly expressed that no one who has read this book can doubt that the mystery of the Holy Trinity was revealed to the Chinese five centuries before the coming of Jesus Christ." Even Remusat, the first occupant of a Chinese chair in Europe, published at Paris in 1823 his *Mémoire sur la Vie et les Opinions de Lao-tze*, to vindicate the view that the Hebrew name Jehovah was phonetically represented in the fourteenth chapter by Chinese characters. These fancies were exploded by the late Stanislas Julien, when he issued in 1842 his translation of the whole treatise as *Le Livre de la Voie et de la Vertu*.

The most important thing is to determine what we are to understand by the *Tao*, for *Teh* is merely its outcome, especially in man, and is rightly translated by our word "virtue." Julien, we have just seen, translated *Tao* by "la voie." Chalmers leaves it untranslated. "No English word," he says (p. xi.), "is its exact equivalent. Three terms suggest themselves—the way, reason, and the word; but they are all liable to objection. Were we guided by etymology, 'the way' would come nearest the original, and in one or two passages the idea of a way seems to be in the term; but this is too materialistic to serve the purpose of a translation. 'Reason,' again, seems to be more like a quality or attribute of some conscious being than *Tao* is. I would translate it by 'the Word,' in the sense of the Logos, but this would be like settling the question which I wish to leave open, viz., what resemblance there is between the Logos of the New Testament and this Chinese *Tao*." Latterly some Sinologists in China have employed "nature" as our best analogue of the term. Thus Waters (*Lao-tze, A Study in Chinese Philosophy*, p. 45) says:—"In the *Tao Teh King* the originator of the universe is referred to under the names Non-Existence, Existence, Nature (*Tao*), and various designations,—all which, however, represent one idea in various manifestations. It is in all cases Nature (*Tao*) which is meant." This view has been skillfully worked out; but it only hides from us the scope of "the Venerable Philosopher." "Nature" cannot

be accepted as a translation of *Tao*. That character was, primarily, the symbol of a way, road, or path; and then, figuratively, it was used, as we also use *roy*, in the senses of means and method,—the course that we pursue in passing from one thing or concept to another as its end or result. It is the name of a quality. Professor Douglas has well said (*Confucianism and Taoism*, p. 159).—"If we were compelled to adopt a single word to represent the *Tao* of Confucius, we should prefer the sense in which it is used by Confucius, 'the way,' that is, *μῆδος*."

What then was the quality which Lao-tze had in view, and which he thought of as the *Tao*,—there in the library of Ch'au, at the pass of the valley of Han, and where he met the end of his life beyond the limits of the civilized state? It was the simplicity of spontaneity, action (which might be called non-action) without motive, free from all selfish purpose, resting in nothing but its own accomplishment. This is found in the phenomena of the material world. "All things spring up without a word spoken, and grow without a claim for their production. They go through their processes without any display of pride in them, and the results are realized without any assumption of ownership. It is owing to the absence of such assumption that the results and their processes do not disappear" (chap. ii.). It only needs the same quality in the arrangements and measures of government to make society beautiful and happy. "A government conducted by sages would free the hearts of the people from inordinate desires, fill their bellies, keep their ambitions feeble, and strengthen their bones. They would constantly keep the people without knowledge and free from desires; and, where there were those who had knowledge, they would have them so that they would not dare to put it in practice" (chap. iii.). A corresponding course observed by individual man in his government of himself becoming again "as a little child" (chaps. x. and xxviii.) will have corresponding results. "His constant virtue will be complete, and he will return to the primitive simplicity" (chap. xxviii.).

Such is the subject matter of this *Tao Teh King*,—the operation of this method or *Tao*, "without striving or crying," in nature, in society, and in the individual. Much that is very beautiful and practical is inculcated in connexion with its working in the individual character. The writer seems to feel that he cannot say enough on the virtue of humility (chap. viii., &c.). There were three things which he prized and held fast,—gentle compassion, economy, and the not presuming to take precedence in the world (chap. lxvii.). His teaching rises to its highest point in chap. lxiii.—"It is the way of *Tao* not to act from any personal motive, to conduct affairs without feeling this trouble of them, to taste without being aware of the flavour, to account the great as small and the small as great, to recompense injury with kindness." This last and noblest characteristic of the *Tao*, the requiting "good for evil," is not touched on again in the treatise; but we know that it excited general attention at the time, and was the subject of conversation between Confucius and his disciples (*Confucian Analects*, xiv. 36).

What is said in the *Tao* on government is not, all of it, so satisfactory. The writer shows, indeed, the benevolence of his heart. He seems to condemn the infliction of capital punishment (chaps. lxixii. and lxixiv.), and he deplores the practice of war (chap. lxi.). But he had no sympathy with the progress of society or with the culture and arts of life. He says (chap. lxv.).—"Those who anciently were skilful in practising the *Tao* did not use it to enlighten the people; their object rather was to keep them simple. The difficulty in governing the people arises from their having too much knowledge, and therefore he who tries to govern a state by wisdom is a scourge to it,

while he who does not try to govern thereby is a blessing." The last chapter but one is the following:—"In a small state with a few inhabitants, I would so order it that the people, though supplied with all kinds of implements, would not (care to) use them; I would give them cause to look on death as a most grievous thing, while yet they would not go away to a distance to escape from it. Though they had boats and carriages, they should have no occasion to ride in them. Though they had buff-coats and sharp weapons, they should not use or use them. I would make them return to the use of knotted cords (instead of written characters). They should think their coarse food sweet, their plain clothing beautiful, their poor houses places of rest, and their common simple ways sources of enjoyment. There should be a neighbouring state within sight, and the sound of the fowls and dogs should be heard from it to us without interruption, but I would make the people to old age, even to death, have no intercourse with it."

On reading these sentiments, we must judge of *Lao-tze* that, with all his power of thought, he was only a dreamer. But thus far there is no difficulty arising from his language in regard to the *Tao*. It is simply a quality, descriptive of the style of character and action, which the individual should seek to attain in himself, and the ruler to impress on his administration. The language about the *Tao* in nature is by no means so clear. While Professor Douglas says that "the way" would be the best translation of *Tao*, he immediately adds—"But *Tao* is more than the way. It is the way and the way-giver. It is an eternal road; along it all beings and things walk; but no being made up for it is being itself; it is everything, and nothing, and the cause and effect of all. All things originate from *Tao*, conform to *Tao*, and to *Tao* at last they return."

Some of these representations require modification; but no thoughtful reader of the treatise can fail to be often puzzled by what said on the point in hand. Julien, indeed, says with truth (p. xlii.) that "it is impossible to take *Tao* for the primordial Reason, for the sublime Intelligence, which has created and governs the world"; but the fact is that many of *Lao-tze's* statements are unthinkable if there be not behind the *Tao* the unexpressed recognition of a personal creator and ruler. Granted that he does not affirm positively the existence of such a Being, yet certainly he does not deny it, and his language even implies it. It has been said, indeed, that he denies it, and we are referred in proof to the fourth chapter:—"The *Tao* is like the emptiness of a vessel; and the use of it, we may say, must be free from all self-sufficiency. How deep and mysterious it is, as if it were the author of all things! We should make our sharpness blunt, and unravel the complications of things; we should attempt our brightness, and assimilate ourselves to the obscurity caused by dust. How still and clear is *Tao*, a phantom with the semblance of permanence! I do not know whose son it is. It might appear to have been before God (T'ien)."

The reader will not overlook the cautious and dubious manner in which the predicates of *Tao* are stated in this remarkable passage. The author does not say that it was before God, but that "it might appear" to have been so. Nowhere else in his treatise does the nature of *Tao* as a method or style of action come more clearly. It has no positive existence of itself; it is but like the emptiness of a vessel, and the manifestation of it by men requires that they endeavour to free themselves from all self-sufficiency. Whence came it? It does not shock *Lao-tze* to suppose that it had a father, but he cannot tell whose son it is. And, as the feeling of its mysteriousness grows on him, he ventures to say that "it might appear to have been before God."

There is here no denial but express recognition of the

existence of God, so far as it is implied in the name *T'ien*, which is the personal name for the concept of Heaven as the ruling power, by means of which the fathers of the Chinese people rose in prehistoric time to the idea of God. Again and again *Lao-tze* speaks of heaven just as "we do when we mean therein the Deity who presides over heaven and earth." These last words are taken from Watters (p. 81), and, though he adds, "We must not forget that this heaven is inferior and subsequent to the mysterious *Tao*, and was in fact produced by it," it has been shown how rash and unwarranted is the ascription of such a sentiment to "the Venerable Philosopher." He makes the *Tao* prior to heaven and earth, which is a phrase denoting what we often call "nature," but he does not make it prior to heaven in the higher and immaterial usage of that name. The last sentence of his treatise is:—"It is the *Tao*—the way—of Heaven to benefit and not injure; it is the *Tao*—the way—of the sage to do and not strive."

It is impossible to go, in the present article, into an exposition of the *Tao T'eh Kung* at greater length. Since Julien died in 1842, there has been, as we have seen, a tendency to overestimate rather than to underestimate its value as a scheme of thought and a discipline for the individual and society. There are in it, indeed, lessons of unsurpassed value, such as the inculcation of simplicity, humility, and self-abnegation, and especially the brief enunciation of the divine duty of returning good for ill; but there are on the other hand the regretful representations of a primitive society when men were ignorant of the rudiments of culture, and the longings for its return.

When it was thought that the treatise made known the doctrine of the Trinity, and even gave a phonetic representation of the Hebrew name *Iehovah*, it was natural, even necessary, to believe that its author had had communication with more western parts of Asia, and there was no end of speculation about visits to India and Judea, and even to Greece. The necessity for assuming such travels has passed away, and they have ceased to be thought of. We can restore *Szu-mu Chien's* histories as reliable. *Lao-tze* might have heard, in the states of *Ch'iu* and among the wild tribes adjacent to them, views about society and government very like his own. *Ch'ien* relates how an envoy came in 624 B.C.—twenty years, that is, before the date assigned to the birth of *Lao-tze*—to the court of Duke M' of Ch'iu, sent by the king some rich loads on the west. The duke told him of the histories, poems, codes of rites, music, and laws which they had in the middle states, while yet rebellion and disorder were of frequent occurrence, and asked how good order was secured all among the wild people, who had none of those appliances. The envoy smiled, and replied that the troubles of China were occasioned by those very things of which the duke wanted, and that there had been a gradual degeneration in the condition of its states, as their professed civilization had increased, even since the days of the ancients ago, *Hwang Ti*, whereas in the land he came from, where there was nothing but the primitive simplicity, their princes showed a pure virtue in their treatment of the people, who responded to them with loyalty and good faith. "The government of a state," said he in conclusion, "is like a man's ruling his own single person. His rule is, and does not consist in, doing so; and this was indeed the method of the sages." *Lao-tze* did not need to go further afield to find all that he has said about government.

We have confined ourselves to the *Tao T'eh Kung* without touching on the religion *Taoism* now existing in China, but which did not take shape until more than five hundred years after the death of *Lao-tze*, though he now occupies the second place in its trinity of "The three Pure or Holy Ones." There is hardly a word in his treatise that savours either of superstition or religion. In the works of *Lao-tze* and *Chuang-tze*, his earliest followers of note, we find abundance of grotesque superstitions; but their beliefs of kind we can say that they had belied; had not become embodied in any religious institutions. When we come to the *Ch'in* dynasty (221-206 B.C.), we meet with a *Taoism* in the shape of a search for the fairy islands of the eastern sea, where the herb of immortality might be gathered. In our first century a magician, called *Chang T'ao-ling*, came before us as the chief professor and controller of this *Taoism*, preparing in retirement "the pill" which rescued his youth, supreme over all spirits, and destroying millions of demons by a stroke of his pencil. He left his books, talismans, and charms, with his sword and seal, to his descendants, and one of them, professing to be animated by his soul, dwells at this day on the *Lung-ku* mountain in *Keang-se*, the acknowledged head or pope of *Taoism*. But even then the system was not yet a religion, with temples or monasteries, liturgies, and forms of public worship. It borrowed all these from Buddhism, which first obtained public

recognition in China between 65 and 70 A. D., though at least a couple of centuries passed before it could be said to have become common in the country.

Even still, with the form of a religion, Taoism is in reality a conglomeration of base and dangerous superstitions. Alchemy, geomancy, and spiritualism have dwelt and dwell under its shadow. Each of its "three Holy Ones," has the title of *Three Zens*, "the Heavenly and Honoured," taken from Buddhism, and also of *Shang Ti* or God, taken from the old religion of the country. The most popular deity, however, is not one of them, but has the title of *Ta Tsang Shang Ti*, "God, the Perfect King." But it would take long to tell of all its "celestial gods," "great gods," "divine rulers," and others. It has been decided, we have said, whether *Lao-tzu* acknowledged the existence of God at all, but the Taoism of the present day is a system of the wildest polytheism. The science and religion of the West will meet from it a most determined opposition. The "Venerable Philosophers" himself would not have welcomed them. The shrieking of our steam-engines, the bustle of our commerce, and this onward march of our various enterprises would have nearly driven him mad, but he ought not to bear the obliquity of being the founder of the Taoist religion. (J. L. B.)

LA PAZ, officially since 1825 L. P. DE AYACUCHO, in memory of the battle of Bolivian Independence, is the capital of Bolivia, at the head of a department of its own name. It lies in 16° 30' S lat and 68° W long., at the height of 11,970 feet above the sea, in the valley of the Chuquapuro or Rio de la Paz, at the base of the Cordillera Real, which rises with imposing cliffs another thousand feet above it. About 40 miles to the east of Lake Titicaca, La Paz has regular coach and steamer communication with Puno, and so with Mollendo on the Pacific. Commercially the town is of very considerable importance as the centre of the Bolivian trade in coca and cinchona. Among the public buildings are the cathedral founded by Pope Paul V in 1605, and ranking as one of the finest in South America, the church of San Francisco erected by the Jesuits, the university (San Andres), and the president's palace. The population, which consists largely of Aymaras, is estimated at between 70,000 and 80,000. The city dates from 1548, and the name Pueblo Nuevo de N. Señora de la Paz was given by its founder, Alonso de Mendoza in honour of the reconciliation between Pizarro and Almagro. In 1605 it was made a bishopric.

LA PÉROUSE, JEAN-FRANÇOIS GALATÉE DE (1741–c 1785), a French navigator, was born near Albi, August 22, 1741. His family name was Galaput, and La Pérouse or La Peyrouse was an addition adopted by himself from a small family estate. As a lad of eighteen, he was wounded and made prisoner on board the "Formidable" when it was captured by Admiral Hawke in 1759; and during the war with England between 1778 and 1783 he served with distinction in various parts of the world, more particularly on the eastern coasts of Canada. His celebrity, however, is rather due to the expedition fitted out by the French Government in 1785 for the discovery of the North-West Passage, and the verification of various matters left doubtful by previous circumnavigators. La Pérouse was placed in command of the "Boussole" and his chief assistant De Langie in command of the "Astrolabe." They sailed from Brest, August 1, 1785, and reached Mount St. Elias, on the coast of Alaska, June 23, 1786. From the search for the North-West Passage they were detained by the same storms which had proved too much for earlier adventurers; and, though they visited the Sandwich Islands, Macao, and the Philippines, it was not till they reached the coasts of north-western Asia that they really broke new ground. There the discovery of Sangai Strait and La Pérouse Strait showed that Saghalien and Yezo were each an independent island. The explorers were well received by the Russian authorities in Kamchatka, and M. Lesseps was sent home overlaid with the records of the expedition. In December 1787, De Langie, Lamonon the naturalist, and ten of the crew of the "Astrolabe," were massacred on one of the Navigator Islands; and, after reaching Botany Bay in

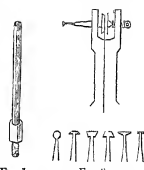
safety, the rest of the expedition was not again heard of. It was not till 1825 that Captain Dillon found the wreckage of what must have been the "Boussole" and the "Astrolabe" on the reefs of Vanikoro, an island to the north of the New Hebrides.

See Milet Minard, *Voyage de la Pérouse autour du Monde*, Paris, 1797, 4 vols.; Peter Dillon, *Narrative of a Voyage on the South Sea*, London, 1829.

LAPIDARY (*lapidarius*, from *lapis*, a stone), one who cuts, grinds, polishes, and engraves small pieces of stone, especially gems. The prehistoric stone implements found in cave deposits, peat mosses, river-gravels, &c., may be regarded as the earliest examples of the chipping and grinding of stone. Small cylinders of serpentine and other soft stones, on which figures and inscriptions were engraved, were fabricated in very early times by the Assyrians. Similar cylinders were afterwards made in rock-crystal, chalcedony, hematite, &c., and these harder substances were engraved by means of drills clamped with the powder of still harder minerals. The use of such drills is said to date as far back as the year 730 B.C. These cylinders were perforated by round holes, and were stung as needles. The stone scarabei and other amulets of the Egyptians were carved or chiselled, and, according to King (*Handbook of Engraved Gems*, 1866), these people do not appear to have followed the Ninevites and Babylonians in the use of the drill. This tool was, however, largely employed by the Etruscan lapidaries, who also used a diamond point in finishing their work. Signets were used by the Greeks as early as 600 B.C. and in the time of Alexander gems of all kinds were cut and engraved, with the exception of the diamond. The art of cutting diamonds was probably known to the Hindus and the Chinese in very early times, but it was unknown in Europe until nearly the close of the 16th century, the diamond cut and polished for Charles the Bold, duke of Burgundy, in 1476 being the first recorded example. The diamond point was extensively used in engraving the gems of the 16th, 17th, and early part of the 18th centuries, when skillful imitations of the antique gems were fabricated, and the employment of this tool is already spoken of by Pliny (*H. N.*, xxxviii 15) and Solinus, c 52. The drills used by the ancients were worked either by hand or with a bow. Holes are now drilled in stone by means of an iron or copper tube, fed with diamond dust and oil (fig 1).

The small tools used for engraving stones are set in a horizontal position, and are worked by vertical driving (fig 2). They are of various forms, some of which are shown in fig. 3, and are made of soft iron and charged with diamond dust and oil. Any substance finely pulverized, and of greater hardness than the material operated upon, may be used for cutting and grinding stone, but diamond dust is preferred as it can be used sparingly by the employment of very thin slitting disks, into the edges of which it is imbedded by the application of an agate or glass roller, the dust being previously worked into a paste with oil. Oil of brack or soft soap is used freely as a lubricant during the process of cutting. The diamond powder is produced by finely pulverizing imperfect stones, usually the coarse variety termed *brak* or *carbonade*, in a steel mortar, or it is ground between flat iron slabs with oil of brack.

The iron slicing disk in common use is 8 or 9 inches in



diameter and about $\frac{1}{16}$ inch in thickness. Such disks with their driving gear are termed *slitting-mills*. When leaden laps charged with emery mud are substituted the arrangement is called a *roughing-mill*, and when leaden or pewter laps charged with rotten-stone are used it is known as a *polishing-mill*. The mills are sometimes worked by steam power, sometimes by hand. In the ordinary pattern of a lapidary's bench the handle turns in a horizontal plane, as shown in fig. 4, where W is the driving-wheel turned by

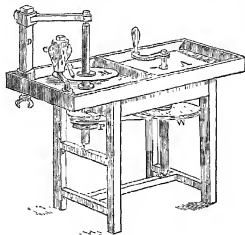


FIG. 4.—Lapidary's Mill

the handle A, and working the pulley P by means of a step. The pulley is fixed on a vertical spindle, which carries M the disk for slitting or the leaden lap for roughing or polishing. The upper end of this spindle is conical, and rotates in a socket drilled in a horizontal arm of iron which projects from a vertical wooden rod D. A block of wood C fits on to the end of an iron support terminal the *gim-peg* or *germ-peg*. This support is used to steady the operator's arm when grinding the edges of small stones, and the wooden block, which is fixed by a wedge, is employed for cutting facets at any desired angle, the stone being cemented to the end of a stick S, which is fixed at the requisite angle in one of the holes or notches made in the sides of the socket C. In slicing stones it is necessary not to bring any sharp edge of the stone against the disk, but to commence upon a moderately flat or smooth surface, otherwise the charge of diamond dust or *seasoning*, which should last for several hours, will be stripped off during the first revolution.

Another form of lapidary's mill consists of a strong framework of oak, 8 or 9 feet long by 6 or 7 feet in height, and with a breadth of about 2 feet. It is formed of four square uprights, mortised into a couple of sole-bars, and braced together by eight cross-bars at top and bottom, which, like all the other parts of the frame, are mortised and strongly bolted together. Half way up the frame a strong board or table is fixed, and above and below this table stout wooden bars or *summers* run the length of the frame. In each of these summers are two square holes through which slide short oaken rods having square sections and bored out conically at the ends to re-

ceive the upper and lower extremities of the iron spindles which carry the laps or sheets (fig. 5). The remainder of the working parts are very similar to those already described, except that the driving-wheels are very large and the lower extremities of their alstrees, which are conical, rest upon sockets fixed to the floor, while their upper ends revolve in holes in a beam. The driving wheels drop over pegs which project from the upper sides of collates, immediately beneath which the axle has a crank. The crank is connected with an arm composed of three flat iron bolts, which are fixed together at suitable lengths by square rings. The other end of the crank bar is provided with a stud by which it is attached to a pivoted wooden arm carrying two upright pegs, which serve as handles for the operator, who imparts a backward and forward motion to the arm.

A very important substitute for the gim-peg-socket, already described, is the *dial*, by means of which facets can be cut with great precision. One of the improved forms of the lapidary's dial consists of two jaws *a, a* (fig. 6), in each of which a hemispherical cavity is ground, and within this cavity a brass ball *b* is contained by the jaws when they are clamped together. A brass tube is attached to this ball, and carries a conical dial *d* at its upper end. Into the lower end of the tube is tightly inserted the cement-rod, which is fixed by a set-screw carrying at its lower end *e* the stone to be cut. At its upper end, which is squared, and projects above the dial, a small index *f* is fitted. Upon the side of one of the jaws is a divided quadrant *g*, with the centre of which the centre of the brass ball coincides. The tube bearing the dial can therefore be inclined at any angle corresponding with the divisions on the exposed face of the quadrant, while, by turning the cement-stick and its index, the stone can be easily set, so that a range of facets may be cut with great accuracy.

Where practicable, the lapidary avails himself of the natural cleavages in the mineral upon which he is going to operate, and these are constant in direction in any one species, but are more easily available in certain minerals than they are in others. When no satisfactory cleavage planes exist, the mineral may be sawn into slabs by a thin wire charged with diamond dust. The diamond is cut and polished upon a lap of cast-iron fed with diamond dust and olive oil. Gems having a hardness of 8 and 9 (Mohs's scale) are cut on copper disks, simi-

FIG. 5.—Part of Lapidary's Mill. A, upper summer (cut through); B, lower summer (cut through); C, spindle; D, pulley; E, lap; F, table (cut through); G, wooden blocks, adjusted by means of wedges.

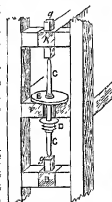


FIG. 5.—Part of Lapidary's Mill. A, upper summer (cut through); B, lower summer (cut through); C, spindle; D, pulley; E, lap; F, table (cut through); G, wooden blocks, adjusted by means of wedges.

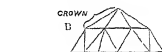
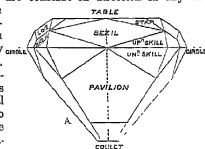


FIG. 7.—Cut Gems. A, brilliant; B, rose; C, gout de suit; D, en cabochon.

larly primed, and are afterwards polished with tripoli and water. Stones of inferior hardness are ground upon a leaden lap with emery and water, and are polished on tin disks with tripoli, or on zinc disks with putty-powder and water. In grinding very

fragile or soft stones disks of hardwood are employed. Precious stones are cut in forms known as *brilliant* and *rose*, and the several parts are designated as shown in fig. 7 (side-elevations). Turquoise, opal, cat's-eye, carnelian, jasper, and a few other stones are cut en cabochon.

Prior to engraving on a stone, the polish is removed with emery from the surface to be engraved, and the device marked on it with a brass point, the outline is then sharply incised, and the work continued by means of small drills, the diamond point, &c.

Within the last few years a great advance has been made in our knowledge of the minute structure and mineral constitution of rocks by cutting and grinding small slices of them so thin that they readily transmit light, and can then be examined under the microscope, and the optical properties of their constituent minerals conveniently studied. Sections suitable for this purpose may be prepared by grinding thin flakes or splinters of a rock or mineral upon a cast iron plate smeared with emery powder and water. The emery employed for the first grinding should not be very fine, that of medium grain being best suited for the purpose. The fragment is pressed by the fingers against the slab, and ground uniformly over all parts of the plate with a circular motion. When a flat surface is obtained, the fragment should be carefully washed from all traces of the emery mud, and a finer face should be imparted to it by a second grinding with the finest flour-emery and water, smeared upon a slab of plate-glass or a smoothly-planed brass slab. When thoroughly cleaned, the smooth face of the chip is warmed and cemented to a small piece of plate-glass with Canada balsam (fig. 8). The oilier and drier the balsam the better it answers this purpose. A little should be placed on the piece of glass and warmed until it liquefies (it must not boil). The smooth surface of the stone is then laid upon the balsam and pressed tightly against the glass, when the balsam has hardened, the grinding process is renewed, the piece of glass serving as a handle, and the flour-emery should generally be employed as soon as the fragment is thin enough to transmit light. When finished, the glass and section are cleaned, the glass is warmed, and the section is pushed off with a blunt needle or wire into a saucer of turpentine, which should be gently warmed, and all traces of dirt should be removed with a camel's hair brush. The section is then lifted from its bath by means of a needle and allowed to subside gently upon a drop of fluid Canada balsam placed on a clean glass slip which has been previously warmed. A thin covering-glass is then slightly warmed and placed over the preparation, care being taken not to include any air-bubbles. The process of grinding sections by hand is necessarily a rather slow one, and, although in the finishing it cannot well be superseded by other methods, still the rough grinding may be much more expeditiously done by means of various machines which have been devised for this purpose. Some of these are worked by hand, others by a treadle. Among the latter, the apparatus devised by Mr J. B. Jordan, and manufactured by Messrs Cotton & Johnstone of Grafton Street, Solihull, and that made by Fuess of Berlin are those in most general use. These machines are provided with slitting disks for cutting thin slices with diamond dust. This saves much grinding, but presents some difficulties to the novice. The grinding laps with which the machines are supplied are generally cast in lead or pewter, while occasionally prepared corundum disks are employed, and disks of hard wood are now and then used for imparting a final polish.

(F. R.)

¹ Described and figured in *The Study of Rocks* (Longman's Text-Books of Science)



Fig. 8

LAPIS LAZULI, a mineral possessing usually a fine blue colour, whence it is much prized for decorative purposes. From the large number of Egyptian ornaments in this material, which have been preserved from the time of the Pharaohs, it is evident that it was a favourite stone with the ancient Egyptians. A few Assyrian seal-cylinders in lapis lazuli are also known. It appears to have been the Greek sapphire, thus, Theophrastus describes the *sappheiros* as sprinkled with gold-dust, a description which is utterly inappropriate to any variety of our modern sapphire, but which applies with much force to the lapis lazuli, inasmuch as this stone frequently contains disseminated particles of iron pyrites, which by their colour and lustre may readily be mistaken for such a metal. In like manner, Pliny refers to one variety of the *sapphus* as being spotted with gold. An allusion to the same quality is plainly found in Job xxviii. 6.

It is but rarely that the lapis lazuli exhibits anything approaching to distinct crystallization. Usually it occurs in compact masses, which break with an uneven fracture but occasionally it presents an imperfect cleavage parallel to the faces of a rhombic dodecahedron, and still more rarely offers distinct faces of form. Its specific gravity is about 2.3, and its degree of hardness between 5 and 6, it therefore scratches glass, and is capable of receiving a fair polish. Although the colour is generally a fine azure, or rich Berlin blue, some varieties exhibit violet, green, or even red tints, or are altogether colourless. The mineral is always opaque, with only slight translucency at the edges. Microscopic sections reveal a want of homogeneity in the constitution of the substance, bluish particles being disseminated through a white matrix.

The lapis lazuli is a silicate of aluminium, calcium, and sodium, but the published analyses are rather discordant. All agree, however, in recording the presence of sulphur, and it is generally supposed that this element exists as a sulphide of iron and sodium, and that it is upon the presence of such a compound that the blue colour depends. The following is an analysis of the South American variety—silica, 45.7; alumina, 25.4; soda, 10.65; potash, 1.35; lime, 7.48; ferric oxide, 1.30; sulphur, 3.66; and sulphuric acid, 4.32. By the action of hydrochloric acid the mineral is decomposed, with separation of gelatinous silica and evolution of sulphuretted hydrogen. Before the blowpipe it fuses readily, with loss of colour.

The lapis lazuli is usually found in crystalline limestone or in gneissous rocks, but its occurrence is confined to very limited localities. It is found in Persia, Tartary, Tibet, and China, and in the neighbourhood of Lake Baikal in Siberia. Fine masses occur in the Andes of Chili and Peru. In Europe it has been found at Dniep in Transylvania, and in the gneiss blocks of Monte Somma. In addition to its use as an ornamental stone, the lapis lazuli was formerly employed, to a large extent, in the preparation of the beautiful blue pigment called *ultramarine*. For this purpose the mineral was ground, calcined, and carefully leached in water. Of late years, however, artificial ultramarine has been prepared which claims to be of equal beauty and permanency with the natural pigment. Artists, however, still regard the natural colour as superior.

LAPITHÆ, a mythic race whose contest with the Centaurs is one of the most famous events in Greek mythology and one of the most favourite subjects of Greek art. The home of the legend is the district round Mount Pelion in Thessaly, it is not found in the other places where the Centaur legend has its home—Pholoe in Arcadia, and the river Eryman in Ætolia. It is impossible to write of the Lapithæ without including also their adversaries the Centaurs and the great battle at the marriage of Pirithous and Deidamia. The outlines of the legend have already been given under CENTAUR; here we shall merely attempt to distinguish between earlier and later elements in the myth, and thus trace its growth. By the Greek sculptors of the school of Phidias the battle of Lapithæ with Centaurs was conceived as a struggle between mankind and mischievous monsters, and symbolical of the great conflict between Greeks and Persians. There can be no

doubt that such a moralized view is of later growth, and inconsistent with the original character of mythology; though the battle is certainly conceived under this form from an early time, and universally throughout the historical period. But on the other hand the genealogies given of the Lapithæ make them a brother race with the Centaurs. Pirithous, king of the Lapithæ, was son of Ixion; so were the Centaurs. Various other accounts lead to the same result. Ultimately then the battle of Lapithæ with Centaurs is a contest of the physical powers of nature, and the excellent discussion of Professor S Colvin (*Journ. Hist. Stud.*, 1. p. 164) leaves little room for doubt that the Centaurs represent the power—dangerous, yet sometimes beneficent—of mountain floods, and that the battle is the mythic expression of the terrible effects of swollen waters. No satisfactory derivation of the word *Lapithæ* has yet been found, but some of the names of individual Lapithæ, such as Dryas, Charaxus, Caneus son of Elate, &c., refer us to the trees and ravines of the mountains.

Beside the article of Professor Colvin, and the numerous works on Greek mythology, see Welcker, *Kt. Schr.*, vol. II.

LAPLACE, PIERRE SIMON, MARQUIS DE (1749-1827), one of the greatest mathematicians and physical astronomers who ever lived, was born at Beaumont-en-Auge in Normandy, March 28, 1749. His early years have remained in the obscurity with which poverty and some ignoble shame of poverty combined to cover them. It is known, however, that his father was a small farmer, and that he owed his education to the interest excited by his lively parts in some persons of position. His first distinctions are said, singularly enough, to have been gained in theological controversy, but at an early age he became mathematical teacher in the military school of Beaumont, the classes of which he had attended as an extern. He was not more than eighteen when, armed with letters of recommendation, he approached D'Alembert, then at the height of his fame and influence, in the hope of finding a career in Paris. The letters remained unnoticed, but Laplace was not a man to be crushed by the first rebuff of fortune. He wrote to the great geometer a letter on the principles of mechanics, which evoked an immediate and enthusiastic response "You," said D'Alembert to him, "needed no introduction; you have recommended yourself; my support is your due." He accordingly obtained for him an appointment as professor of mathematics in the École Militaire of Paris, and continued to forward his interests with zeal and constancy.

The future of the young mathematician was now assured, and his scientific vocation finally determined. He had not yet completed his twenty-fourth year when he entered upon the course of discovery which has earned him the title of "the Newton of France." Having, in his first published paper,¹ shown his mastery of analysis, he immediately proceeded to apply the powerful instrument at his command to the great outstanding problems in the application of the law of gravitation to the celestial motions. Of these the most conspicuous was offered by the opposite inequalities of Jupiter and Saturn, which the strenuous efforts of Euler and Lagrange had failed to bring within the bounds of theory. The discordance of their results incited Laplace to a searching examination of the whole subject of planetary perturbations, and his maiden effort was rewarded with a discovery which constituted, when developed and completely demonstrated by his own further labours and those of his illustrious rival Lagrange, the most important advance made in physical astronomy

since the time of Newton. In a paper read before the Academy of Sciences, February 10, 1773 (*Mém. présentés par divers Savans*, tom. vii., 1776), Laplace announced his celebrated conclusion of the invariability of planetary mean motions, carrying the proof as far as the cubes of the eccentricities and inclinations. This was the first and most important step in the establishment of the stability of the solar system. It was followed up by a series of profound investigations, in which Lagrange and Laplace alternately surpassed and supplemented each other in assigning limits of variation to the several elements of the planetary orbits. The analytical tournament closed with the communication to the Academy by Laplace, in 1787, of an entire group of remarkable discoveries. It would be difficult, in the whole range of scientific literature, to point to a memoir of equal brilliancy with that published (divided into three parts) in the volumes of the Academy for 1784, 1785, and 1786. The long-sought cause of the "great inequality" of Jupiter and Saturn was found in the near approach to commensurability of their mean motions; it was demonstrated in two elegant theorems (see *Astronomy*, vol. ii. p. 781), independently of any except the most general considerations as to mass, that the mutual action of the planets could never largely affect the eccentricities and inclinations of their orbits; and the singular peculiarities detected by him in the Jovian system were expressed in the so-called "laws of Laplace" (*Astronomy*, p. 810). He completed the theory of these bodies in a treatise contained amongst the Paris *Mémoires* for 1788 and 1789, and the tables computed by Delambre from the data there supplied served, by their striking superiority to those hitherto available, to mark the profit derived from the investigation by practical astronomy.² The year 1787 was rendered further memorable by Laplace's announcement, November 19 (*Mémoires*, 1786), of the dependence of lunar acceleration upon the secular changes in the eccentricity of the earth's orbit. The last apparent anomaly, and the last threat of instability, thus disappeared from the solar system.

With these brilliant performances the first period of Laplace's scientific career may be said to have closed. If he made no more striking discoveries in celestial mechanics, it was rather their subject matter than his powers that failed. The general working of the great machine was now laid bare, and it needed a further advance of knowledge to render a fresh set of problems accessible to investigation. The time had come when the results obtained in the development and application of the law of gravitation by three generations of illustrious mathematicians might be collected in a single work, and presented from a single point of view. It was to this task that the second period of Laplace's activity was devoted. As a monument of mathematical genius applied to the celestial revolutions the *Mécanique Céleste* ranks second only to the *Principia* of Newton.

The declared aim of the author³ was to offer a complete solution of the great mechanical problem presented by the solar system, and to bring theory to coincide so closely with observation that empirical equations should no longer find a place in astronomical tables. His success in both respects fell but little short of his lofty ideal. The first part of the work (2 vols. 4to, Paris, 1799) contains methods for calculating the movements of translation and rotation of the heavenly bodies, for determining their figures, and resolving tidal problems; the second, especially dedicated to the improvement of tables, exhibits in the third and fourth volumes (1802 and 1809) the application of three formulae; while a fifth volume, published in three instalments, 1823-25, comprises the results of Laplace's latest researches, together with a valuable history of progress in each separate branch of his subject. In the delicate task of apportioning his own large share of merit, he certainly does not err on

¹ "Recherches sur le calcul intégral," *Mémoires de la Soc. Roy. de Turin*, 1786-89.

² Girard, *History of Physical Astronomy*, p. 96.

³ "Plan de l'ouvrage," *Œuvres*, tom. I. p. 1.

the sake of modesty; but it would perhaps be as difficult to produce an instance of injustice, as of generosity, in his estimate of others. For more serious blame attaches to his all but total suppression in the body of the work—and the fault pervades the whole of his writings—of the names of his predecessors and contemporaries. Theorems and formulae are appropriated wholesale without acknowledgment, and a production which may be described as the organized result of a century of patient toil presents itself to the world as the offspring of a single brain. The *Mécanique Céleste* is, even to those most conversant with analytical methods, by no means easy reading. The late M. Biot, who had the privilege of assisting in the correction of its proof sheets, remarks that it would have extended, had the demonstrations been fully developed, to eight or ten instead of five volumes, and he saw at times the author himself obliged to devote an hour's labour to recovering the dropped links in the chain of reasoning covered by the recurring formula, "Il est assés à voir".¹

The *Exposition du Système du Monde* (Paris, 1796) has been styled by Arago "the *Mécanique Céleste* disembarassed of its analytical paraphernalia." Not only the conclusions reached by geometers are stated, but the methods followed by them are indicated. The instruments, so to speak, of a popular dissertation clothe and conceal the skeleton of an analytical treatise. The style is lucid and masterly, and the summary of astronomical history with which it terminates has been reckoned amongst the masterpieces of the language. To this linguistic excellence the writer owed the place accorded to him in 1810 amongst the "forty" of the French Academy, of which institution he became president in the following year. The famous "nebular hypothesis" of Laplace makes its appearance in the *Système du Monde*. Although relegated to a note (vii.), and propounded "Avec la défiance qui doit inspirer tout ce qui n'est point un résultat de l'observation ou du calcul," it is plain, from the complacency with which he recurs to it² at the lapse of above a quarter of a century, that he regarded the speculation with considerable interest. That it formed the starting-point, and has remained the model, of thought on the subject of planetary origin is due to the simplicity of its assumptions, and the clearness of the mechanical principles involved, rather than to any cogent evidence of its truth. It is curious that Laplace, while bestowing more attention than they deserved on the crude conjectures of Buffon, seems to have been unaware that he had been, to some extent, anticipated by Kant, who had put forward in 1755, in his *Allgemeine Naturgeschichte*, a true nebular cosmogony, though one in which the primitive reign of chaos was little likely to terminate.

The career of Laplace was one of severely interrupted prosperity. Admitted to the Academy of Sciences as an associate in 1773, he became a member in 1785, having, about a year previously, succeeded Bezout as examiner to the royal artillery. During a temporary access of revolutionary suspicion, he was removed from the commission of weights and measures; but the slight was quickly effaced by new honours. He was one of the first members, and became president, of the Bureau of Longitudes, took a prominent place at the Institute (founded in 1796), professed analysis at the École Normale, and aided in the organization of the decimal system. The publication of the *Mécanique Céleste* gained him world-wide celebrity, and his name appeared on the lists of all the principal scientific associations of Europe, including the Royal Society. But merely scientific distinctions by no means satisfied his ambition. He aspired to the rôle of a politician, and has left a memorable example of genius degraded to servility for the sake of a ribbon and a title. The ardour of his republican principles gave place, after the 18th Brumaire, to devotion towards the first consul, a sentiment promptly rewarded with the post of minister of the interior. His

insipidity for affairs was, however, so flagrant that it became necessary to supersede him at the end of six weeks, when Lucien Bonaparte became his successor. "He brought into the administration," according to the dictum of the future emperor, "the spirit of the infinitesimals." His failure was consoled by elevation to the senate, of which body he became chancellor in September 1803. He was at the same time named grand officer of the Legion of Honour, and obtained in 1813 the same rank in the new order of Réunion. The title of count he had previously acquired on the creation of the empire. Nevertheless he cheerfully gave his voice in 1814 for the dethronement of his patron, and his "suppleness" merited a seat in the chamber of peers, and, in 1817, the dignity of a marquise. The memory of these tergiversations is perpetuated in his writings. The first edition of the *Système du Monde* was inscribed to the Council of Five Hundred; to the third volume of the *Mécanique Céleste* (1802) was prefixed the declaration that, of all the truths contained in the work, that most precious to the author was the expression of his gratitude and devotion towards the "pacifier of Europe", upon which noteworthy protestation the suppression, in the editions of the *Théorie des Probabilités* subsequent to the restoration, of the original dedication to the emperor formed a fitting commentary.

During the later years of his life, Laplace lived much at Arcueil, where he had a country-place adjoining that of his friend Berthollet. With his co-operation the Société d'Arcueil was formed, and he occasionally contributed to its *Memoirs*. In this peaceful retirement he pursued his studies with unabated ardour, and received with uniform courtesy distinguished visitors from all parts of the world. Here, too, he died, attended to the last by his physician Dr Majendie, and his mathematical coadjutor Bouvard, March 5, 1827, having nearly completed his seventy-eighth year. His last words were: "Ce que nous connaissons est peu de chose, ce que nous ignorons est immense."

Although commonly believed to have held atheistical opinions, Laplace refrained from giving any direct expression to them in his writings. His character, notwithstanding the vanity and egotism by which it was disfigured, had an amiable and engaging side. Young men of science found in him an active benefactor. His relations with these "adopted children of his thought" possessed a singular charm of affectionate simplicity; their intellectual progress and material interests were objects of equal solicitude to him, and he demanded in return only diligence in the pursuit of knowledge. M. Biot relates that, when he himself was beginning his career, Laplace introduced him at the Institute for the purpose of explaining his supposed discovery of equations of mixed differences, and afterwards showed him, under a strict pledge of secrecy, the papers, then yellow with age, in which he had long before obtained the same results, but which he had laid aside with a view to future development. This instance of abnegation is the more worthy of record that it formed a marked exception to Laplace's usual course. Between him and Legendre there was a feeling of "more than coldness," owing to his appropriation, with scant acknowledgment, of the fruits of the other's labours; and our celebrated countryman, Dr Thomas Young, counted himself, rightly or wrongly, amongst the number of those similarly aggrieved by him. With Lagrange, on the other hand, he always remained on the best of terms.

The extreme abstemiousness of his life, joined to a naturally good constitution, preserved Laplace from most of the infirmities incidental to old age. He was indeed obliged to use his eyes with precaution; but his powerful memory remained unimpaired, and it was not until within two years of his death that his health began to

¹ *Journal des Savants*, 1850.
² *Mém. Chém.*, tom. v. p. 848.

suffer from his severe application. He married a beautiful and amiable woman, and left a son, born in 1789, who succeeded to his title, and rose to the rank of general in the artillery.

It might be said that Laplace was a great mathematician by the original structure of his mind, and became a great discoverer through the sentiment which animated it. The regulated and persistent enthusiasm with which he regarded the system of nature was with him from first to last. It can be traced in his earliest essay, and it dictated the ravings of his final illness. By it his extraordinary analytical powers became strictly subordinated to physical investigations. To this lofty quality of mind he added a rare sagacity in perceiving analogies, and in detecting the new truths that lay concealed in his formulae, and a tenacity of mental grip, by which problems, once seized, were held fast, year after year, until they yielded up their solutions. In every branch of physical astronomy, accordingly, deep traces of his work are visible. "He would have completed the science of the skies," Fourier remarks, "had the science been capable of completion."

For a fuller account of the results achieved by him, the article ASTRONOMY, vol. ii p. 761, may be consulted, it need only be added that he first examined the conditions of stability of the system formed by Saturn's rings, pointed out the necessity for their rotation, and fixed for it a period (10^4 33m) differing by little more than a minute from that established by the observations of Herschel, that he detected the existence in the solar system of an invariable plane such that the sum of the products of the planetary masses by the projections upon it of the areas described by their radii vectors in a given time is always a maximum, made notable advances in the theory of astronomical refraction (*Mécanique*, tom. iv. p. 268), and constructed formulae, agreeing remarkably with observation, for the barometrical determination of heights (*Mécanique*, tom. iv. p. 324). His removal of the considerable discrepancy between the actual and Newtonian velocities of sound, by taking into account the increase of elasticity due to the heat of compression, would alone have sufficed to illustrate a lesser name. Molecular physics also engaged a large share of his attention, and he announced in 1824 his purpose of treating the subject in a separate work. With Lavoisier he made an important series of experiments on specific heat (1782-84), in the course of which the "ice calorimeter" was discovered; and they contributed jointly to the *Mémoire de l'Académie* (1781) a paper on the development of electricity by evaporation. Laplace was, moreover, the first to offer a complete analysis of capillary action based upon a definite hypothesis—that of forces "sensible only at inappreciable distances"—and he made strenuous but unsuccessful efforts to explain the phenomena of light on an identical principle. It was a favourite idea of his that chemical affinity and capillary attraction would eventually be included under the same law, and it was perhaps as much because it threatened an inroad on a cherished generalization as because it seemed to him little capable of mathematical treatment that the undulatory theory of light was distasteful to him.

The investigation of the figure of equilibrium of a rotating fluid mass engaged the attention of Laplace during the greater part of his long life. His first memoir was communicated to the *Académie* in 1778, when he was sixty-four years of age, his last in 1817, when he was eighty-eight. The results of his many papers on this subject—characterized by him as "un des points les plus intéressants du système du monde"—are embodied in the *Mécanique Céleste*, and furnish one of the most remarkable proofs of his extraordinary genius. Maclaurin, Legendre, and D'Alembert had furnished partial solutions of the problem, confining their attention to the possible figures which would satisfy the conditions of equilibrium. Laplace treated the subject from the point of view of the gradual aggregation and cooling of a mass, and demonstrated that the form which such a mass would ultimately assume must be an ellipsoid of revolution whose equator was determined by the primitive plane of maximum areas.

The honour of having brought almost to perfection the closely related problem of the attraction of spheroids must also be accorded to him. All the powers of analysis in the hands of the greatest masters replaced the old geometrical methods, and their superiority was soon evidenced by a succession of remarkable discoveries. Legendre, in 1778, extended Maclaurin's theorem concerning ellipsoids of revolution to the case of any spheroid of revolution where the attracted point, instead of being limited to the axis or equator, occupied any position in space; and Laplace, in his *Théorie du Mouvement et de la Figure Elliptique des Planètes* (un-

ished in 1784), effected a still further generalization by proving, what had been suspected by Legendre, that the theorem was equally true for any conical ellipsoids. Finally, in a celebrated memoir, *Théorie des Attractions des Sphéroïdes et de la Figure des Planètes*, published in 1785 among the *Paris Mémoires* for the year 1785, written, however, after the treatise of 1784, Laplace treated exhaustively the general problem of the attraction of any spheroid upon a particle situated outside or upon its surface.

The researches of Laplace and Legendre on the subject of attractions derive additional interest and importance from having introduced two powerful engines of analysis for the treatment of physical problems, Laplace's Coefficients and the Potential Function. The expressions for the attraction of an ellipsoid involved integrations which presented formidable difficulties; it was, therefore, with pardonable exultation that Laplace announced his discovery that the attracting force in any direction could be obtained by the direct process of differentiating a single function. He thereby translated the forces of nature into the language of analysis, and laid the foundations of the mathematical sciences of heat, electricity, and magnetism. This function, V , which received the name of potential from Green in 1828, and independently from Gauss in 1840, is defined as the sum of the masses of the molecules of the attracting body divided by their respective distances from the attracted point, or, in mathematical language—

$$V = \iiint \frac{\rho \, dx \, dy \, dz}{\{(x-a)^2 + (y-b)^2 + (z-\gamma)^2\}^{\frac{1}{2}}},$$

ρ being the density of the body at the point x, y, z , a, b, γ , the coordinates of the attracted point, and the limits of integration being determined by the form of the attracting mass. V is thus a function of a, b, γ , that is to say, depends for its value on the position of the point, and its several partial differentials with respect to these coordinates furnish the components of the attractive force. The integrations, however, could not in general be effected so as to express V in finite terms, but Laplace showed that V satisfied the partial differential equation

$$\frac{d^2 V}{dx^2} + \frac{d^2 V}{dy^2} + \frac{d^2 V}{dz^2} = 0,$$

which is still known as Laplace's equation. It is worthy of remark that it was not in this symmetrical form that the equation was discovered, but in the complicated shape which it assumes when expressed in polar coordinates—

$$\frac{d}{d\mu} \left\{ (1-\mu^2) \frac{dV}{d\mu} \right\} + \frac{1}{1-\mu^2} \frac{d^2 V}{d\theta^2} + \frac{d^2 V}{d\phi^2} = 0,$$

where μ is substituted for $\cos \theta$. This differential equation forms the basis of all Laplace's researches in attractions, and makes its appearance in every branch of physical science.

The expressions which are known as Laplace's coefficients, a name first given to them by Dr Whewell, occupy a distinguished place in modern analysis. They were first introduced in their generality by Laplace in the memoir on attractions, 1785, above referred to, which is, to a great extent, reprinted in the third book of the *Mécanique Céleste*, but Legendre, in a celebrated paper entitled *Recherches sur l'Attraction des Sphéroïdes homogènes*, printed in the tenth volume of the *Œuvres de Laplace*, 1783, had previously made use of them, and proved some of their properties, in the simplified form which they assume with one instead of two variables. They may be defined as follows. If two points in space are determined by their polar coordinates, r, θ, ϕ , and r', θ', ϕ' , T the reciprocal of the distance between them is expressed in terms of those coordinates by

$$\left[r^2 - 2rr' \left\{ \mu\mu' + \sqrt{1-\mu^2} \sqrt{1-\mu'^2} \cos(\omega-\omega') \right\} + r'^2 \right]^{-\frac{1}{2}},$$

where μ and μ' are written for $\cos \theta$ and $\cos \theta'$ respectively. This expression may be expanded in a series of the form

$$\frac{1}{r} \left[P_0 + P_1 \frac{r'}{r} + P_2 \frac{r'^2}{r^2} + \dots + P_n \frac{r'^n}{r^n} + \dots \right],$$

where P_0, P_1, \dots, P_n are Laplace's coefficients of the orders 0, 1, \dots, n . They are rational integral functions of $\mu, \sqrt{1-\mu^2} \cos \phi$, and $\sqrt{1-\mu^2} \sin \phi$, and are precisely the same functions of $\mu', \sqrt{1-\mu'^2} \cos \phi'$ and $\sqrt{1-\mu'^2} \sin \phi'$; or, in other words, of the rectangular co-ordinates of the two points divided by their distances from the origin. The general coefficient P_n is of n dimensions in these quantities, and its maximum value is known to be unity, so that the above written series will be convergent if r' is greater

¹ See *Monthly Notices of the Astronomical Society*, xxvii. p. 311. They are also included in the more general expression "Spherical harmonics" ("Fonctions sphériques," "Kugelfunktionen").

² *Annales de Chimie et de Physique*, 1816, tom. iii. p. 238.

than, it can be easily proved that T satisfies Laplace's differential equation—

$$\frac{d}{d\mu} \left\{ (1-\mu^2) \frac{dT}{d\mu} \right\} + \frac{1}{1-\mu^2} \frac{d^2T}{d\omega^2} + \frac{d^2T}{d\omega^2} + \frac{d^2T}{d\omega^2} = 0,$$

and if for T we substitute the expanded form, we obtain the general differential equation of which Laplace's coefficients are particular integrals—

$$\frac{d}{d\mu} \left\{ (1-\mu^2) \frac{dP_\mu}{d\mu} \right\} + \frac{1}{1-\mu^2} \frac{d^2P_\mu}{d\omega^2} + \mu(\mu+1)P_\mu = 0$$

Expressions which satisfy this equation are referred to as Laplace's functions; they include as a particular case the coefficients, which are, as we have seen, certain definite functions of the spherical surface coordinates of the two points. If

$$\alpha = \mu\mu' + \sqrt{1-\mu^2}\sqrt{1-\mu'^2} \cos(\omega - \omega'),$$

the coefficients become functions of α alone, and it was in this form that Laplace first introduced them. One of the fundamental properties of Laplace's functions, known as Laplace's theorem is that, if Y_1 and Z_1 be two such functions, μ and ω' being whole numbers and not identical, then

$$\int_0^\pi \int_0^{2\pi} Y_1 Z_1 d\omega' d\omega = 0$$

Again, if Y_1 is the same function of μ' and ω' , that Y_2 is of μ and ω , we have the important relation

$$Y_1' = \frac{2+1}{2\pi} \int_0^\pi \int_0^{2\pi} Y_2 P_1 d\omega' d\omega$$

But the property on which their utility in physical researches chiefly depends is that every function of the coordinates of a point on a sphere can be expanded in a series of Laplace's functions.¹

In the figure of the earth, the theory of attractions, and the sciences of electricity and magnetism this powerful calculus occupies a prominent place. Gauss in particular has employed it in the calculation of the magnetic potential of the earth, and it has recently received new light from Professor Clerk Maxwell's interpretation of harmonics with reference to poles on the sphere.

Laplace, always profound rather than elegant, nowhere displays the massiveness of his genius so conspicuously as in the theory of probabilities. The science which Pascal and Fermat had initiated he brought very nearly to perfection, but the demonstrations are so involved, and the causation in the chain of reasoning so frequent that the *Théorie Analytique* is to the best mathematicians a work requiring the most arduous study. The theory of probabilities, which Laplace describes as common sense expressed in mathematical language, first attracted his attention from its importance in physics and astronomy, and he applies his theory not only to the ordinary problems of chance, but also to the inquiry into the causes of phenomena, vital statistics, and future events.

The device known as the method of least squares, for reducing numerous equations of condition to the number of unknown quantities to be determined, had been adopted as a practically convenient rule by Gauss and Legendre; but Laplace first treated it as a problem in probabilities, and proved by an intricate and difficult course of reasoning that it was also the most advantageous, the mean of the probabilities of error in the determination of the elements being thereby reduced to a minimum.

The method of generating functions, the foundation of his theory of probabilities, Laplace published in 1779; and the first part of his *Théorie Analytique* is devoted to the exposition of the principles, which in their simplest form consist in treating the successive values of any function as the coefficients in the expansion of another function with reference to a different variable. The latter is therefore called the generating function of the former. A direct and an inverse calculus is thus created, the object of the former being to determine the coefficients from the generating function, of the latter to discover the generating function from the coefficients. The one is a problem of interpolation, the other a step towards the solution of an equation in finite differences. The method, how-

ever, is now obsolete from the more extended facilities afforded by the calculus of operations.

The first formal proof of Lagrange's theorem for the development in a series of an implicit function was furnished by Laplace, who gave to it an extended generality. He also showed that every equation of an even degree must have at least one real quadratic factor, reduced the solution of linear differential equations to definite integrals, and furnished an elegant method by which the linear partial differential equation of the second order might be solved. He was also the first to consider the difficult problems involved in equations of mixed differences, and to prove that an equation in finite differences of the first degree and the second order might always be converted into a continued fraction.

In 1812, the works of Laplace being nearly out of print, his widow was about to sell a farm in order to procure funds for a new impression, when the Government of Louis Philippe took the matter in hand. A grant of 40,000 francs having been obtained from the chamber, a national edition was issued in seven 4to vols., bearing the title *Œuvres de Laplace*, 1843-47. The *Mécanique Céleste* with its four supplements occupies the first 5 vols., the 6th contains the *Système du Monde*, and the 7th the *Théorie des Probabilités*, to which the more popular *Essai Philosophique* forms an introduction. Of the four supplements added by the author, 1816-25, he tells us that the problems in the last were contributed by his son. An enumeration of Laplace's memoirs and papers (about one hundred in number) is rendered superfluous by their embolism in his principal works. The *Théorie des Prob.* was first published in 1812, the *Essai* in 1814, and both works as well as the *Système du Monde* went through repeated editions. Laplace's first separate work, *Théorie du Mouvement et de la Figure Elliptique des Planètes*, 1784, was published at the expense of President Richard de Saron.

The *Précis de l'Histoire de l'Astronomie*, 1801, formed the first book of the 5th edition of the *Système du Monde*. An English translation, with copious elucidatory notes, of the first 4 vols of the *Mécanique Céleste*, by Dr Bowditch, was published at Boston, U.S. 1829-39, in 4 vols. 4to; a compendium of certain portions of the same work by Mr Somerville appeared in 1881, and the *Théorie des Prob.* to the first 2 vols. by Burkhardt at Berlin in 1801. English translations of the *Système du Monde* by Mr Pond and Mr Harte were published, the first in 1809, the second in 1830. An edition entitled *Les Œuvres Complètes de Laplace*, 1878, &c., which is to include the whole of his memoirs, is now in course of publication under the auspices of the Academy of Sciences. The *Essai Philosophique* has already appeared complete in the first book of the *Mécanique Céleste*.

Scanty notices of Laplace's life will be found in Fontaine's *Éloge*, June 15, 1829, in the funeral oration of Poisson, and Arago's *Résumé*, 1842, translated amongst his *Biographies* by Admiral Smyth and Mr Grant. His astronomical works are contained in the *Tables des Éléments des trois Corps et Giant's Hist. of Astronomy*. For Laplace's functions see Dr E. Heine, *Handbuch der Kugelfunctionen*, Berlin, 1861, John H. Pratt, *A Treatise on Attraction*, 1886; Todhunter's *Elementary Treatise on Laplace's Functions*, 1876, and *History of the Mathematical Theories of Attraction*, 1879; N. M. Ferrers's *Elementary Treatise on Spherical Harmonics*, 1877; and L. Schläfli, *Die neuer Heineschen Kugelfunctionen*, 1881. Consult also Thomson and Tait, *Treatise on Natural Philosophy*, 1879, p. 141; Clerk Maxwell, *Treatise on Electricity*, chap. ix.; Professor Niven in *P.M. Trans.*, 1879, p. 379; Dufrenoy in *Oeuvres*, xvi. p. 35; and Jacob, vol. II. p. 223, xvi. p. 62. Some of Laplace's views on the theory of probabilities are simplified in Lacroix's *Traité élémentaire du Calcul des Probabilités* and De Morgan's *Essay*, published in Lardner's Cabinet Cyclopædia. For the history of the subject see *A History of the Mathematical Theory of Probability*, by Isaac Todhunter, 1865. (A. M. C.)

LAPLAND, or LAPPLAND, is the north-west portion of the continent of Europe, bounded W., N., and E. by the North Atlantic, the Arctic Ocean, and the White Sea, and S. partly by the White Sea, but mainly by a conventional line. It includes the northern parts of Norway, Sweden, and Finland, and the western part of the Russian government of Archangel. A line drawn from the mouth of the Salten Fjord on the Norwegian coast to the mouth of the Ponoi on the White Sea, practically identical with the 61st parallel of north latitude, measures 700 miles. Of Russian Lapland only a very small portion lies outside of the Arctic circle; but in Swedish Lapland the southern confines descend as low as 64°. According to Frijs (in Petermann's *Mitth.*, 1870), the total area of Lapland may be estimated at 153,200 square miles, of which 15,073 miles belong to Norway, 48,898 to Sweden, 26,575 to Finland, and 61,654 to Russia.

Lapland is merely the land of the Lapps or Laps, and does

¹ This equation was first integrated by Mr Hargreave, *Philosophical Transactions*, 1841, p. 76, and it has since been successfully treated by Professor Boole, *Canab. and Dub. Math. Journ.*, vol. I. p. 10, and Professor Deukin, *Phil. Trans.*, 1857, p. 43. See Boole's *Differential Equations*, §3 et seq. p. 458.

² The proof of this theorem in its full generality has given rise to much controversy, where, however, the form of the function is rational and integral—the only case of practical importance—no difficulty is experienced. The reader is referred to two papers by Ivory in the *Phil. Trans.*, 1812 and 1822; Poisson, *Théorie Mathématique de la Chaleur*; L. Dirichlet, in *Oeuvres*, vol. xvi.; and O. Bonnet, in *Lacroix's Journal*, vol. xvi.

not constitute a geographical unity. The Scandinavian portion presents the usual characteristics of the mountain plateau of that peninsula,—on one side the bold headlands, fjords, deep-grooved valleys, and glaciers of Norway, on the other the long mountain lakes and lake-fed rivers of Sweden. On the Swedish side the Lapp borders only come down to within from 30 to 40 miles of the coast, where the rivers begin to lose the character of mountain streams. With the exception of Torne Lappmark, which is really part of Scandinavia, Finnish and Russian Lapland may be generally described as comparatively low country, broken by detached hills and ridges, one of which, the Umbek Dundar, attains an elevation of 2500 feet. Rivers and lakes abound. In the north of the Finnish region lies the great Enare or Inara (formerly Upper Imandra) Lake, with an area of 1147 square miles; and the south is traversed by the countless head-waters of the Kemi, which falls into the Gulf of Bothnia to the east of the Swedish frontier. The largest of the rivers of Russian Lapland—or, as it is often called, the Kola peninsula—is the Tulom, which falls into the Arctic Ocean, and others of importance are the Pasvig, the Pono, and the Verege. Lake Imandra, or Imandra (in Lappish Aven), is about 65 miles long by 3 or 4 broad, (Lake Nouljaur is 35 miles by 7; and Quollejaur, Umbocor, Konjarvi, and Pasjarvi are all of considerable extent.) An opinion was long prevalent that there was a natural boundary of the most striking kind between the Arctic coast of Norwegian and that of Russian Lapland,—that to the east of Jacob's river the harbours or fjords were ice-bound for six months of the year, while the influence of the Gulf Stream never allowed those to the west to be frozen. This, however, is not the case. The principal harbours on the Murman coast eastward to the mouth of the White Sea remain open like those of Norway.

Though Lapland contains vast stretches of desolate tundra and dreary swamp, the country as a whole has a certain quiet beauty, and in the wilder districts the scenery is wonderfully various in colour and form. "It is hardly possible," says Lieutenant Temple in *Proc. Roy. Geog. Soc.* 1880, "to conceive a greater contrast to the ice-bound regions which lie between the same parallels in the western hemisphere." And, though it gives little scope for husbandry, Lapland is richly furnished with much that is serviceable to man. Not to mention the iron and copper mines, it still possesses great store of timber, pine and spruce and birch; though fruit trees yield no fruit, there is abundance of edible berries; the rivers and lakes abound with salmon, trout, perch, and pike; myriads of water-fowl, ptarmigan, partridges, and capercaillie breed within its borders; and the cod, herring, halibut, and Greenland sharks of its seas give occupation to thousands of fishermen.

The chief characteristics of Lapland is its Arctic climate and the distribution of daylight and darkness. In the northern parts the longest day and the longest night last for three months each, and through the greater part of the country the sun does not set at midsummer or rise at midwinter.

The following calendar of the climate after *Lestadius* relates more particularly to the northern districts of Swedish Lapland, but is more or less applicable to a large part of the country:—*January*: cold and clear; no day-light; about 4 o'clock the "rose of dawn"; mean temperature, 0° 50 Fahr. *February*: cold, snow and wind; day-light from 6-7 A.M. to 6-8 P.M.; mean temperature, -1° 4. *March*: heat of the sun begins to modify the cold; steady snow-fall, snow begins to appear; mean temperature, 11° 8. *April*: weather variable; snow and wind, birds of passage, crows, and snow sparrows appear, snow melts from the branches; mean temperature, 26° 8. *May*: the first month in the year; spring flowers in blossom; bird life abundant; sowing season; temperature often reaches 68° during the day; seed is often "brinded" eight days after it is sown; mean temperature, 36° 5. *June*: ice breaks up on lakes and rivers; woods rush into leaf; about the 20th continual day; mean temperature, 49° to 50°. *July*: quite warm, mountain floods; grain shoots into ear; fishing and hunting; mos-

quitos, cloudberries ripe; mean temperature, 56°. *August*: much rain, harvest, by the 10th strong frosts at night; mean temperature, 56°. *September*: short days; rain, wind, sleet; raspberries, strawberries, bilberries, &c., ripe, fall of the leaf; mean temperature, 41°. *October*: "golden pudding time"; slaughter of reindeer and laying up of meat store for winter; mean temperature, 27° 50. *November*: full winter; lakes frozen over; fishing still prosecuted with ice-netts; mean temperature, 12° 24. *December*: much like January, hunting of bears, wolves, &c.; mean temperature, 1°.

The population of Lapland has been considerably recruited in modern times by immigrants from the south, but the country is still very sparsely peopled, and the Lapps still predominate. There are no towns, and the villages are not only few and insignificant, but often hardly less nomadic than the people, being shifted according to exigencies of fodder or fuel. Hammerfest, the "most northern town of the European continent," has only 2100 inhabitants, and Kola (formerly Malmö), the principal settlement in Russian Lapland, does not now exceed 500.

The Lapps.—The Lapps (Swed., *Lappar*; Russian, *Лопари*; Norw., *Finner*) call their country *Sámo* or *Samo*, and themselves *Samelats*—names almost identical with those employed by the Finns for their country and race, and probably connected with a root signifying "dark" (see Donner, *Verg. Wort der Finn.-Ugr. Sprachen*, Hels., 1876). Lapp is almost certainly a nickname imposed by foreigners, although some of the Lapps apply it contemptuously to those of their countrymen whom they think to be less civilized than themselves.¹

In Sweden and Finland the Lapps are usually divided into fisher, mountain, and forest Lapps. In Sweden the first class includes many impoverished mountain Lapps. As described by *Lestadius* (1827-32), their condition was a very miserable one; but since his time matters have much improved. The principal colony has its summer quarters on the Stoor-Lule Lake, possesses good boats and nets, and, besides catching and drying fish, makes money by the shooting of wild fowl and the gathering of eggs. When he has acquired a little means it is not unusual for the fisher to settle down and reclaim a bit of land. The mountain and forest Lapps are the true representatives of the race. In the wandering life of the mountain Lapp his autumn residence, on the borders of the forest district, may be considered as the central point, it is there that he erects his *njalla*, a small wooden store-house raised high above the ground by one or more piles. At the beginning of November, a little sooner or later, he begins to wander south or east into the forest land, and in the course of the winter he may visit, not only such places as Jockmolok and Arjeplog, but even Gelle, Upsala, or Stockholm. About the beginning of May he is back at his *njalla*, but as soon as the weather grows warm he pushes up to the mountains, and there throughout the summer pastures his herds and prepares his store of cheese. By autumn or October he is busy at his *njalla* killing the surplus reindeer bulls and curing meat for the winter. From the mountain Lapp the forest (or, as he used to be called, the spruce-fir) Lapp is mainly distinguished by the narrower limits within which he pursues his nomadic life. He never wanders outside of a certain district, in which he possesses hereditary rights, and maintains a series of camping grounds which he visits in regular rotation. In May or April he lets his reindeer loose, to wander as they please; but immediately after midsummer, when the mosquitoes become troublesome, he goes to collect them. Catching a single deer and "belling" it, he drives it through the wood; the other deer, whose instinct leads them to gather into herds for mutual protection against the mosquitoes, are

¹ The most probable etymology is the Finnish *lappu*, and in this case the meaning would be the "land's-end folk."

attracted by the sound. Should the summer be very cool and the mosquitoes few, the Lapp finds it next to impossible to bring the creatures together. About the end of August they are again let loose, but they are once more collected in October, the forest Lapp during winter pursuing the same course of life as the mountain Lapp.

In Norway there are three classes—the sea Lapps, the river Lapps, and the mountain Lapps, the first two settled, the third nomadic. The mountain Lapps have, on the whole, a rather ruder and harder life than the same class in Sweden. About Christmas those of Kautokeino and Karasjokk are usually settled in the neighbourhood of the churches, in summer they visit the coast, and in autumn they return inland. Previous to 1852, when they were forbidden by imperial decree, they were wont in winter to move south across the Russian frontiers. It is seldom possible for them to remain more than three or four days in one spot. Flesh is their favourite, in winter almost their only food, though they also use reindeer milk, cheese, and rye or barley cakes. The sea Lapps are in some respects hardly to be distinguished from the other coast dwellers of Finmark. Their food consists mainly of cooked fish. The river Lapps, many of whom, however, are descendants of Quains or Finns proper, breed cattle, attempt a little tillage, and entrust their reindeer to the care of mountain Lapps.

In Finland there are comparatively few Laplanders, and the great bulk of them belong to the fisher class. Many of them are settled in the neighbourhood of the Enare Lake. In the spring they go down to the Norwegian coast and take part in the sea fisheries, returning to the lake about midsummer. Formerly they found the capture of wild reindeer a profitable occupation, using for this purpose a palisaded avenue gradually narrowing towards a pitfall.

The Russian Lapps are also for the most part fishers, as is natural in a district with such an extent of coast and such a number of lakes, not to mention the advantage which the fisher has over the reindeer keeper in connexion with the many fests of the Greek Church. They maintain a half nomadic kind of life, very few of them having become regular settlers in the Russian villages. It is usual to distinguish them according to the district of the coast which they frequent, as Murman (Murmanski) and Terian (Terski) Lapps. A separate tribe, the Filmanns, i.e., Finnmans, nomadize about the Pazzyets, Motoff, and Petchenga tundras, and retain the peculiar dialect and the Lutheran creed which they owe to a former connexion with Sweden. They were formerly known as the "twice and thrice tributary" Lapps, because they paid to two or even three states—Russia, Denmark, and Sweden.

The ethnographical position of the Lapps has not been clearly determined, though it is evident they can no longer be classified with the Finns. They are, as has been seen, far from a numerous people, and within the historical period they have considerably recruited themselves from neighbouring races. Shortness of stature¹ is their most obvious characteristic, though in regard to this much exaggeration has prevailed. Duben (p. 167) found an average of 4·9 feet for males and a little less for females; Mantegazza, who made a number of anthropological observations in Norway in 1879, gives 5 feet and 4·75 feet respectively (*Archivio per l'antrop.*, 1880). Individuals much above or much below the average are rare. The body is usually of fair proportions, but the legs are rather short, and in many cases somewhat bandy. Dark, swarthy, yellow, copper-coloured are all adjectives employed by competent observers to describe their complexion,—the truth being that their habits of life do not conduce either to the preservation or

display of their natural colour of skin, and that some of them are really fair, and others, perhaps the majority, really dark. The colour of the hair, too, ranges from blonde and reddish to a bluish or greyish black, and the eyes are black, hazel, blue, or grey. The shape of the skull is the most striking peculiarity of the Lapp. He is the most brachycephalous type of man in Europe, perhaps in the world.² According to Virchow, the women in width of face are more Mongolian-like than the men, but neither in men nor women does the opening of the eye show any true obliquity. In children the eye is large, open, and round. The nose is always low and broad, more markedly retoused among the females than the males. Wrinkled and puckered by exposure to the weather, the faces even of the younger Lapps assume an appearance of old age. The muscular system is usually well developed, but there is deficiency of fatty tissue, which affects the features (particularly by giving relative prominence to the eyes) and the general character of the skin. The thinness of the skin, indeed, can but rarely be paralleled among other Europeans. Among the Lapps, as among other lower races, the index is shorter than the ring finger.³

The Lapps are a quiet, inoffensive people. Crimes of violence are almost unknown among them, and the only common breach of law is the killing of tame reindeer belonging to other owners. In Russia, however, they have a bad reputation for lying and general untrustworthiness, and drunkenness is well-nigh a universal vice. In Scandinavia laws have been directed against the importation of intoxicating liquors into the Lapp country since 1723.

Superficially at least the great bulk of the Lapps have been Christianized,—those of the Scandinavian countries being Protestants, those of Russia members of the Greek Church. In education the Scandinavian Lapps are far ahead of their Russian brethren, to whom reading and writing are arts as unfamiliar as they were to their pagan ancestors. The general manner of life is patriarchal. The father of the family has complete authority over all its affairs; and on his death this authority passes to the eldest son. Parents are free to disinheritor their children; and, if a son separates from the family without his father's permission, he receives no share of the property except a gun and his wife's dowry.⁴

By the very circumstances of their position the Lapps are of necessity conservative in most of their habits, many of which can hardly have altered since the first taming of the reindeer. But the strong current of mercantile enterprise has carried a few important products of southern civilization into their huts. The lines in which Thomson describes their simple life—

The reindeer form their riches, these their tents,
Their robes, their beds, and all their homely wealth
Supply; their wholesome fare and cheerful cups—

are still applicable in the main to the mountain Lapps; but even they have learned to use coffee as an ordinary beverage, and to wear stout Norwegian cloth (*vaadnal*).

Linguistically the Laps belong to the great Uralo-Altaic family, the similarity of their speech to Finnish is evident on the surface. It is broken up into very distinct and even mutually unintelligible dialects, the origin of several of which is, however, easily found in

¹ Bertillon found in one instance a cephalic index of 94. The average obtained by Pruner Bey was 84·7, by Virchow 82·5.

² See Retzius, *Antrop. Kraser* (Stockholm, 1878); Virchow, in *Arch. für Anthrop.*, tom. iv., 1870; papers by Virchow (1874), Hagenbeck and Europeans (1875), and Van der Horst (1878), in *Zeitschrift für Ethnologie*, and by Gázdáry (1888) and Pruner Bey (1884), in *Mémoires de la Soc. d'Anthrop.* Bertillon, in *Bulletin de la Revue d'Anthrop.*, has given a comparison of the craniology of the Lapps with that of Persians, Kafirs, and New Caledonians.

⁴ A valuable paper by Ephimenco, on "The Legal Customs of the Lapps, especially in Russian Lapland," appears in vol. vii. of the *Mém. of Russ. Geog. Soc.*, Ethnog. Section, 1878.

¹ Hence they have been supposed by many to be the originals of the "little folk" of Scandinavian legend.

the political and social dismemberment of the people. Duben distinguishes four leading dialects, but a much greater number are recognizable. In Russian Lapland alone there are three, due to the influence of Norwegian, Karelian, and Russian (Lonnqvist, *Adat Säs Säs, Penttinen*, vol. iv). "The Lapas," says Castren, "have long, the misfortune to come into direct contact with foreign languages, and consequently they have been very much changed, and consequently it has not only adopted an endless number of foreign words, but in many grammatical aspects fashioned itself after foreign models." That it began at a very early period to emulch itself with Scandinavian words is shown by the use it still makes of forms belonging to a linguistic stage older even than that of Icelandic. "The Lapas," says Castren, "have been so much changed for the purpose of discovering what stage of culture the people had reached before their contact with the Norse. Agricultural terms, the names of the metals, and the word for smith, are all of Scandinavian origin, and the words for "taming" and "milk" would suggest that the southern strangers taught the Lapps how to tame and milk their animals. The fact that the word for "milk" in this creature must always have held in their estimation is evident from the existence of more than three hundred native render words

The Lapp tongue was long ago reduced to writing by the missionaries, but very little has been printed in it except school-books and religious works. A number of popular tales and songs, indeed, have been taken down from the lips of the people by Fjellner, Gionlaan and others. J. A. Frjns, professor of Lapp in the university of Uppsala, has published a *Lappsk språk och folksång*, containing *lapp eevnir, ordspök, og skän, Christnams 1856*, and *Lappsk mytologi, eevnir og folksäng*, Christnams, 1871. See also G Donner, *Læser der Lappen*, Helsingfors, 1876. The songs are extremely similar to those of the Finns, and a process of mutual borrowing seems to have gone on. In one of the sign-like pieces—Pishan-Peshan's son—these are so distinctly reminiscent of those of the Eskimo, that probably the tale of the latter must have been the very origin of the song. The Sun, is full of quaint folklores about the taming of the reindeer. Giants, as well as a blind or one-eyed monster, are fitquently introduced, and the *Asopik* fable is not without its representatives. Grammars of the Lapp have been published by Fjellstom (1788), Leenz (1798), Rask (1838), Stockström (1840); lexicons by Frjns (1856), and others. The Lapps are able to speak one or even two of the neighbouring tongues.

The reputation of the Lapidars for skill in magic and divination is of very early date, and in Finland is not yet extinct. When Erik Blood-axe, son of Harold Haarfager, visited Ramezund in 932, he found Grunhild, daughter of Asa Tote, living among the Lapps, to whom she had been betrothed, but who had been so trained in witchcraft, and even the Terrible of Russia sent for magicians from Lappland to explain the cause of the appearance of a comet. One of the powers with which they were formerly credited was the raising of winds by the blowing of the Lapp-whistle. Edward Rieu, "our tyrant hanging in a whip." When they lose one of these they may raise tolerable winds. When they lose another the winds are more vehement; but by losing the third they raise storms tempestuous as in old times they were accustomed to ravage the coast. The Lapps are very superstitious, and their superstitions are very familiar in English with allusions to "Lapland witches," it appears that the art, according to native custom, was in the hands of the women. During his divination the wizard fell into a state of trance or ecstasy, his soul being held to run about at large to pursue the evil spirits, and he was then seen to rise up in the air, oval in shape, and made of wood, 1 to 4 feet in length. Over the upper surface was stretched a white-dressed reindeer skin, and at these corners (so to speak) hung a variety of charms—rinds of wool, bones, teeth, claws, etc. The area was divided into several spaces, often into four, and each space was filled with a different kind of material. A variety of figures and conventional signs were drawn in the several compartments: the sun, for instance, is frequently represented by a square and a stroke from each corner, Thor by two hammers placed crosswise, and in the more modern specimens symbols for Christ, the Virgin Mary, and the Virgin Mary. The wizard, after the divination was laid on a definite spot, the drum beaten by a hammer, and conclusions drawn from the position taken up by the spirit. Any Lapp who had attained to manhood could in ordinary circumstances consult the drum for himself, but in matters of unusual importance the professional wizard (shud, noda, or noda) had to be called in.

Lapps have a dima tradition that their ancestors lived in a far eastern land, and tell true stories of their conflicts with Norsemen and Karahans. But no answer can be obtained from them to the questions naturally put by the historian in regard to their early distribution and movements. By many it has been maintained that they were formerly spread over the whole of the Scandinavian peninsula, and they have even been considered by some as the remnants of that primal race of cave-dwellers which hunted the reindeer over the snow-fields of central and western Europe. But much of the evidence adduced for these

theories is highly questionable. The contents of the so-called Lapps' graves found in various parts of Scandinavia are often sufficient in themselves to show that the appellation must be a misnomer, and the syllable Lap or Lapp found in many names of places can often be proved to have no connexion with the Lapps. Nothing more can be affirmed with certainty than that the area occupied or visited by the Lappe once extended farther south (in Russia as far, it would appear, as Lake Ledge), and that they already occupied their present position in the north of Russia, as is attested in the history. According to Duben the name has been mentioned in the century—in the *Finska Neger*, composed about 1200, in Saxo Grammaticus, and in a papal bull of date 1230, but the people are probably to be identified with those Funs of Tacitus whom he describes as wild hunters with skins for clothing and rude huts as only means of shelter, and certainly with the Skirphindus of Procopius (*Procop.*, i. 15), the Scythini of Paulus Wamandrus, and the Scythi of the *Geographia* of Ptolemy. Some of the details given by Procopius, in regard for instance to the treatment of infants, show that his informant was acquainted with certain characteristic customs of the Lappe.

In the 9th century the Norsemen from Norway began to treat their feebler northern neighbours as a subject race. The wealth of Ötär,—"northern of the northmen,"—whose native has been preserved by King Alfred, consisted mainly of an hundred of those deer they call hrens, and an tribute paid by the natives, and the Norsemen, in return, gave them the right to hunt and to collect contributions from the Fins (the Lapps) recognised by Harold Harfager. So much wealth was attached to this source of wealth that as early as 1050 strangers were excluded from the futaude of Funnaak, and a kind of coast-guard prevented their intrusion. Meantime the Karelians were pressing on the eastern Lapps, and in the course of the 11th century the rulers of Novgorod began to treat the Lapps as a Norseman's subject race. The ground-swell of the Tartar invasion drove the Karelians westward in the 13th century, and for many years even Funnaak was so unsettled that the Norsemen received no tribute from the Lapps. At length in 1326 a treaty was concluded between Norway and Russia by which the supremacy of the Norwegians over the Lapps was acknowledged, and the Lapps were to pay tribute to the King of Saa, and the supremacy of the Russians over the Karelians as far as Lyngen and the Malselv. The relations of the Lapps to these more powerful neighbours were complicated by the rivalry of the different Scandinavian kingdoms. After the disruption of the Calmar Union (1623), Sweden began to assert its rights with vigour, and in 1696 the treaty of Tusula between Sweden and Russia was signed, by which the Lapps were divided between eastern Russia, Bothnia, and Väranger shall pay their due to the king of Sweden." It was in vain that Christian IV of Denmark visited Kola and exacted homage in 1609, and every year sent messengers to protest against the collection of his tribute by the Swedes (a custom which continued down to 1836). Charles of Sweden took the title of "King of the Lapps" in 1657, and in the same year he asserted his power over all Scandinavian Lapland. By the peace of Karlskrona (1657) Gustavus Adolphus gave up the Swedish claim to Funnaak; and in 1761 mutual renunciations brought the relations of Swedish and Norwegian (Danish) Lapland to their present position. Meanwhile Russian influences had been spreading westward; and in 1721 the Russian Emperor Peter the Great had annexed Finland, he also added to his dominions the whole of Finnish Lapland to the east of the Muonio and the Konaanus.

The Lapps have had the ordinary fate of a subject and defenceless people; they have been afflicted with little regard to their own interests or inclinations. The example set by the early Norwegians was followed by the Swedes, a peculiar class of adventure hunters, the Bickarlars (from *Bickar*, "trade") began in the sixteenth century to farm the land and to receive the extensive privileges from the king, grew to great wealth and influence. In 1606 there were twenty-two Bickarlars in Tornio, seventeen in Luleå, sixteen in Piteå, and sixty-six in Umeå Lappmark. They are regularly spoken of as having or owning Lapps, whom they hire out, and dispose of as they please. The Lapps are not only the property of the Bickarlars, but followed much the same course. The very institution of the Solovets monastery, intended by St Tryphon for the benefit of the poor neglected pagans, turned out the occasion of much injustice towards them. By a charter of Ivan Vasilievitch (November 1569), the Lapps were assigned to the Solovets monastery, and to the Metol and Petchenga districts, and they soon sought to extend their control over those not legally assigned to them (Ephraem etc.). Other monasteries in distant parts of the empire were gifted with similar proprietary rights and the supplantation of the Lapps followed. The concession to which the Lapps were subjected.

It is long, however, since these abuses were abolished; and in Scandinavia more especially the Lapps of the present day enjoy the advantages resulting from a large amount of philanthropic legislation on the part of their rulers. There seems to be no fear of their becoming extinct, except it may be by gradual amalgamation with

their more powerful neighbours. The aggregate number in all Lapland is estimated at 27,000. According to official statistics the Swedish Lappe increased from 6617 in 1880 to 6702 in 1870. In Norway there were 14,464 in 1846, 17,178 in 1866. For Russia and Finland the numbers were given in 1859 as 1200 and 2153, and according to Rehnstedt the whole number in Russia is not very more than 3000. The number of rander possessed by the whole people is estimated at 843,000.

Gustaf von Urban's *Om Lappländ och Laparna* (Stockh., 1878) is the fullest and most systematic work on its subject. It gives a list of more than two hundred authorities. See also Söderberg, *Lapponia* (Frankf., 1879, English version, Oxford, 1874), for long the standard book. Regard, *Yngste de Lapponer* (Oslo, often reprinted, in Fikerton, vol. 1), Hagström, *Redskrift öfver de i Ull Skogarna Bönsa Lapponer*, Stockholm, 1747; Loom, *Antarctica oder Finlands Lapponer*, Copenhagen, 1767, extremely important, in Danish and Latin; Arentz, *Antarktis durch Jessoen, Berlin, 1804*; Lesnaffin, *Journal*, Stockholm, 1811; Leopold von Buch, *Reise durch Norwegen und Lappland*, Berlin, 1849; Bayly's *Taylor, Northern Travel*, London, 1868; Guntter, *Nordlands Reise* (Hels., 1852-58, German; Knud, St. Petersburg, Stockholm, 1869; with *Handbuch-Reise*, Christ., 1869, of great value; Frits, *An journey* (1867); *Pravoslav, etc.*, Christ., 1871; Arentz, *Reise nach Lappland*, Leipzig, 1874; Nordenskiöld-Quarsten, *Lapponien & Lappland*, St. Petersburg, 1874; *Reise* by Kallstén, etc., for the Anthropological Exhibition at Moscow, 1877; Moscow, 1878; Rehnstedt, *Lapland*, etc., Freiburg, 1878; De Quillat, *Land of the Midnight Sun*, London, 1881; Edward Rieu, *The White Sea Peninsula*, London, 1882.

(L. A. W.)

LA PORTE, chief city of La Porte county, Indiana, U.S., is situated at the intersection of three railways, 12 miles south of Lake Michigan, and about 60 miles south-east of Chicago. Surrounded by a fertile agricultural region, it carries on a considerable trade, and has manufacturing of agricultural implements, foundries, and various mills. The vicinity has become a favorite summer residence, on account of its beautiful lakes, which in winter supply large quantities of clear ice for the Chicago and southern markets. The population in 1880 was 6195.

LAPPENBERG, JOHANN MARTIN (1794-1865), a German historical writer, was born July 30, 1794, at Hamburg, where his father held a good official position; early in life he began to study medicine, and afterwards history, at Edinburgh. The latter pursuit he continued in London and at the universities of Berlin and Göttingen, graduating as doctor of laws of Göttingen in 1816. He was forthwith sent by the Hamburg senate as resident minister to the Prussian court, where he remained till 1823, when he became keeper of the Hamburg archives, an office in which he had the amplest opportunities for the cultivation and exercise of those habits of laborious and critical research on which his highly respectable reputation as an historian rests. He continued to hold this post until 1863, when a serious affection of the eyes compelled him to resign. In 1850 he had the honour of representing Hamburg at the Frankfurt conference. His death took place on November 28, 1865.

Lappenberg's most important contribution to literature, and that by which he is best known outside of Germany, was his *Geschichte von England* (2 vols., Hamburg, 1834-37), which was translated by Thorpe (1848-57) and continued by Pauli (from 1160). His other works include a continuation of the *Geschichte des Ursprungs der Deutschen* of Sartonius, 1830; *Heimathliches Urkundenbuch*, 1842; *Hamburgs Buchdruckerhäuser*, 1846; *Chroniken der Stadt Hamburg in niederdeutscher Sprache*, 1859-61; *Quellen zur Geschichte des Bräutheims u. der Stadt Bremen*, 1841, editions of the *Meinung* of Moreburg, Adam of Bremen, Helmold, and Arnold of Lübeck in the *Monumenta* of Pertz, and an edition of Th. Mann's *Fall Zulempen*, 1858.

LAPWING, Anglo-Saxon *Hleapwince* (= "one who turns about in rising or flight," see Skene's *Etymol. Dictionary*, p. 321); a bird, the *Tringa vulcanus* of Linnaeus and the *Actitis vulgaris* or *F. cristatus* of modern ornithologists.

In the temperate parts of the Old World this species is perhaps the most abundant of the Plovers, *Charadriidae*, breeding in greater or fewer numbers in almost every suitable place from Ireland to Japan,—the majority migrating towards winter to southern countries, as the Punjab, Egypt, and Barbary,—though in the British Islands some are always found at that season, chiefly about estuaries. As a straggler it has occurred within the Arctic

Circle (as on the Varanger Fjord in Norway), as well as in Iceland and even Greenland; while it not unfrequently appears in Madeira and the Azores. Conspicuous as the strongly contrasted colours of its plumage and its very peculiar flight make it, one may well wonder at its success in maintaining its ground when so many of its allies have been almost exterminated, for the Lapwing is the object perhaps of greater persecution than any other European bird that is not a plunderer. Its eggs—the well known "Plovers' Eggs" of commerce—are taken by the thousand or ten thousand; and, worse than this, the bird, wary and wild at other times of the year, in the breeding-season becomes easily approachable, and is (or used to be) shot down in enormous numbers to be sold in the markets for "Golden Plover." Its growing scarcity as a species was consequently in Great Britain very perceptible until an Act of Parliament (35 & 36 Vict. cap. 78) frightened people into letting it alone, and its numbers have since then as perceptibly increased, to the manifest advantage of many classes of the community—those who would eat its eggs, those who would eat its flesh (at this right time of year), as well as the agriculturists whose lands it frequented, for it is admitted on all hands that no bird is more completely the farmer's friend. What seems to be the secret of the Lapwing holding its position in spite of slaughter and rapine is the adaptability of its nature to various kinds of localities. It will find sustenance for itself and its progeny equally on the dreest soils as on the fattest pastures; upland and fen, arable and moorland, are alike to it, provided only the ground be open enough. The wailing cry and the frantic gestures of the cock bird in the breeding-season will tell any passer-by that a nest or brood is near; but, unless he knows how to look for it, nothing save mere chance will enable him to find it. Yet by practice those who are acquainted with the bird's habits will accurately mark the spot whence the hen silently rises from her treasure, and, disregarding the behaviour of the cock, which is intended to delude the intruder, will walk straight to one nest after another as though they knew beforehand the exact position of each. The nest is a slight hollow in the ground, wonderfully inconspicuous even when deepened, as is usually the case, by incubation, and the black-spotted olive

¹ There is a prevalent belief that many of the eggs sold as "Plovers'" are those of Rooks, but no notion can be more absurd, since the appearance of the two is wholly unlike. Those of the Redstart, of the Golden Plover (to a small extent), and enormous numbers of those of the Black-headed Gull, and in certain places of some of the Terns, are, however, undoubtedly sold as Lapwings', having a certain similarity of shell to the latter, and a difference of flavour only to be detected by a pale palate. It is estimated that 500,000 Lapwings' eggs are yearly sent to England from the one province of Friesland in Holland (see *Ornith. Centralblatt*, 1877, p. 168).

² This measure was really insufficient to afford it, or any other bird, proper protection, but the British public seldom read Acts of Parliament critically, and, hearing that one had been passed for the Preservation of Wild Birds, in which the Lapwing was specially named, most persons desisted from persecuting this species, not in the least knowing that the utmost penalty they could meet by killing it in the close-season would be but branding.

³ This sounds like pretence, with some variety of intonation. Hence the names *Pewit*, *Pease-weed*, and *Tench*, commonly applied in some parts of Britain to this bird,—though the first is that by which one of the smaller Gulls, *Larus ridibundus* (see GULL, vol. xi. p. 274), is known in the dialects it frequents. In Sweden *Vipa*, in Germany *Kiebitz*, in Holland *Kiebitz*, and in France *Dickwit*, are names of the Lapwing, given to it from its usual cry. Other English names are Green Plover and Hoppole—the latter from its long homilic crest and pied plumage. The Lapwing's conspicuous crest seems to have been the cause of a common blunder among our writers of the Middle Ages, who translated the Latin word *Upupa*, properly *HOODER* (*g. u.*), by *Lapwing*, as being the crested bird with which they were best acquainted. In like manner other writers of the same or an earlier period latinized Lapwing by *Egrettilis* (plum), and rendered that again into English as Egrets—the tuft of feathers misleading them also. The word *Vulcanus* is from *vulcanus*, the fen used for winnowing corn, and refers to the snail-like bending of the bird's wings.

⁴ Osdon in 1481 has "lapwryches" (*Reynard the Fox*, esp. 27).

eggs (four in number) are almost invisible to the careless or untrained eye unless it should happen to glance directly upon them. The young when first hatched are clothed with mottled down so as closely to resemble a stone and to be overlooked as they squat motionless on the approach of danger. At a distance the plumage of the adult appears to be white and black in about equal proportions, the latter predominating above, but on closer examination nearly all the seeming black is found to be a bottle-green gleaming with purple and copper, and the tail-coverts, both above and below, are seen to be of a bright bay colour that is seldom visible in flight. The nest consists of six or eight narrow and elongated feathers, turned slightly upwards at the end, and is usually carried in a horizontal position, extending in the cock beyond the middle of the back, but it is capable of being erected so as to become nearly vertical. Frequenting (as has been said) parts of the open country so very divergent in character, and as remarkable for the peculiarity of its flight as for that of its cry, the Lapping is far more often observed in nearly all parts of the British Islands than any other of the group, *Limicola*, to which it belongs. The peculiarity of its flight seems due to the wide and rounded wings it possesses, the steady and ordinarily somewhat slow flapping of which impels the body at each stroke with a manifest though easy jerk. Yet on occasion, as when performing its migrations, or even its almost daily transits from one feeding-ground to another, and still more when being pursued by a Falcon, the speed with which it moves through the air is very considerable; and the passage of a flock of Lapwings, twinkling aloft or in the distance, as the dark and light surfaces of the plumage are alternately presented, is always an agreeable spectacle to those who love a landscape enlivened by its wild creatures. On the ground this bird runs nimbly, and is nearly always engaged in searching for its food, which is wholly animal.

Allied to the Lapping are several forms that have been placed by ornithologists in the genera *Hoplopterus*, *Chettusia*, *Lobivanellus*, *Sarcophorus*, and so forth, but the respective degrees of affinity they bear to one another is not rightly understood, and space would prohibit any attempt at here expressing it. In some of them the hind toe, which has already ceased to have any function in the Lapping, is wholly wanting. In others the wings are armed with a tubercle or even a sharp spur on the carpus. Few have any occipital crest, but several have the face ornamented by the outgrowth of a fleshy lobe or lobes. With the exception of North America, they are found in most parts of the world, but perhaps the greater number in Africa. Europe has three species—*Hoplopterus spinosus*, the Spur-winged Plover, and *Chettusia gregaria* and *C. leucura*, but the first and last are only stragglers from Africa and Asia.

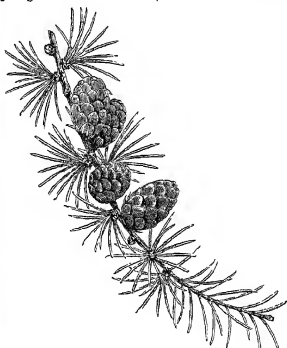
(A. N.)

LÁR, a city of Persia, capital of Láristán, in 27° 30' N. lat., 53° 58' E. long., 174 miles from Shiráz, and 127 from the coast at Mogu Bay. Láristán stands at the foot of a mountain range in an extensive plain covered with palm trees. The crest of a hill immediately behind the town is crowned by the ruins of a castle formerly deemed impregnable. Láristán was once a flourishing place, but a large portion is now in ruins, and the population is reduced to about 13,000. There are still some good buildings, of which the most prominent is the bazaar, said to be the finest in Persia, and resembling that of Shiráz, but considerably larger. The governor's residence stands in the centre of the town, and is surrounded by strong walls flanked with towers. There is also an outer moat filled by a canal of recent structure, which also serves to supply the numerous cisterns when the rain water fails. Láristán is noted for its manufacture of muskets and cloth.

LARCENY. See THEFT

LARCH (from the German *Leiche*, Latin, *larva*), a name applied to a small group of coniferous trees, of which the common larch of Europe is taken as the type. The members of the genus *Larix* are distinguished from the firs, with which they were formerly placed, by their deciduous leaves, scattered singly, as in *Abies*, on the young shoots of the season, but on all older branchlets growing in whorl-like tufts, each surrounding the extremity of a rudimentary or abortive branch, from cedars (*Cedrus*) they differ, not only in the deciduous leaves, but in the cones, the scales of which are thinner towards the apex, and are persistent, remaining attached long after the seeds are discharged. The trees of the genus are closely allied in botanic features, as well as in general appearance, so that it is sometimes difficult to assign to them determinate specific characters, and the limit between species and variety is not always very accurately defined. Nearly all are natives of Europe, or the northern plains and mountain ranges of Asia and North America, though one occurs only on the Himalaya, a somewhat aberrant form, usually placed in a separate sub-genus, is peculiar to north China and Japan.

The common larch (*L. europaea*) is, when grown in perfection, a stately tree with tall erect trunk, gradually tapering from root to summit, and horizontal branches



Branchlet of Larch (*Larix europaea*)

springing at irregular intervals from the stem, and in old trees often becoming more or less drooping, but rising again towards the extremities; the branchlets or side shoots, very slender and pendulous, are pretty thickly studded with the whorls of narrow linear leaves, of a peculiar bright light green when they first appear in the spring, but becoming of a deeper hue when mature. The yellow stamen-bearing flowers are in sessile, nearly spherical catkins, the fertile ones vary in colour, from red or purple to greenish-white, in different varieties; the erect cones, which remain long on the branches, are above an inch in length and oblong-ovate in shape, with reddish-brown scales somewhat wared on the edges, the lower bracts usually rather longer than the scales. The tree flowers in April or May, and the winged seeds are shed the following autumn. When standing in an open space, uncrowded by neighbouring trees,

the larch grows of a nearly conical shape, with the lower branches almost reaching the ground, while those above gradually diminish in length towards the top of the trunk, presenting a very symmetrical form; but in dense woods the lower parts become bare of foliage, as with the firs under similar circumstances. When springing up among rocks or on ledges, the stem sometimes becomes much curved, and, with its spreading boughs and pendent branchlets, often forms a striking and picturesque object in the alpine passes and steep ravines in which the tree delights to grow. In the prevalent European varieties the bark is reddish-grey, and rather rough and scarred in old trees, which are often much lichen-covered. The trunk attains a height of from 80 to 140 feet, with a diameter of from 3 to 5 feet near the ground, but in close woods is comparatively slender in proportion to its altitude. The larch abounds on the Alps of Switzerland, on which it flourishes at an elevation of 5000 feet, and also on those of Tyrol and Savoy, on the Carpathians, and in most of the hill regions of central Europe, it is likewise found on parts of the Apennine chain, but is not indigenous to the Pyrenees, and in the wild state is unknown in the Spanish peninsula. It forms extensive woods in Russia, but does not extend its range to the Scandinavian countries, where its absence is somewhat remarkable, as the tree grows freely in Norway and Sweden where planted, and even multiplies itself by self-sown seed, according to Schubeler, in the neighbourhood of Trondhjem. In the north-eastern parts of Russia, in the country towards the Petchora river, and on the Ural, a peculiar variety prevails, regarded by some as a distinct species (*L. sibirica*); this form is abundant nearly throughout Siberia, extending to the Pacific coast of Kamchatka and the hills of Dahuria. The Siberian larch has smooth grey bark and smaller cones, approaching in shape somewhat to those of the American hackmatack; it seems even harder than the Alpine tree, growing up to latitude 68°, but, as the inclement climate of the polar shores is neared, dwindling down to the form of a dwarf and even trailing bush, on the Altai, however, Pallas states that it flourishes only at medium elevations.

The larch, from its lofty straight trunk and the high quality of its wood, must be regarded as one of the most important of coniferous trees, its growth is extremely rapid, the stem attaining a large size in from sixty to eighty years, while the tree yields good useful timber at forty or fifty, it forms firm heartwood at an early age, and the sapwood is less perishable than that of the fir, rendering it more valuable in the young state.

The wood of large trees is close and compact in texture, in the best varieties of a deep reddish colour varying to brownish-yellow, but apt to be lighter in tint, and less hard in grain, when grown in rich soils or in low sheltered situations. It is remarkably tough, resisting a rough strain better than any of the fir or pine woods in common use, though not as elastic as some; properly seasoned it is as little liable to shrink as to split; the boughs being small compared to the trunk, the timber is more free from large knots, and the small knots remain firm and undecayed. The only drawback to these good qualities is a certain inability to warp and bend, unless very carefully seasoned, for this purpose it is recommended to be left floating in water for a year after felling, and then allowed some months to dry slowly and completely before sawing up the logs; barking the trunk in winter while the tree is standing, and leaving it in that state till the next year, has been often advised with the larch as with other timber, but the practical inconveniences of the plan have prevented its adoption on any large scale. When well prepared for use, larch is one of the most durable of coniferous woods. Its strength and toughness render it valuable for naval purposes, to which it is largely applied, its freedom from any tendency to split adapts it for clinker-built boats, for the construction of which a high authority, Matthew, pronounced it the best of all woods. It is much employed for house building in all countries where it grows in abundance, most of the picturesque log-houses in Vend and the adjacent outcrops are built of squared larch trunks, and derive their fine brown tint from the hardened rind that slowly exudes from the wood after long exposure to the summer sun; the

wooden shingles, that in Switzerland supply the place of tiles, are also frequently of larch. In Germany it is much used by the cooper as well as the carpenter, durable staves for casks being made of this valuable wood, while the foam of the trunk admirably adapts it for all purposes for which long straight timber is needed. It is one of the most durable of woods in wet ground or under water, and answers well for fence-posts and river piles, many of the foundations of old Venetian vessels upon larch, the lasting qualities of which were well known and appreciated, not only in medieval times, but in the far-off days of Vitruvius and Pliny. The harder and darker varieties are valuable to the cabinetmaker in the construction of cheap solid furniture, being fine in grain and taking polish better than many more costly woods. A peculiarity of larch wood is the difficulty with which it is ignited, although so resinous, a quality that gives it still higher value to the builder; for, though not quite so incombustible as the Romans deemed it, large pieces do not as easily take fire as the ordinary kinds of deal timber; mud, coated with a thin layer of plaster, beams and pillars of larch might probably be found to justify Cæsar's epithet "*ignis impenetrabile lignum*"; even the small branches are not easily kept alight, and a larch fire in the open needs considerable care. Yet the forests of larch in Siberia often suffer from conflagration. When these fires occur while the trees are full of sap, a curious phenomenon is witnessed: the bark of the half-burnt stems; when dried of a pale drab colour, like some of the coarser kinds of gun-grain, and is soluble in water, the solution resembling gun-water, in place of which it is sometimes used, considerable quantities are collected and sold as "Orenburg gum"; in Siberia and Russia it is occasionally employed as a semi-medicinal food, being stewed in an oil-water. For burning in close stoves and furnaces, larch makes tolerably good fuel, its value being estimated by Hartig as only one-fifth less than that of beech, the charcoal is compact, and is in demand for iron-smelting and other metallurgical uses in some parts of Europe.

In the trunk of the larch, especially when growing in climates where the sun is powerful in summer, a first clear turpentine exudes in great abundance, on the declivities of the Alps of Savoy and the south of Switzerland, it is collected by the peasants for sale, though not in such quantity as formerly, when, being taken to Venice for shipment, it was known in commerce as "*Venise turpentine*". Old trees are selected, from the bark of which it is observed to exude in the early summer; holes are bored in the trunk, somewhat inclined upward towards the centre of the stem, in which, between the layers of wood, the turpentine is said to collect in small lacunæ, wooden gutters placed in these holes convey the viscous fluid into little wooden pails hung on the end of each gutter; the collection flows slowly all through the summer months, the little tubs are emptied and replaced as they fill, a tree in the proper condition yields from 6 to 8 lb a year, and will continue to give an annual supply for thirty or forty years, being, however, reckoned quite useless for timber by objection to this exhausting process. In Tyrol, whence a supply is also obtained, a single hole is made near the root of the tree in the spring; this is stopped with a plug, and the turpentine is removed by a scoop in the autumn, but each tree yields only from a few ounces to 3 lb by this process. Real larch turpentine is a thick tenacious fluid, of a deep yellow colour, and nearly transparent, it does not harden by time, it contains 15 per cent. of the essential oil of turpentine, also resin, succinic, pine, and styracic acids, and a bitter extractive matter. According to Pereira, much sold under the name of Venetian turpentine is a mixture of common resin and oil of turpentine, and probably little of the real article now reaches England. On the French Alps a sweet excretion is found on the stem of the young larches in June and July, resembling manna in taste and laxative properties, and known as *Manna de Briançon* or *Manna Brigantina*; it occurs in small whitish irregular granular masses, which are removed in the morning before they are too much dried by the sun, this manna seems to differ little in kind from that of the sap of the tree, which also contains *mannite*, its osmotic powers are weaker than those of the manna of the manna ash (*Ostrya*), but it is employed in France for the same purposes. The bark of the larch is largely used in some countries for tanning; it is taken from the trunk only, being stripped from the trees when felled, its value is about equal to that of bark bark; but, according to the experience of British tanners, it is scarcely half as strong as that of the oak. The soft inner bark is occasionally used in the wilds of Siberia as a ferment, by hunters and others, being boiled and mixed with yeast, and buried in the snow for a short time, when it is employed as a substitute for other leaven, and in making the sour liquor called "*quass*". In Germany a fungus (*Holoporus larchæ*) grows on the roots and stems of decaying larches, which was formerly in esteem in England as a drastic purgative, but has given place to safer drugs, though it is still occasionally used by the Continental pharmacist. The young shoots of the larch are sometimes given in Switzerland as fodder to cattle.

The larch, though mentioned by Parkinson in 1620 as "nursed up" by a few "lovers of variety" as a rare exotic.

does not seem to have been much grown in England till early in the last century. In Scotland the date of its introduction is a disputed point, but it seems to have been planted at Dunkeld by the duke of Athole in 1727, and about thirteen or fourteen years later considerable plantations were made at that place, the commencement of one of the largest planting experiments on record, it is estimated that 14 million larches were planted on the Athole estates between that date and 1826. The cultivation of the tree rapidly spread, and the larch has long become a conspicuous feature of the scenery in many parts of Scotland. It grows as rapidly and attains as large a size in British habitats suited to it as in its home on the Alps, and often produces equally good timber, but has sometimes been planted under circumstances little adapted to its successful growth. The larch of Europe is essentially a mountain tree, and requires, not only free air above, but a certain moderate amount of moisture in the soil beneath, with, at the same time, perfect drainage, to bring the timber to perfection,—conditions often occurring on the mountain slope and rocky glen that form its natural habitats, but not always so readily provided in artificial culture. Complete freedom from stagnant water in the ground, and abundant room for the spread of its branches to light and air, are the most necessary requirements for the successful growth of larch,—the contrary conditions being the most frequent causes of failure in the cultivation of this valuable tree. Where these important needs are complied with, it will flourish in a great variety of soils, stiff clays, wet or mossy peat, and moist alluvium being the chief exceptions, in its native localities it seems partial to the debris of primitive and metamorphic rocks, but is occasionally found growing luxuriantly on calcareous subsoils; in Switzerland it attains the largest size, and forms the best timber, on the northern declivities of the mountains; but in Scotland a southern aspect appears most favourable. The best variety for culture in Britain is that with red female flowers; the light-flowered kinds are said to produce inferior wood, and the Siberian larch does not grow in Scotland nearly as fast as the Alpine tree. The larch is raised from seed in immense numbers in British nurseries, that obtained from Germany is preferred, being more perfectly ripened than the cones of home growth usually are. The seeds are sown in April, on rich ground, which should not be too highly manured, the young larches are planted out when two years old, or sometimes transferred to a nursery bed to attain a larger size; but, like all conifers, they succeed best when planted young; on the mountains, the seedlings are usually put into a mere slit made in the ground by a spade with a triangular blade, the place being first cleared of any heath, broken, or tall herbage that might smother the young tree; the plants should be from 3 to 4 feet apart, or even more, according to the growth intended before thinning, which should be commenced as soon as the boughs begin to overspread much; little or no pruning is needed beyond the careful removal of dead branches. The larch is said not to succeed on arable land, especially where corn has been grown, but recent experience does not seem to support this prejudice, that against the previous occupation of the ground by Scotch fir or Norway spruce is probably better founded, and, where timber is the object, it should not be planted with other conifers. On the Grampians and neighbouring hills the larch will flourish at a greater elevation than the pine, and will grow up to an altitude of 1700 or even 1800 feet; but it attains its full size on lower slopes. In very dry and bleak localities, the Scotch fir will probably be more successful up to 900 feet above the sea, the limit of the luxuriant growth of that hardy conifer in Britain; and in moist valleys or on imperfectly drained acclivities Norway

spruce is more suitable. The growth of the larch while young is exceedingly rapid, in the south of England it will often attain a height of 25 feet in the first ten years, while in favourable localities it will grow upwards of 80 feet in half a century or less, one at Dunkeld felled sixty years after planting was 110 feet high, but usually the tree does not increase so rapidly after the first thirty or forty years. Larches now exist in Scotland that rival in size the most gigantic specimens standing in their native woods, a tree at Dalwick, Peeblesshire (said to have been planted in 1725), is 5 feet in diameter, one at Glenarbuch, near the Clyde, is above 140 feet high, with a circumference of 13 feet. The annual increase in girth is often considerable even in large trees, the fine larch near the abbey of Dunkeld figured by Strutt in his *Sylvia Britannica* increased $2\frac{1}{2}$ feet between 1796 and 1825, its measurement at the latter date being 13 feet, with a height of 97½ feet.

In the south of England, the larch is much planted for the supply of hop-poles, and is considered one of the best woods for that purpose, the stems being straight and easily trimmed into poles, while they are extremely durable, though in parts of Kent and Sussex those formed of Spanish chestnut are regarded as still more lasting. In plantations made with this object, the seedlings are placed very close (from $1\frac{1}{2}$ to 2 feet apart), and either cut down all at once, when the required height is attained, or thinned out, leaving the remainder to gain a greater length; the land is always well trenched before planting. The best season for larch planting, whether for poles or timber, is the month of November, the operation is sometimes performed in the spring, but the practice cannot be commended, as the sap flows early, and, if a dry period follows, the growth is sure to be checked. The thinning of the larch woods in the Highlands are in demand for railway sleepers, scaffold poles, and mining timber, and are applied to a variety of agricultural purposes. The tree generally succeeds on the Welsh hills, and might with advantage be planted on many of the drier mountains of Ireland, now more barren moorland or poor unremunerative pasture.

The European larch has long been introduced into the United States, where, in suitable localities, it flourishes as luxuriantly as in Britain. Of late years some small plantations have been made in America with an economic view, the tree growing much faster, and producing good timber at an earlier age, than the native hackmatack, while the wood is less ponderous, and therefore more generally applicable.

The larch in Britain is occasionally subject to destructive casualties. The young seedlings are sometimes nibbled by the hare and rabbit, and on parts of the Highland hills both bark and shoots are eaten in the winter by the roe-deer, which is a great enemy to young plantations, larch woods should always be fenced in to keep out the hill-cattle, which will browse upon the shoots in spring. The "woolly apha," "American blight," or "larch blight" (*Eriosema larycia*) often attacks the trees in close valleys, but rarely spreads much unless other unhealthy conditions are present. A far more formidable enemy is the disease known as the "heart-rot"; it occurs in all the more advanced stages of growth, occasionally attacking young larches only ten years old or less, but is more common at a later period, when the trees have acquired a considerable size, sometimes spreading in a short time through a whole plantation. The trees for a considerable period show little sign of unhealthiness, but eventually the lower part of the stem near the root begins to swell somewhat, and the whole tree gradually goes off as the disease advances, when cut down, the trunk is found to be decayed at the centre, the "rot" usually commencing near the ground and gradually extending upwards. Trees of good size are thus rendered nearly worthless, often showing little sign of unhealthiness till felled. Great difference of opinion exists among foresters as to the cause of this destructive malady; the manner in which it spreads would seem to indicate a fungoid origin, and the previous growth of pine on the ground is one of the most usual explanations offered. That some fungoid mycelium may be the remote cause of the disease seems not improbable; but there is little doubt that any circumstance that tends to weaken the tree acts as

a predisposing cause of the attack, and the best safeguards are probably perfect drainage, and early and sufficient thinning. On exposed hill-sides, and other well-drained breezy localities, the larch is little liable to failure from "rot" or any other cause. On arid soils, however, the tree will sometimes be injured in very dry seasons, and such situations, though suitable for Scotch fir, are therefore badly adapted for larch.

Considerable quantities of larch timber are imported into Britain for use in the dockyards, in addition to the large home supply. The quality varies much, as well as the colour and density, an Italian sample in the museum at Kew (of a very dark red tint) weighs about 24½ lb to the cubic foot, while a Polish specimen, of equally good larch, is 44 lb to the same measurement.

For the purposes of the landscape gardener, whose chief aim is the picturesque, the larch is a valuable aid in the formation of park and pleasure ground. On steep hill-sides, the lofty asping stem and drooping branchlets add a pleasing feature to the prospect; the light airy aspect of the tree adapts it as a contrast to the heavier masses of the pines and firs, the bright light-green foliage in the spring affords an agreeable variety, and nature presents few more refreshing objects to the sight than a larch plantation bursting into young leaf, in the late autumn, the pale yellow of the changing foliage stands out in strong relief to the sombre tones of the ever-green conifers, or the deep red-brown of the beech, but in park or plantation the larch is never seen to such advantage as when hanging over some tumbling brook or rocky pass among the mountains. A variety with very pendulous boughs, known as the "drooping" larch, is occasionally met with in gardens.

The bark of the larch has lately been introduced into pharmacy, being green, generally in the form of an alcoholic tincture, in chronic bronchitic affections and internal hemorrhages. It contains, in addition to tannin, a peculiar principle called *larixin*, which may be obtained in a pure state by distillation from a concentrated infusion of the bark; it is a colourless substance in long crystals, with a bitter and astringent taste, and a faint reaction, hence some term it *lari icinic acid*.

The genus is represented in the eastern parts of North America by the hackmatacks (*L. laricina*), of which there are several varieties, two so well-marked that they are by some botanists considered specifically distinct. In one (*L. microcarpa*) the cones are very small, rarely exceeding ½ inch in length, of a rounded-oblong shape; the scales are very few in number, often in the young state, reddish-brown when ripe, the tree itself resembles the European larch in general appearance, but is of more slender growth; its trunk is seldom more than 2 feet in diameter, and rarely above 40 feet high; this form is the red larch, the *épinette rouge* of the French Canadians. The black larch (*L. pendula*) has rather larger cones, of an oblong shape, about ½ inch long, purplish or green in the immature state, and dark brown when ripe, the scales somewhat more numerous, the bracts all shorter than the scales. The bark is dark bluish-grey, smoother than in the red larch, on the trunk and lower boughs often glossy, the branches are more or less pendulous and very slender. The red larch grows usually on higher and drier ground, ranging from the Virginia mountains to the shores of Hudson's Bay; the black larch is found often on moist land, and even in swamps. The hackmatack is one of the most valuable timber trees of America; it is in great demand in the ports of the St. Lawrence for shipbuilding, the best vessels built in British America having their frames wholly or partially constructed of this fine wood. It is far more durable than any of the oaks of that region, is heavy and close-grained, and much stronger, as well as more lasting, than that of the pines and firs of Canada. In many parts all the finer trees have been cut down, but large woods of it still exist in the St. Lawrence district, especially near Lake St. John, and in Newfoundland is the prevalent tree in some of the forest tracts, it is likewise common in Maine and Vermont. In the timber and building yards the "red" hackmatack is the kind preferred, the produce, probably, of *L. microcarpa*; the "grey" is less esteemed, but the varieties from which these woods are obtained cannot always be traced with certainty. Several of the specimens of the red larch exist in English parks, but its growth is much slower than that of *L. europæa*, and it has never been planted on a large scale; the more pendulous forms of *L. pendula* are elegant trees for the garden. The hackmatacks might perhaps be grown with advantage in places too wet for the common larch.

In western America a larch occurs more nearly resembling *L. europæa*, the western larch (*L. occidentalis*) of Nuttall, who speaks of it as found by him in "the coves of the Rocky Mountains on the western slope of Oregon." The leaves are short, thicker and more rigid than in any of the other larches, the cones are much larger than those of the hackmatacks, egg-shaped or oval in outline; the scales are of a fine red in the immature state, the bracts green and extending far beyond the scales in a rigid leaf-like point. The bark is much like the same reddish tint as that of the common larch of Europe. This is probably the tree described by Fremont as the European larch, and found by him in great abund-

ance on the Blue Mountains, near the valley called the Grand Rond. He alludes to the large size of the trunk, some of the trees being 200 feet high and one 10 feet in circumference, the stems were often clear of branches for 100 feet from the ground. Little is known of the quality of the timber, but specimens of the wood seem to be firm and close in grain, the colour is a pale reddish tint throughout. From its great size the tree would appear worthy of the attention of American planters.

The other species of the genus *Larix* present few features of interest except to the botanist.

(C. P. J.)

LARD is the melted and strained fat of the common hog. The bulk of the lard of commerce is obtained from the abdominal fat of the animal, but in the preparation of inferior qualities fatty scraps of all kinds which result from the preparation of pork are melted up, and occasionally entire flanks of pigs are treated for the fat they yield. Ordinary lard is a pure white fat of the consistency of butter, having a faint characteristic taste, and scarcely any odour. It melts at between 78° to 83° Fahr., has a specific gravity of 0.915, and consists of 62 per cent of fluid fat (olein or lard oil), and 38 per cent of the hard fats palmitin and stearin. If perfectly pure, it has no tendency to become rancid, but there is generally sufficient impurity present to develop a change in the olein, which gradually exhibits itself by a yellow colour and a rancid odour and taste.

Lard is an article of considerable importance in commerce; it is calculated that the annual produce of the substance in the United States of America alone is not less than 5,000,000 cwt. Its preparation is conducted in connexion with the great pork-curing and packing establishments, mostly centred in Chicago, Cincinnati, St. Louis, Milwaukee, Louisville, and Indianapolis.—Chicago alone now monopolizing about one-half of the American trade. In these establishments the fat is "rendered" in large vats heated by coils or worms of steam pipes, each charge being completely melted in from ten to twelve hours. The graves or cracklings which remain are used for making "dog biscuits," &c. The finest lard is prepared from the "leaf" fat of the abdominal cavity, and passes into commerce as "prime steam lard." The intestinal fat, trimmings, and refuse yield No. 2 lard, which is mostly sent to the European market. The summer-killed pigs yield on an average 34 lb of lard, while the winter-killed animals produce about 37 lb, but in the case of selected animals these figures may rise to 45 lb and 54 lb respectively. The uses of lard are numerous; it is largely employed by biscuit and pastry bakers and in domestic cookery; it is used in the dressing and currying of leather, it is an important article in pharmacy for ointments, plasters, and suppositories; it forms a principal ingredient in many pomades and preparations for the toilet; and it is the source of the important lard oil and "solar stearin" noted below. Lard is occasionally adulterated with water up to 20 per cent, with starch, chalk, plaster of Paris, baryta, &c. Such falsifications, owing to the nature of the substance, are easily detected—the water by bringing the substance gently to the melting point when it separates; starch by the characteristic reaction with iodine; and mineral substance by the ash remaining after the burning of the fat. The imports into the United Kingdom in 1880 amounted to 927,512 cwt., value £1,852,160,—the very large proportion of 873,100 cwt. coming from the United States, and 46,618 from British North America. A large amount of native lard is also consumed in the United Kingdom, this being usually put up in bladders for sale. That prepared in Wiltshire is the most highly prized, and is the quality generally used in domestic cookery.

Lard oil is the limpid, clear, colourless oil expressed by pressure and gentle heat from lard, leaving a solid, glistening, and crystalline residue, known in commerce as "solar stearin," which is useful in candle making, but is also used to adulterate spermaceti. Lard oil has now

an important function in industry, being principally employed for the oiling of wool and in lubrication. It is also a good deal consumed in the falsification of more valuable oils, for which its neutral properties well adapt it, and it is turn is adulterated with cotton seed oil, &c.

LARDNER, DIONYSIUS (1793-1859), a prolific scientific writer, was born at Dublin, April 3, 1793. His father was a solicitor, and intended his son to follow the same calling. After some years of uncongenial desk work, Lardner, determining on a university career, entered Trinity College, Dublin, and graduated B.A. in 1817. In 1823 he became professor of natural philosophy and astronomy at University College, London, a position which he held till 1840, when he eloped with a married lady, and had to leave the country. After a most successful lecturing tour through the principal cities of the United States, which realized 200,000 dollars, he returned to Europe in 1845. He settled at Paris, and continued to reside there till within a few months of his death, which took place at Naples, April 29, 1859.

Though lacking in real originality or brilliancy, Lardner showed himself to be a successful popularizer of science. He was the author of numerous mathematical and physical treatises on such subjects as algebraic geometry (1823), the differential and integral calculus (1825), the steam engine (1828), besides hand-books on various departments of natural philosophy (1864-68), but it is as the editor of *Lardner's Cyclopedia* (1830-44) that he will be best remembered. To this scientific library of 124 volumes many of the ablest savants of the day contributed, Lardner himself being the author of the treatises on arithmetic, geometry, heat, hydrostatics and pneumatics, mechanics (in conjunction with Kater), and electricity (in conjunction with Walker). *The Cabinet Library* (12 vols., 1830-32) and the *Museum of Science and Art* (12 vols., 1854-56) are his other chief undertakings. A few original papers appear in the Royal Irish Academy's *Transactions* (1824), in the Royal Society's *Proceedings* (1831-36), and in the Astronomical Society's *Monthly Notices* (1852-53); and two letters to the British Association on railway constants (1856, 1857) are from his pen.

LARDNER, NATHANIEL (1684-1768), author of *The Credibility of the Gospel History*, was born at Hawkhurst, Kent, in 1684. After having studied for the Presbyterian ministry in London, and also at Utrecht and Leyden, he in 1709 took licence as a preacher, but, failing to gain acceptance in the pulpit, he in 1713 entered the family of a lady of rank as tutor and domestic chaplain, and in this position he remained until 1721. In 1724 he was appointed to deliver the Tuesday evening lecture in the Presbyterian chapel, Old Jewry, London, and in 1729 he became assistant minister to the Presbyterian congregation in Orchard Friars. He died at Hawkhurst on July 24, 1768.

An anonymous volume of *Memoirs* appeared in 1786; and a life by Kippax is prefixed to the edition of the *Works* of Lardner, published in 11 vols. 8vo in 1788, in 4 vols. 4to in 1817, and 10 vols. 8vo in 1827. The full title of his principal work—a work which, though now quite out of date, gives its author a permanent place of some respectability in the history of Christian apologetics—is *The Credibility of the Gospel History, or the Principal Facts of the New Testament confirmed by Passages of Ancient Authors, who were contemporary with our Saviour or his Apostles or lived near their time*. Part I., in 2 vols. 8vo, appeared in 1767, the publication of part II., in 12 vols. 8vo, began in 1788 and ended in 1765. In 1780 there was a second edition of part I., and the *Additions and Alterations* were also published separately. A Supplement, otherwise entitled *A History of the Apostles and Evangelists, Writers of the New Testament*, was added in 3 vols. (1758-57), and reprinted in 1780. Other works by Lardner are *A large Collection of Ancient Jewish and Hebraic Testimonies to the Truth of the Christian Revelation, with Notes and Observations*, 4 vols. 4to, 1764-67; *The History of the Heresies of the two first centuries after Christ*, published posthumously in 1780; a considerable number of occasional sermons; and *A Letter concerning the question whether the Logos supplied the place of the Human Soul in the Person of Jesus Christ*. In this tract, written in 1780 and published in 1769, Lardner indicated his preference for the Unitarian view.

LARES were Roman deities, whose character and worship share in the obscurity that envelops all antique

Roman religion. They belonged to the cultus of the dead, from which so much of Roman and Greek religion was derived, they were the deified ancestors still living in their graves in the house, and worshipped by the family as their guardians and protectors. But the dead were powerful also to do harm, unless they were duly propitiated with all the proper rites, they were spirits of terror as well as of good, in this fearful sense the names *Lemures* and still more *Laræ* were appropriated to them. The name *Lar* has been thought to be an Etruscan word, meaning "lord"; it is a common personal name or title in Etruria. We find certainly, from a very early time, a distinction between *Lares privati* and *Lares publici*. The former were worshipped in the house by the family alone, and the *Lar familiares* was conceived as the head of the family and of the family cultus. The *Lares publici* belonged to the state religion; and their worship, after having fallen into neglect, was restored by Augustus and to some extent remodelled. It is therefore difficult to distinguish how far the known rites of the cultus are ancient, but it seems certain that the *genius* of Augustus, as refounder of the state, was added, and that the original *Lares praestites* were two in number. Schwegler and others have maintained that this pair are the twin brothers so frequent in early religions, the Romulus and Remus of the Roman foundation-legend; that the tale of the twins is in most of its elements derived from the religion of the two *Laræ*; that Acca Larentia, the foster-mother of the twins, is the same as *Lara*, *Larunda*, *Mania*, or *Muta*, the mother of the *Laræ*, and that the Larentalia, celebrated on December 23, was a feast of the *Laræ*. But the two sets of legends must be strictly distinguished, the difference in the quantity of the opening syllable shows that Larentia has no connexion with *Larunda* and the *Laræ*; the Larentalia was a festival of Jupiter and Acca Larentia, in which the *Laræ* had no place; and Mommsen argues that Remus was a late addition to the foundation legend, in which originally Romulus alone was known. As restored by Augustus, the *Lares praestites* were the guardians of the state and protectors of its unity; and, in lesser circles, every division of the city had likewise its *Lares compitales*, now three in number, who had their own *aedilia* at the cross roads and their special festival, *Compitalia*. The temple of the city *Lares* (*aeculum Larum*) was near the top of the Via Sacra.

The worship of the private *Laræ*, who had their home either on the hearth of the *atrium*, or in their own little shrines, *lararium*, persisted throughout the pagan period, but in later times changed its character to a great extent. The emperor Alexander Severus had images of Abraham, Christ, and Alexander the Great among his household *Laræ*. These domestic *Laræ* were worshipped daily, but with special rites on the kalends, nones, and ides of every month; they shared with the family in every festival; when the young bride entered the house for the first time she offered a sacrifice to them; when the boy assumed the *toga virilis* he dedicated his childish *bulle* to the *Lar familiares*. Marquardt maintains that there was only one *Lar* in each household, and that the two *Laræ compitales* were the guardians of the two roads that intersected at the *compita*. The *Lemures* are distinguished from the *Laræ* were propitiated at the festival of the *Lemuralia*, on the 8th, 11th, and 13th of May. In it the dead were propitiated, and the strange unexplained ceremony of throwing the *arææ* into the river was performed. A legend of the birth of the *Laræ* makes them children of the god Mercury and a female figure, *Larunda*, *Lara*, or *Lala*. The fact that the dog was sacred to them, and that a stone figure of a dog stood in the Saelianum *Larum*, deserves notice in illustration of this legend, for the dog is connected with the Greek god Hermes. Probably this may have arisen under Greek influence. Other classes of *Laræ* mentioned as early as the republican period are the *Laræ rurales*, *viales*, *permarina*. To the last-named *Laræ* dedicated a temple in commemoration of the naval victory over Antiochus, 190 B.C. The generally accepted view is that the *Laræ* are represented as young men, crowned with laurel, dressed in short high-girt tunics, holding horns and cups in their hands; but Marquardt, in accordance with his view that there was only one *Lar*, considers that these two figures are ponses, and on a coin of the gens *Oesia* the *Laræ* are represented as two young men with chlamys and

spare, seated, with a dog between them. Jordan remarks that in the conduct of the end of the toga was thrown over the head, whereas the Lares always wear only a tunic, and have never veiled heads. The *Comptatius* was, during the Republican time, a *foras conceptus*, set by the pastor at some time soon after the Saturnalia, December 17-19. Under the empire it was fixed for January 8-6.

See Schumann, *De Duo Mandatis*, Heraberg, *De Duo Locomis*; Hartung, *Reich der Römer*, Schwieger, *Röm. Gesch.*, vol. II., Preller, *Röm. Mythol.*; Jordan, "Vesta und die Lares," and "De Lauro Iugis," in *Annali*, 1862; Reifferscheid, "De Læ et piet. Pomp.," in *Annali*, 1863; Marquardt, *Röm. Staatsrecht*, in 120, 197, 244; Mommsen, "Aetas Laurentia," in *Idem. Forsch.*, II., and "Romus Legend," in *Historia*, 1881.

LARGILLIÈRE, NICOLAS (1656-1746), perhaps the most distinguished portrait painter of the age of Louis XIV., was born at Paris, October 20, 1656. His father, who was a merchant, took him to Antwerp at the age of three, and when nine years old he accompanied a friend of the family to London, where he remained nearly two years. The attempt to turn his attention to business having failed, he entered, some time after his return to Antwerp, the studio of Goubeau, quitting this at the age of eighteen to seek his fortune in England, where he was befriended by Lely, who employed him for four years at Windsor. His skill attracted the notice of Charles II., who wished to retain him in his service, but the fury aroused against Catholics by the Rye House Plot alarmed Largillière for his own safety, and he left England for Paris, where he was well received by Le Brun and Van der Meulen. In spite of his Flemish training the reputation of Largillière, especially as a portrait painter, was soon established; his brilliant colour and lively touch attracted all the celebrities of the day,—actresses, public men, and popular preachers flocking to his studio. Huet, bishop of Avranches, Cardinal de Noailles, the Duclos, and President Lambert, with his beautiful wife and daughter, are amongst some of his most noted subjects. It is said that James II. recalled Largillière to England on his accession to the throne in 1685, that he declined to accept the office of keeper of the royal collections, but that, although he could not be induced to remain in London permanently, he made a short visit, during which he painted portraits of the king, the queen, and the prince of Wales. This last is impossible, as the birth of the prince did not take place till 1688, the three portraits, therefore, painted by Largillière of the Pretender in his youth must all have been executed in Paris, to which city he returned some time before March 1685, when he was received by the Academy as a member, and presented as his diploma picture the fine portrait of Le Brun, now in the Louvre. He was received as an historical painter; but, although he occasionally produced works of that class (*Oruifiction*, engraved by Roettiers), and also treated subjects of still life, it was in historical portraits that he excelled. Horace Walpole tells us that he left in London those of Pierre van der Meulen and of Sybrecht. His works are rare in the local museums, but several are at Versailles. The church of St. Étienne du Mont at Paris contains the finest example of Largillière's work when dealing with large groups of figures, it is an *ex voto* offered by the city to St. Genevieve, painted in 1694, and containing portraits of all the leading officers of the municipality. Largillière passed through every post of honour in the Academy, until in 1743 he was made chancellor. He died on the 20th March 1746. Oudry was the most distinguished of his pupils. Largillière's work found skilful interpreters in Van Schuppen, Edelink, Desplaces, Drevet, Pilon, and other engravers.

LARISSA (in Turkish *Pens Şehir*), the most important town of Thessaly, is situated in a rich agricultural district on the right bank of the Salambrina (Peneus), about 35 miles north-west of Volo. Up till 1881 it was the seat of a pasha in the vilayet of Janina, it now ranks

as the chief town of the new Greek province. Its long subjection to Turkey has left little trace of a nobler antiquity, and the most striking features in the general view are the mosques and the Mohammedan burying-grounds. It was the seat of a strong Turkish garrison, and the great mass of the people were of Turkish blood. In the outskirts is a village of Africans from the Sudan—a curious remnant of the forces collected by Ali Pasha. The manufactures include Turkish leather, cotton, silk, and tobacco, but the general state of trade and industry is far from being prosperous. Fevers and agues are rendered prevalent by the badness of the drainage and the overflowing of the river, and the death-rate is higher than the birth-rate. The population is estimated at 25,000 or 30,000.

Larissa, written Larisa on ancient coins and inscriptions, is near the site of the Homeric Argissa. It appears in early times as a powerful city under the rule of the Alcmæonæ, whose authority extended over the whole plain of the Pelagoponæ. The inhabitants sided with Athens during the Peloponnesian War, and during the Roman invasion their city was a point of considerable importance. In the 6th century it was made the seat of an archbishop, who has now fifteen suffragans. During the war of Greek independence Larissa was the headquarters of Ali Pasha. Notices of the few ancient inscriptions recently found at Larissa are given by Miller in *Mélanges philologiques*, Paris, 1880. The name Larissa is a common one, and the city has many particularly to be distinguished from Larissa Cremata on Mount Olympus.

LARISTÁN, a province of Persia, bounded by Farsistán on the W and N.W., by Kirmán on the E. and N.E., by the Persian Gulf on the S. It lies between 28° 30' and 28° 26' N. lat., 52° 30' and 55° 30' E. long., and has an extreme length and breadth of 210 and 120 miles respectively, with an area of 20,000 square miles. Laristán is one of the least productive provinces in Persia, consisting mainly of mountain ranges in the north and east, and of arid plains varied with rocky hills and salt or sandy valleys stretching thence to the coast. In the highlands there are some fertile upland tracts producing corn, dates, and other fruits; and there the climate is genial. But elsewhere it is extremely sultry, and on some low-lying coast lands subject to malaria. Good water is everywhere so scarce that but for the rain preserved in cisterns the country would be mostly uninhabitable. The coast is chiefly occupied by Arab tribes under their own chiefs, who are virtually independent, paying merely a nominal tribute to the shah's Government. They reside in small towns and mud forts scattered along the coast, and were till recently addicted to piracy. The people of the interior are mostly of the old Iranian stock, intermediate between the Tajiks and Kurds, and speaking an archaic form of Persian. Here the chief tribes are the Memajan, about 1600, with numerous flocks and herds; the Bekoi, 2500, and the Tahuni, 200. Laristán was subdued eight hundred years ago by a Turki khan, and remained an independent state till its last ruler was deposed and put to death by Shah 'Abbás the Great. Population about 90,000.

LARK, Anglo-Saxon *Læwerce*, German *Lerche*, Danish *Lærke*, Dutch *Leuwerik*, a bird's name (perhaps always, but now certainly) used in a rather general sense, the specific meaning being signified by a prefix, as Skylark, Titlark, Woodlark, and so forth. It seems to be nearly synonymous with the Latin *Aldaia* as used by older authors; and, though this was to some extent limited by Linnaeus, several of the species included by him under the genus he so designated have long since been referred elsewhere. By Englishmen the word Lark, used without qualification, almost invariably means the SKYLARK, *Aldaia arvensis*, which, as the best known and most widely-spread species throughout Europe, has been invariably considered the type of the genus. It scarcely needs description. Of all birds it holds unquestionably the fore-

most places in our literature, and there is hardly a poet or poetaster who has not made it his theme, to say nothing of the many writers of prose who have celebrated its qualities in passages that will be remembered so long as our language lasts. It is also one of the most favourite cage birds, as it will live for many years, in captivity, and, except in the season of moult, will pour forth its thrilling song many times in an hour for weeks or months together, while its affection for its owner is generally of the most marked kind. Difficult as it is to estimate the comparative abundance of different species of birds, there would probably be no error in accounting the Skylark the most plentiful of the Class in Western Europe. Not only does it frequent almost all unwounded districts in this quarter of the globe, making known its presence throughout spring and summer, everywhere that it occurs, by its glad and heart-lifting notes, but, unlike most birds, its numbers increase with the spread of agricultural improvement, and since the beginning of the century the extended breadth of stable land in Great Britain must have multiplied manifold the Lark-population of the country. Nesting chiefly in the growing corn, its eggs and young are protected in a great measure from all molestation, and, as each pair of birds will rear several broods in the season, their produce on the average may be set down as at least quadrupling the original stock—the eggs in each nest varying from five to three. The majority of young Larks seem to leave their birthplace so soon as they can shift for themselves, but what immediately becomes of them is one of the many mysteries of bird life that has not yet been penetrated. When the stubbles are cleared, old and young congregate in flocks, but the young then seem appear to be those only of the later broods. In the course of the autumn they give place to others coming from more northerly districts, and then as winter succeeds in great part vanish, leaving but a title of the numbers previously present. On the approach of severe weather, in one part of the country or another, flocks arrive, undoubtedly from the Continent, which in magnitude cast into insignificance all those that have hitherto inhabited the district. On the east coast of both Scotland and England this immigration has been several times noticed as occurring in a constant stream for as many as three days in succession. Further inland the birds are observed "in numbers simply incalculable," and "in countless hundreds." On such occasions the bird-catchers are busily at work with their nets or snares, so that 20,000 or 30,000 Larks are often sent together to the London market, and at the lowest estimate £2000 worth are annually sold there. During the winter of 1867-68, 1,255,500 Larks, valued at £2260, were taken into the town of Dieppe.¹ The same thing happens in various places almost every year, and many persons are apt to believe that thereby the species is threatened with extinction. When, however, it is considered that, if these birds were left to continue their wanderings, a large proportion would die of hunger before reaching a place that would supply them with food, and that of the remainder an enormous proportion would perish at sea in their vain attempt to find a settlement, it must be acknowledged that man by his wholesale massacres, which at first seem so brutal, is but anticipating the act of Nature, and on the whole probably the fate of the Larks at his hands is not worse than that which they would encounter did not his nets intervene.

The Skylark's range extends across the Old World from the Faroe to the Kurile Islands. In winter it occurs in North China, Nepal, the Punjab, Persia, Palestine, Lower Egypt, and Barbary. It sometimes strays to Madeira, and has been killed in Bermuda, though its unassisted appear-

ance there is doubtful. It has been successfully introduced on Long Island in the State of New York, and into New Zealand—in which latter it is likely to become as troublesome a denizen as any other subjects upon which Acclimatization Societies have exercised their middle-class activity. Allied to the Skylark a considerable number of species have

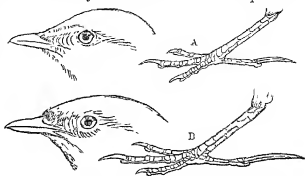


FIG. 1.—A, *Alauda agrestis*; B, *Alauda arvensis*.

been described, of which perhaps a dozen may be deemed valid, besides a supposed local race, *Alauda agrestis*, the difference between which and the normal bird is shown in the annexed woodcut (fig. 1), kindly lent to this work by Mr. Dresser, in whose *Birds of Europe* it is described at length. These are found in various parts of Africa and Asia.

The WOODLARK, *Alauda arvensis*, is the only other clearly-established European species of the genus, as now limited by some recent authorities. It is a much more local and therefore a far less numerous bird than the Skylark, from which it may be easily distinguished by its finer bill, shorter tail, more spotted breast, and light superciliary stripe. Though not actually inhabiting woods, as its common name might imply, it is seldom found far from trees. Its song wants the variety and power of the Skylark's, but has a resonant sweetness peculiarly its own. The bird, however, requires much care in captivity, and is far less often caged than its congener. It has by no means so wide a range as the Skylark, and perhaps the most eastern locality recorded for it is Erzeroum, while its appearance in Egypt and even in Algeria must be accounted rare.

Not far removed from the foregoing is a group of Larks characterized by a larger crest, a stronger and more curved bill, a rufous lining to the wings, and some other minor features. This group has been generally termed *Galerita*,² and has for its type the Crested Lark, the *Alauda cristata* of Linnaeus, a bird common enough in parts of France and some other countries of the European Continent, and said to have been obtained several times in the British Islands. Many of the birds of this group frequent the borders if not the interior of deserts, and such as do so exhibit a more or less pale coloration, whereby they are assimilated in hue to that of their haunts. The same characteristic may be observed in several other groups—especially those known as belonging to the Genera *Calandrella*, *Ammonomanes*, and *Certhilauda*, some species of which are of a light sandy or cream colour. The genus last named is of very peculiar appearance, presenting in some respects an extraordinary resemblance to the Hoopoe, so much so that the first specimen described was referred to the genus *Upupa*, and named *U. alaudipes*. The resemblance, however, is merely one of analogy. The Hoopoe (*q.v.*) belongs to a totally distinct Order of birds, widely differing anatomically and physiologically, and we can hardly yet assume that this resemblance is the effect of what is commonly

¹ See Yarrell (*Hist. Br. Birds*, ed. 4, i. pp. 618-621), where particular references to the above statements, and some others, are given.

² The name, however, is inadmissible, owing to its prior use in Entomology.

called "mimicry," though that may ultimately prove to be the case.

There is, however, abundant evidence of the susceptibility of the Alaudine structure to modification from external circumstances,—in other words, of its plasticity, and perhaps no homogeneous group of *Passeres* could be found which better displays the working of "Natural Selection." This fact was recognized many years ago, and ere "Darwinism" was founded as a creed, by one whose knowledge of the Alaudidae was based on the safe ground of extensive personal observation, and by one who cannot be suspected of any prejudice in favour of new-fangled notions. The remarks made by Canon Tristram (*Ibis*, 1859, pp 429-433) deserve all attention, going, as they go, to the root of the matter, and nothing but the exigencies of space precludes their reproduction here.

A monograph of the Family executed by a competent ornithologist from an evolutionary point of view could not fail to be a weapon of force in the hands of all evolutionists. Almost every character that among *Passerine* birds is accounted most sure is in the Larks found subject to modification. The form of the bill varies in an extraordinary degree. In the Woodlark (fig. 2, A), already noticed, it is almost as slender as a Warbler's, in *Anthus* it is stout; in *Certhilauda* (fig. 2, B) it is elongated and curved; in *Pyrrhuloxia* and *Melanocorypha* (fig. 3, A) it is stout and Finch-like, while in *Rhamphocorys* (fig. 3, B) it is exaggerated to an extent that surpasses almost any *Fringilline* form, exceeding in its development that found in some members of the perplexing genus *Paradoxornis*, and even presenting a resemblance to the same feature in the far-distant *Anas-tonus*—the tomsia of the maxilla not meeting those of the mandibula along their whole length, but leaving an open space between them. The hind claw, generally greatly elongated in Larks, is in *Calandrella* (fig. 4) and some other genera reduced to a very moderate size. The wings exhibit almost every modification, from the almost entire



FIG. 4.—*Calandrella beryllina*.

absorption of the first primary in the Skylark to its considerable development (fig. 5), and from tertials and scapulars of ordinary length to the extreme elongation found in the *Motacillidae* and almost in certain *Lamprolaima*. The most constant character indeed of the Alaudidae would seem to be that afforded by the *podotheca* or covering of the tarsus,

which is scutellate behind as well as in front, but a character easily overlooked.¹

In the Old World Larks are found in most parts of the Palearctic, Ethiopian, and Indian Regions, but only one genus, *Mirafra*, inhabits Australia, where it is represented by, so far as is ascertained, a single species, *M. horsfieldi*, and there is no true Lark indigenous to New Zealand. In the New World there is also only one genus, *Otocorys*,² where it is represented by two species, one of which, found over nearly the whole of North America, is certainly not

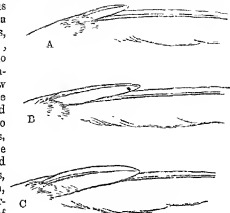


FIG. 2.—A, *Alauda arvensis*, B, *Certhilauda*.

distinguishable from the Shore-Lark of Europe and Asia, *O. alpestris*, while the other, confined to the higher elevations of more southern latitudes, seems to be the relic of a former immigration (perhaps during a glacial period) of the northern form, which has through isolation come to be differentiated as *O. chrysolaema* (see BIRDS, vol. III, p. 746). The Shore-Lark is in Europe a native of only the extreme north, but is very common near the shores of the Varanger Fjord, and likewise breeds on mountain-tops further south-west, though still well within the Arctic circle. The mellow tone of its call note has obtained for it in Lapland a name signifying "Bell-bird," and the song of the cock is lively, though not very loud. The bird trustfully resorts to the neighbourhood of houses, and even enters the villages of East Finnmark in search of its food. It produces at least two broods in the season, and towards autumn migrates to lower latitudes in large flocks. Of late years these have been observed almost every winter on the east coast of Great Britain, and the species instead of being regarded, as it once was, in the light of an accidental visitor to the United Kingdom, must now be deemed an almost regular visitor, though in very varying numbers. The observations on its habits made by Audubon in Labrador have long been known, and often reprinted.³ Other congeners of this bird are the *O. penicillata* of south-eastern Europe, Palestine, and Central Asia—to which are referred by Mr. Dresser (*B. Europe*, iv, p. 401) several other forms originally described as distinct, but the specific validity of one of them, *O. longirostris*, has since been reasserted by Dr. Scully (*Ibis*, 1881, p. 581)—as well as the *O. luteola* of Arabia and Mauritania. All these birds, which have been termed Horned Larks, from the tuft of elongated black feathers growing on each side of the head, form a little group easily recognized by their peculiar coloration, which calls to mind some of the Ringed Plovers, *Egialitis* (see KILLDEER, p. 76 of the present volume).

The name Lark is also frequently applied to many birds which do not belong to the Alaudidae as now understood.

¹ By assigning far too great an importance to this superficial character (in comparison with others), Sundevall (*Tentamen*, pp. 53-58) was induced to ally the Larks, Hoopoes, and several other heterogeneous groups in one "Series," to which he applied the name of *Scutellipalmaria*.

² By American writers it is usually called *Zonotrichia*, but that name seems to be preoccupied in natural history.

³ The osteology of this bird is minutely described by Dr. Sharpe (*Bull. U. S. Geol. Survey*, vi, pp. 119-147).

The Mud-Lark, Rock-Lark, Titlark, and Tree-Lark are *Pipits* (*q.v.*) The Grasshopper-Lark is one of the aquatic *Warblers* (*q.v.*), while the Meadow-Lark of America, as has been already said, is an *Icterus* (vol. xii. p. 697). Sand-Lark and Sea-Lark are likewise names often given to some of the smaller members of the *Lamcolæ*. Of the true Larks, *Amdaudæ*, there may be perhaps about one hundred species, and it is believed to be a physiological character of the Family that they moult but once in the year, while the *Pipits*, which in general appearance so much resemble them, undergo a double moult, as do others of the *Motacillidæ*, to which they are most nearly allied. (A. N.)

LARNACA, or LARNICA. See *CYPRUS*

LA ROCHEFOUCAULD, FRANÇOIS DE (1618-1680), the greatest maxim writer of France, one of her best memoir writers, and perhaps the most complete and accomplished representative of her ancient nobility, was born at Paris in the Rue des Petits Champs on the 16th of September 1618. His family was one of the most ancient and noble in France, counting twenty-one descents in the direct male line from Foucauld, Seigneur de la Roche in the province of Angoumois, who flourished early in the 11th century. The house of Rochevoucauld took the Protestant side for a time in the quarrels of the 16th century, but was faithful to Henry IV. in religion as in politics. La Rochevoucauld's father was a favourite of Louis XIII., and was created by him duke and peer in 1622, the possessions of the family in Angoumois and the neighbouring provinces being very considerable. The author of the *Maxims*, who during the lifetime of his father and his own most stirring years bore the title of Prince de Marillac, was somewhat neglected in the matter of education, at least of the scholastic kind; but he joined the army before he was sixteen, and almost immediately began to make a figure in public life. He had been nominally married a year before to Andrée de Vivonne, of whom little enough is known to satisfy even a Greek. She seems to have been an affectionate wife, and not a breath of scandal touches her,—two points in which La Rochevoucauld was perhaps more fortunate than he deserved. For some years Marillac continued to take part in the annual campaigns, where he displayed the utmost bravery, though he never obtained credit for much military skill. Then he fell under the influence of Madame de Chevreuse, the first of three celebrated women who successively influenced his life. Through Madame de Chevreuse he became attached to the queen Anne of Austria, and in one of her quarrels with Richelieu and her husband a wild scheme seems to have been actually formed, according to which Marillac was to carry her off to Brussels on a pillion. These caballings against Richelieu, however, had no more serious results than occasional exiles, that is to say, orders to retire to his father's estates. After the death of the great minister (1642), opportunity seemed to be favourable to the vague ambition which then animated half the nobility of France. Marillac became one of the so-called *importants*, and took an active part in reconciling the queen and Condé in a league against Gaston of Orleans. But the growing credit of Mazarin came in his way, and the *liaison* in which about this time (1645) he became entangled with the beautiful duchess of Longueville made him irrevocably a Frondeur. He was a conspicuous figure in the siege of Paris, fought desperately in the desultory engagements which were constantly taking place, and was severely wounded. In the second Fronde Marillac followed the fortunes of Condé, and the death of his father, which happened at the time (1650), gave rise to a characteristic incident. The nobility of the province gathered to the funeral, and the new duke de la Rochevoucauld took the opportunity of persuading them to follow him in an attempt on the royalist garrison of Saumur, which, however, was not

successful. We have no space to follow La Rochevoucauld through the tortuous cabals and negotiations of the later Fronde; it is sufficient to say that he was always brave and generally unlucky. His run of bad fortune reached its climax in the battle of the Faubourg Saint Antoine (1652), where he was shot through the head, and it was thought that he would lose the sight of both eyes. It was nearly a year before he recovered, and then he found himself at his country seat of Vertueil, with no result of twenty years fighting and intriguing except impaired health, a seriously embarrassed fortune, and some cause for bearing a grudge against almost every party and man of importance in the state. He spent some years in this retirement, and he was fortunate enough (thanks chiefly to the fidelity of Gonville, who had been in his service, and, passing into the service of Mazarin and of Condé, had acquired both wealth and influence) to be able to repair in some measure the breaches in his fortune. He did not, however, return to court life much before Mazarin's death. Louis XIV. was then in the full adolescence of his absolute power, and the turbulent aristocratic anarchy of the Fronde was a thing utterly of the past.

Somewhat earlier, La Rochevoucauld had taken his place in the salon of Madame de Sablé, a member of the old Rambouillet coterie, and the founder of a kind of successor to it. It was known that La Rochevoucauld, like almost all his more prominent contemporaries, had spent his solitude in writing memoirs, while the special literary employment of the Sablé salon was the fabrication of *Sentences* and *Maxims*. In 1662, however, more trouble than reputation, and not a little of both, was given to him by a surreptitious publication of his memoirs, or what purported to be his memoirs, by the Elsevirs. Many of his old friends were deeply wounded, and he hastened to deny flatly the authenticity of the publication, a denial which (as it seems, without any reason) was not very generally accepted. Three years later (1665) he published, though without his name, the still more famous *Maxims*, which at once established him high among the men of letters of the time. About the same date began the friendship with Madame de la Fayette, which lasted till the end of his life. The glimpses which we have of him henceforward are chiefly derived from the letters of Madame de Sévigné, and, though they show him suffering agonies from gout, are on the whole pleasant. He had a circle of devoted friends; he was recognized as a moralist and man of letters of the first rank; he might have entered the Academy for the asking; and in the altered measure of the times his son the Prince de Marillac, to whom some time before his death he resigned his titles and honours, enjoyed a considerable position at court. Above all, La Rochevoucauld was generally recognized by his contemporaries from the king downward as a type of the older noblesse as it was before the sun of the great monarch dimmed its brilliant qualities. This position he has retained until the present day. He died at Paris on the 17th of March 1680, of the disease which had so long tormented him.

La Rochevoucauld's character, if considered without the prejudice which a dislike to his ethical views has sometimes occasioned, is thoroughly respectable and even amiable. Like almost all his contemporaries, he saw in politics little more than a chessboard where the people at large were but pawns, and the glory and profit were reserved to the nobility. The weight of testimony, however, inclines to the conclusion that he was unusually scrupulous in his conduct, and that his comparative ill success in the struggle arose more from this scrupulousness than from anything else. He has been charged with irresolution, and there is some ground for admitting the charge so far as to pronounce him one of those the keenness of whose intellect, together with

their apprehension of both sides of a question, interferes with their capacity as men of action. But there is no ground whatever for the view which represents the *Maxims* as the mere outcome of the spite of a disappointed intriguer, disappointed through his own want of skill rather than of fortune.

Interesting, however, as he is when considered as a man and as a typical figure of a brilliant and historically important class, his importance as a social and historical figure is far inferior to his importance as a man of letters. His work in this respect consists of three parts—letters, *Memoirs*, and the *Maxims*. The letters collected by the diligence of his latest editor exceed one hundred in number, and are biographically valuable, besides displaying not a few of his literary characteristics; but they need not further detain us. The *Memoirs*, when they are read in their proper form, yield in literary merit, in interest, and in value to no memoirs of the time, not even to those of Retz, between whom and La Rochefoucauld there was a strange mixture of enmity and esteem which resulted in a couple of most characteristic portraits. But their history is unique in its strangeness. It has been said that a pirated edition appeared in Holland, and this despite the author's protest continued to be reprinted for some thirty years. It has been now proved beyond doubt or question to be a mere cento of the work of half a dozen different men, scarcely a third of which is La Rochefoucauld's, and which could only have been possible at a time when it was the habit of persons who frequented literary society to copy pell-mell in commonplace books the MS. compositions of their friends and others. Some years after La Rochefoucauld's death a new recension appeared, somewhat less incorrect than the former, but still largely adulterated, and this held its ground for more than a century. Only in 1817 did anything like a genuine edition (even then by no means perfect) appear. The *Maxims*, however, had no such fate. The author re-edited them frequently during his life, with alterations and additions; a few were added after his death, and it is usual now to print the whole of them, at whatever time they appeared, together. Thus taken, they amount to about seven hundred in number, in hardly any case exceeding half a page in length, and more frequently confined to two or three lines. The view of conduct which they illustrate is usually and not quite incorrectly summed up in the words "everything is reducible to the motive of self-interest." Though not absolutely incorrect, the phrase is misleading. The *Maxims* are in no respect mere deductions from or applications of any such general theory. They are on the contrary independent judgments on different relations of life, different affections of the human mind, and so forth, from which, taken together, the general view may be deduced or rather composed. Sentimental moralists have loudly protested against this view, yet it is easier to declaim against it in general than to find a flaw in the several parts of which it is made up. With a few exceptions La Rochefoucauld's maxims represent the matured result of the reflexion of a man deeply versed in the business and pleasures of the world, and possessed of an extraordinarily fine and acute intellect, on the conduct and motives which have guided himself and his fellows. There is as little trace in them of personal spite as of *forbearance de vice*. But the astonishing excellence of the literary medium in which they are conveyed is even more remarkable than the general soundness of their ethical import. In uniting the four qualities of brevity, clearness, fulness of meaning, and point La Rochefoucauld has no rival. His *Maxims* are never mere epigrams; they are never platitudes; they are never dark sayings. He has packed them so full of meaning that it would be impossible to pack them closer, yet there is no undue compression; he

has sharpened their point to the utmost, yet there is no loss of substance. The comparison which occurs most frequently, and which is perhaps on the whole the justest, is that of a bronze medalion, and it applies to the matter no less than to the form. Nothing is left unfinished, yet none of the workmanship is finical. The sentiment, far from being merely hard as the sentimentalists pretend, has a vein of melancholy poetry running through it which calls to mind the traditions of La Rochefoucauld's devotion to the romances of chivalry. The maxims are never shallow; each is the text for a whole sermon of application and corollaries which any one of thought and experience can write. Add to all this that the language in which they are written is French, still at almost its greatest strength, and chastened but as yet not emasculated by the reforming influence of the 17th century, and it is not necessary to say more. To the literary critic no less than to the man of the world La Rochefoucauld ranks among the scanty number of pocket-books to be read and re-read with ever new admiration, instruction, and delight.

The editions of La Rochefoucauld's *Maxims* published in his lifetime bear the dates 1665 (*édité par l'auteur*), 1668, 1671, 1675, 1678. An important edition which appeared after his death in 1698 may rank almost with these. As long as the *Memoirs* remained in the state above described no edition of them need be mentioned, and none of the complete works was possible. There have been several editions more or less complete in the last seventy years, but they are all thrown into the shade by that of MM. Gibert and Gourdan, 1868-81, in the series of *Grands Écrivains de la France*, 3 vols. This is complete as to the text, but a glossary and some other additional matters have yet to appear. The handsomest separate edition of the *Maxims* is the so-called *Édition de Dictionnaire*, 1870, but cheap and hasty sales are plentiful (G. S.).

LA SALLE, chief city of La Salle county, Illinois, U.S., is situated on the right bank of the Illinois river, navigable up to this point, about 80 miles south-west of Chicago, with which it is connected by the Illinois and Michigan Canal as well as by rail. La Salle is a rising commercial city, with manufactures of glass, sulphuric acid, and soda-ash, and some export of ice, as well as extensive zinc rolling mills—the only works of the kind in the United States. The supply of bituminous coal in the vicinity is large, the output of the mines being 1,000,000 tons annually. The population in 1880 was 7847.

LA SALLE, ROBERT CAVELIER, SIEUR DE (1643-1687), a French explorer in North America, was born at Ronen in November 1643. He became a settler in Canada, and about 1669, leaving his trading post at La Chine, above Montreal, he sought to reach China by way of the Ohio, supposing, from the reports of Indians, this river to flow into the Pacific. He made explorations of the country between the Ohio and the lakes, but, when Joliet and Marquette made it evident that the main river Mississippi emptied in the Gulf of Mexico, he conceived a vast project for extending the French power in the lower Mississippi valley, and thence attacking Mexico. He obtained extensive grants from the French Government, rebuilt Fort Frontenac, established a post above Niagara Falls, and built a small vessel, in which he sailed up the lakes to Green Bay. Thence, despatching his vessel freighted with furs, he proceeded with the rest of the party, in boats and on foot, to the Illinois river, near the head of which he began a post called Fort Crève Cœur, and a vessel in which to descend the Mississippi from the mouth of the Illinois, and, leaving Tonty, with five men, at Fort Crève Cœur, he returned by land to Canada. Towards the close of 1681 La Salle, with a party in canoes, again reached the head of Lake Michigan, at the present site of Chicago, and, making

¹ The full original title was *Reflexions ou Sentences de Maximes Morales*.

the long portage to the Illinois, descended it to the Mississippi, which he followed to its mouth, where he set up a cross and the arms of France, April 9, 1682. La Salle fell sick on his voyage up the river, and sent on intelligence of his success, which was carried to France by Father Maubré, and was published in Hennepin's work in 1683. When La Salle reached France, projects were taken up by the Government for an expedition against the rich mining country of northern Mexico. Plans were submitted by La Salle and by Peñalosa, a renegade Spaniard, who, while governor of New Mexico in 1662, had penetrated apparently to the Mississippi. La Salle was accordingly sent out in July 1684, with four vessels and a small body of soldiers, ostensibly to found an establishment at the mouth of the Mississippi, but really to push on and secure a favourable base of operations, and gain the aid of the Indians against the Spaniards, while awaiting a more powerful force under Peñalosa. The design was so well masked, and subsequently misrepresented, that he is generally said to have been carried beyond the Mississippi by the treachery of Beaugue, a naval officer commanding one of the vessels. After running along the coast, La Salle returned to Espiritu Santo Bay, Texas. There he landed his soldiers, but lost one vessel with valuable stores. He refused Beaugue's offer to obtain aid for him from the West Indies, and when that officer, according to his orders, sailed back, La Salle put up a rude fort. Then for two years, from January 1685 to January 1687, he wasted the time in aimless excursions by land, never getting beyond the present limits of Texas, and making no attempt to explore the coast or reach the Mississippi with his remaining vessel. His colonists and soldiery dwindled away; no reinforcements or expedition under Peñalosa arrived; and in January 1687, leaving part of his force at Fort St. Louis, he set out with the rest to reach Canada by way of the Mississippi to obtain relief. His harshness and arbitrary manner had provoked a bitter feeling among his followers, and he was assassinated on the 19th of March, near the Trinity river. Some of the survivors reached Touhy's post on the Arkansas, and returned to France by way of Canada. The party left at the fort were nearly all cut off by the Indians, a few survivors having been rescued by a Spanish force sent to root out the French.

For the various operations of La Salle, the chief works are Hennepin's *Description of Louisiana*, 1683; Le Clercq's *Establishment of the Faith*, 1681; Touhy's *Narrative* (1687), and Joutel's (1711), and the immense collection of documents published by Magry (8 vols. 8vo, Paris, 1875-78). Hennepin and Le Clercq's accounts were published partially in Shea's *Discovery of the Mississippi*, 1852, and recently entire. La Salle's early explorations have been discussed by Thuillier, Verreau, and Shea; historical scholars generally rejecting the claims set up by Magry. Parkman gives La Salle's whole career in his *Discovery of the Great West*, modified, however, greatly in his *La Salle*, Boston, 1870. (J. G. S.)

LASCAR, an Anglo-Persian term (from *laskhar*, an army), which formerly meant a non-combatant, or public follower of the ordnance department. Later on it came to mean any supernumeraries, and especially the native sailors engaged to supplement the crews of European vessels in the Eastern waters. The term is at present applied generally to the seafaring populations of the Indian seaboard manning British vessels sailing between England and the East. The Peninsular and Oriental and other large steamship companies now employ the lascars almost exclusively, preferring them to European crews on account of their greater docility, temperance, and obedience to orders. Nearly all are Mohammedans, and, besides their several native tongues, speak among themselves a sort of lingua franca based on Hindustani, with a considerable admixture of English, Arabic, and other elements. The word lascar is still applied somewhat in its former sense to tent-pitchers, inferior artillerymen, coolies, or sutlers.

LASCARIS, CONSTANTINE (? -1493), an eminent Greek scholar, was a member of the family which in the 13th century had furnished three emperors of Nicea, and was born at Constantinople, but in what year is unknown. After the fall of Constantinople in 1453, he took refuge in Italy, where Francesco Sforza, duke of Milan, appointed him Greek tutor to his daughter Hippolyta, afterwards married to Alphonso, king of Naples. It was at Milan that Zaret published in 1476 the *Grammatica Græca, sive Compendium octo Oratorum Partium*, of Lascaris, remarkable as being the first book entirely in that language issued from the printing press. After leaving Milan, Lascaris taught for some time in Rome and in Naples, but ultimately, on the invitation of the inhabitants, settled in Messina, where he continued to teach publicly until his death in 1493. Among his numerous pupils here was the celebrated Pietro Bembo. Lascaris bequeathed his library of valuable MSS to the senate of Messina; the collection was afterwards carried off to Spain and lodged in the Escorial.

Besides the *Grammatica*, which has often been reprinted, Lascaris wrote little of any kind and nothing of any value apart from the importance which attaches to his position as one of the promoters of the revival of Greek learning in Italy. Two little treatises by him on Siolians and Calabrians who had written in Greek were first published by Manrolio in 1563, and afterwards reprinted by Zaccaria in the *Bibliotheca di Storia Letteraria*. His dissertation on Ophiurus is to be found in the first volume of the *Marmorata Tournefortii*. Inerte gives some letters of Lascaris in the *Epistole Epirotae Matritenses Codices Græci manuscripti*. See Vilemann, *Lascaris, ou les Grecs du quinzième siècle*, Paris, 1825.

LASCARIS, JOANNES or JANUS (c. 1445-1535), surname Rhyndacenus from the river Rhyndacus in Bithynia, his native province, was born about 1445. He was a member of the imperial family of Lascaris, and after the fall of Constantinople fled into Italy, where ultimately he found refuge at the court of Lorenzo de' Medici, whose intermediary he was with the sultan Bajazet II. In the purchase of Greek MSS for the Medicean library. On the expulsion of the Medici from Florence, he, at the invitation of Charles VIII. of France, removed to Paris (1495), where he taught publicly, although he does not appear to have had any official or salaried connexion with the university. Among his pupils were Gulielmus Budæus and Danæsius. By Louis XII. he was several times employed on various public missions; and in 1515 he appears to have accepted the invitation of Leo X. to take charge of the Greek college he had founded at Rome. We afterwards find Lascaris employed along with Budæus by Francis I. in the formation of the royal library at Fontainebleau, and also again sent in the service of the French crown to Venice. He died at Rome in 1535.

He edited or wrote *Anthologia Epigrammatum Græcorum*, in seven books, Florence, 1494; *Cathecismi Hymni, cum Scholiis Græcis*, Florence, about 1494; *Scholæ Græcæ in Theodori, in integrum restituta*, Rome, 1517; *Homæcarum questionum liber, et de Nympharum antro in Olympe opusculum*, Rome, 1518; *De versu Græcorum liberum forma ac campis apud antiquos*, Paris, 1528. See Jovius, *Elogia clarorum virorum*; Hody, *De Græcis Illustribus*; and Bayle's *Dictionary*, s.v.

LAS CASAS, BARTOLOMÉ DE (1474-1556), for some time bishop of Chiapa in Mexico, and known to posterity as "The Apostle of the Indies," was a native of Seville, where he was born in 1474. His father, one of the companions of Columbus in the voyage which resulted in the discovery of the New World, was rich enough to be able to send him to Salamanca, where he graduated. In 1498 he accompanied his father in an expedition under Columbus to the West Indies, from which he returned in 1500; and in 1502 he went with Nicolás de Orando, the governor, to Hayti, where eight years afterwards he was admitted to priestly orders, being the first person to receive that consecration in the colonies. In 1511, the conquest of Cuba having been resolved on, he passed over to that island to

take part in the work of "population and pacification," and in 1513 or 1514 he witnessed and vainly endeavoured to check the fearful massacre of Indians at Caonao. Soon afterwards there was assigned to him and his friend Renteria a large village in the neighbourhood of Xagua, with a number of Indians attached to it in what was known as a "repartimiento" (allotment), and like the rest of his countrymen he sought to make the most of this opportunity for growing rich, but at the same time he occasionally celebrated masses and preached. Soon, however, having become deeply convinced of the injustice and other moral evils connected with the repartimiento system, he began to preach against it, at the same time giving up his own slaves. With the consent of his partner he resolved to go to Spain in the cause of the oppressed natives, and the result of his representations was that in 1516 Cardinal Jimenez caused a commission of three Hieronymites to be sent out for the reform of abuses, Las Casas himself, with the title of "protector of the Indians" being appointed, with a salary, to advise and inform them. This commission had not been long at San Domingo, however, before Las Casas became painfully aware of the indifference of his coadjutors to the cause which he himself had so closely at heart, and July 1517 found him again in Spain, where he developed his scheme for the complete liberation of the Indians,—a scheme which not only included facilities for emigration from Spain, but was intended to give to each Spanish resident in the colonies the right of importing twelve negro slaves. The emigration movement proved a failure, and Las Casas lived long enough to express his sorrow and shame for having been so slow to perceive that the Africans were as much entitled to the rights of man as were the natives of the New World. Overwhelmed with disappointment, he retired to the Dominican monastery in Hayti, where he joined the order in 1522, and devoted eight years of extreme seclusion to the acquisition of that store of classical and scholastic learning which appears so curiously in all his writings. About 1530 he appears to have revisited the Spanish court, but on what precise errand or with what result is not known, the vagueness and confusion of the records of this period of his life extends to the time when, after visits to Mexico, Nicaragua, Peru, and Guatemala, in the cause of religion and of his order, he undertook an expedition in 1537 into Tuzulutlan or the Tierra de Guerra ("Land of War"), the inhabitants of which were, chiefly through his tact and skill, peaceably converted to Christianity, mass being celebrated for the first time amongst them in the newly founded town of Rabinal in 1538. In 1539 Las Casas was sent to Spain to obtain Dominican recruits, and through Loaysa, general of the order, and confessor of Charles V., he was successful in obtaining many royal orders and letters which were supposed to be favourable to his enterprise, among others that which prohibited for the time being the entrance of any lay Spaniard into Tuzulutlan. During this stay in Europe, which lasted more than four years, he more than once visited Germany to see Charles, whom the business of the empire was detaining there; he also (1542) wrote his *Veinte Razonas* ("Twenty Reasons") in defence of the liberties of the Indians and the *Brevesima Relacion de la Destruccion de las Indias*, the latter of which was published some twelve years later, and has since been translated into several European languages. In 1543 he refused the Mexican bishopric of Cuervo, but was prevailed upon to accept that of Chiapa, for which he sailed in 1544. Thwarted at every point by the officials, and outraged with passionate hatred by his countrymen in his attempt to carry out the "new laws" which his humanity had procured (see the "*Remedios que refirio*" in the Seville edition of his *Obras*, 1552), he returned to Spain and

resigned his dignity three years afterwards (1547). In 1550 he met Sepúlveda in public debate on the theses drawn from the recently published *Apologia pro Libro de Justia Belli Covae*, in which the latter had maintained the lawfulness of waging unprovoked war upon the natives of the New World. The course of the discussion may still be traced in the account of the "Disputa" contained in the *Obras* (1552). In 1555 Las Casas successfully remonstrated with Philip II. against the financial project for selling the reversion of the "encomiendas"—a project which would have involved the Indians in hopeless bondage. In July of the following year he died at Madrid, whither he had gone to urge (and with success) the necessity of restoring a court of justice which had been repressed in Guatemala.

A *Historia de las Indias* was left by Las Casas to the convent of San Gregorio at Valladolid, with directions that it should not be printed for fifty years. Herrera, however, was permitted to consult it for his *Historia General* (1601). It afterwards lay neglected until the Royal Academy of History took it up with an intention of publishing it. That intention was afterwards abandoned, Prescott, who appears to have seen the MS., hopes that it may yet be given to the world. *Sketches of the Life of Las Casas* have been given by Llorente and by Quintana. The English reader will find adequate notices in the appendix to bk. II., chap. viii., of Prescott's *Conquest of Mexico*, and in the copious monograph of Sir Arthur Helps (*Life of Las Casas*, 1868).

LÁSCO, or LASCOT, JOHN See ALASCO, vol. i. p. 443.

LASSA. See LHASA.

LASSALLE, FERDINAND (1825-1864), the originator of the social-democratic movement in Germany, was born at Breslau in 1825. Like Karl Marx, the chief of international socialism, he was of Jewish extraction. His father, a prosperous merchant in Breslau, intended Ferdinand for a business career, and with this view sent him to the commercial school at Leipzig; but the boy, having no liking for that kind of life, got himself transferred to the university, first at Breslau, and afterward at Berlin. His favourite studies were philology and philosophy, he became an ardent Hegelian, and in politics was one of the most advanced. Having completed his university studies in 1846, he began to write a work on Heracleitus from the Hegelian point of view, but it was soon interrupted by more stirring interests, and did not see the light for many years. From the Rhine country, where he settled for a time, he went to Paris, and made the acquaintance of his great compatriot Heine, who conceived for him the deepest sympathy and admiration. In the letter of introduction to Varnhagen von Ense, which the poet gave Lassalle when he returned to Berlin, there is a striking portrait of the young man. Heine speaks of his friend Lassalle as a young man of the most remarkable endowments, in whom the widest knowledge, the greatest abstinence, and the richest gifts of expression are combined with an energy and practical ability which excite his astonishment, but adds, in his half-mocking way, that he is a genuine son of the new era, without even the pretence of modesty or self-denial, who will assert and enjoy himself in the world of realities. At Berlin Lassalle became a favourite in some of the most distinguished circles; even the veteran Humboldt was fascinated by him, and used to call him the *Wunderkind*. Here it was, also, towards the end of 1846, that he met the lady with whom his life was to be associated in so remarkable a way, the Countess Hatzfeldt. She had been separated from her husband for many years, and was at feud with him on questions of property and the custody of their children. With characteristic energy Lassalle attached himself to the cause of the countess, whom he believed to have been outrageously wronged, made a special study of law, and, after bringing the case before thirty-six tribunals, reduced the powerful count to a compromise on terms most favourable to his client. The process, which lasted ten years, gave rise to not a little scandal, especially

that of the *Cassettengeschichte*, which pursued Lassalle all the rest of his life. This "affair of the casket" arose out of an attempt by the countess's friends to get possession of a bond for a large life annuity settled by the count on his mistress, a Baroness Meyendorf, to the prejudice of the countess and her children. Two of Lassalle's comrades succeeded in carrying off the casket, which contained the lady's jewels, from the baroness's room at a hotel in Cologne. They were prosecuted for theft, one of them being condemned to six months' imprisonment; Lassalle, accused of moral complicity, was acquitted on appeal. He was not so fortunate in 1849, when he underwent a year's durancé for resistance to the authorities at Düsseldorf during the troubles of that stormy period. But going to prison was quite a familiar experience in Lassalle's life. Till 1859 Lassalle resided mostly in the Rhine country, presenting the suit of his friend the countess, finishing the work on Heraclitus, which was not published till 1858, and taking little part in political agitation, but ever a helpful friend of the working men. He was not allowed to live in Berlin because of his connexion with the disturbances of '48. In 1859, however, he entered the city disguised as a carter, and finally, through the influence of Humboldt with the king, got permission to stay there. The same year he published a remarkable pamphlet on the *Italian War and the Mission of Prussia*, in which he came forward to warn his countrymen against going to the rescue of Austria in her war with France. He pointed out that if France drove Austria out of Italy she might annex Savoy, but could not prevent the restoration of Italian unity under Victor Emmanuel. France was doing the work of Germany by weakening Austria, the great cause of German disunion and weakness; Prussia should form an alliance with France in order to drive out Austria, and make herself supreme in Germany. After their realization by Bismarck these ideas have become sufficiently commonplace; but they were nowise obvious when thus published by Lassalle. In 1861 he published a great work in two volumes, the *System of Acquired Rights*.

Hitherto Lassalle had been known only as the author of two learned works, as connected with an extraordinary lawsuit which had become a wide-spread scandal, and as a young man of whom even the most distinguished veterans expected great things. Now began the short-lived activity which was to give him an historical significance. It was early in 1865, when the struggle of Bismarck with the Prussian liberals was already begun. Lassalle, who had always been a democrat of the most advanced type, saw that an opportunity had come for asserting a third great cause—that of the working men—which would outflank the liberalism of the middle classes, and might even command the sympathy of the Government. His political programme was, however, entirely subordinate to the social, that of bettering the condition of the working-classes, for which he believed the schemes of Schulze-Dehtzsch were utterly inadequate. Lassalle flung himself into the career of agitator with his accustomed vigour. His worst difficulties were with the working men themselves, among whom he met the most discouraging apathy. For a war to the knife with the liberal press he was quite prepared, and he accepted it manfully. His mission as organiser and emancipator of the working class lasted only two years and a half. In that period he issued about twenty separate publications, most of them speeches and pamphlets, but one of them, that against Schulze-Dehtzsch, a considerable treatise, and all full of keen and vigorous thought. He founded the "Allgemeiner Deutscher Arbeiterverein," was its president and almost single handed champion, conducted its affairs, and carried on a vast correspondence, not to mention about a dozen state prosecutions in which he was during that period

involved. Berlin, Leipzig, Frankfurt, and the industrial centres on the Rhine, were the chief scenes of his activity. His greatest success was on the Rhine, where in the summer of 1863 and 1864 his travels as missionary of the new gospel resembled a triumphal procession. The agitation was growing rapidly, but he had achieved little substantial success when a most unworthy death closed his career.

While posing as the Messiah of the poor, Lassalle was a man of decidedly fashionable and luxurious habits. His suppers were well known as among the most exquisite in Berlin. It was the most piquant feature of his life that he, one of the gilded youth, a connoisseur in wine, and a learned man to boot, had become agitator and the champion of the working man. In one of the literary and fashionable circles of Berlin he had met a young lady, a Fraulein von Donniges, for whom he at once felt a passion, which was ardently reciprocated. In the summer of 1864 he met her again on the Rigi, when they resolved to marry. She was a young lady of twenty, decidedly unconventional and original in character, but the daughter of a Bavarian diplomatist then resident at Geneva, who was angry beyond all bounds when he heard of the proposed match, and would have absolutely nothing to do with Lassalle. The lady was imprisoned in her own room, and soon, apparently under the influence of very questionable pressure, renounced Lassalle in favour of another admirer, a Wallachian, Count von Racowitza. Lassalle, who had resorted to every available means to gain his end, was now mad with rage, and sent a challenge both to the lady's father and her betrothed, which was accepted by the latter. At the Carouge, a suburb of Geneva, the meeting took place on the morning of August 28, 1864, when Lassalle was mortally wounded. In spite of such a foolish ending, his funeral was that of a martyr; and by many of his adherents he has been regarded since with feelings almost of religious devotion.

Lassalle did not lay claim to any special originality as a socialistic thinker, nor did he publish any systematic statement of his views. His aim was not scientific or theoretic completeness, but the practical one of organising and emancipating the working classes, and his plans were promulgated in occasional speeches and pamphlets, as the crises of his agitation seemed to demand. Yet his leading ideas are sufficiently clear and simple. Like a true Hegelian he saw three stages in the development of labour: the ancient and feudal period, which, through the subjection of the labourer, sought solidarity without freedom; the reign of capital and the middle classes, established in 1789, which sought freedom by destroying solidarity; and the new era, beginning in 1848, which would reconcile solidarity with freedom by introducing the principle of association. It was the basis and starting-point of his opinions that, under the empire of capital and so long as the working man was merely a receiver of wages, no improvement in his condition could be expected. This position he founded on the well-known law of wages formulated by Ricardo, and accepted by all the leading economists, that wages are controlled by the ordinary relations of supply and demand, that a rise in wages leads to an increase in the labouring population, which, by increasing the supply of labour, is followed by a corresponding fall of wages. Thus, population increases or decreases in fixed relation to the rise or fall of wages. The condition of the working man will never permanently rise above the mere standard of living required for his subsistence, and the continued envy of his kind. Lassalle held that the co-operative schemes of Schulze-Dehtzsch on the principle of "self-help" were utterly inadequate, for the obvious reason that the working classes were destitute of capital. The struggle of the working man helping himself

with his empty pockets against the capitalists he compared to a battle with teeth and nails against modern artillery. In short, Lassalle accepted the orthodox political economy to show that the inevitable operation of its laws left no hope for the working classes, and that no remedy could be found but by abolishing the conditions in which these laws had their validity—in other words, by abolishing the present relations of labour and capital altogether. And this could only be done by the productive association of the working men with money provided by the state. The states of Europe had spent hundreds of millions in silly dyastic squabbles, or to appease the wounded vanity of royal mistresses; why refuse to advance a few millions to solve the greatest problem of modern civilization? Lassalle's estimate was that a loan of a hundred million thalers would be more than enough to bring the principle of productive association into full movement throughout the kingdom of Prussia. And he held that such association should be the voluntary act of the working men themselves, the Government merely reserving to itself the right to examine the books of the various societies. All the arrangements should be carried out according to the rules of business usually followed in such transactions. But how move the Government to grant such a loan? Simply by introducing (direct) universal suffrage. The working men were an overwhelming majority, they were the state, and should control the Government. The aim of Lassalle, then, was to organize the working classes into a great political power, which in the way thus indicated, by peaceful resolute agitation, without violence or insurrection, might attain the goal of productive association. In this way the fourth estate would be emancipated from the despotism of the capitalist, and a great step taken in the solution of the great "social question."

It will be seen that the net result of Lassalle's life was to produce a European scandal, and to originate a socialist movement in Germany, which, in spite of repressive laws, at last election (1881) was able to return thirteen members to the reichstag. This result was hardly commensurate with his ambition, which was boundless. In the heyday of his passion for Fraulein von Dönniges, his dream was to be enthroned as the president of the German republic with her seated at his side. With his energy, ability, and gift of dominating and organizing, he might indeed have done a great deal. Bismarck courted with him as the representative of a force that might help him to combat the Prussian Liberals; so late as 1878, in a speech before the reichstag, he spoke of him with deep respect, as a man of the greatest amiability and ability from whom much could be learned. Even Bishop Ketteler of Mainz had declared his sympathy for the cause he advocated.

Lassalle's two learned works were *Die Philosophie Heraklitos des Dunklen von Ephesos* (Berlin, 1868), and *das System der erworbenen Rechte* (Leipzig, 1861), both marked by great learning and intellectual power. But of far more historical interest are the speeches and pamphlets connected with his socialist agitation, of which the most important are: *Über Verfassungsveränderung; Arbeiterprogramm; Offenes Antwortschreiben; Zur Arbeiterfrage; Arbeiterrecht; Herr Bastiat-Schulze von Delitzsch, über Kapital und Arbeit*. His drama, *Fräulein von Sickingen*, published in 1870, is a work of no poetic value.

The best authority on Lassalle's life and writings is George Brandes's Danish work, *Ferdinand Lassalle* (German translation, Berlin, 1877). See also Laveleye, *Le socialisme contemporain*, Paris, 1881; *Fortnightly Review*, 1880; *Contemporary Review*, 1881. There is already a considerable literature on his love affair and death.—*Meine Begegnungen mit F. Lassalle*, by Helene von Raasow-Ha, a very strange book; *Zusammenhänge über das tragische Leben und F. Lassalle's* by B. Becker; *Im Anschluss an die Memoren der F. von Raasow-Ha*, by A. Kutschbach; and an English and Italian novel.

(T. K.)

LASSEN, CHRISTIAN (1800–1876), an eminent Orientalist, was born on October 22, 1800, at Bergen in Norway.

Having received his first university education at Christiania, he went to Germany, and continued his philological studies at Heidelberg and Bonn. The latter university, though only founded a few years previously (in 1818), had already become one of the chief centres of Oriental studies. The lectures of A. W. von Schlegel, the distinguished critic and leader of the German Romantic school, who shares with F. Bopp the honour of having founded the critical school of Sanskrit philology, were especially attractive to the young Norwegian, and determined him henceforth to devote his energies chiefly to the exploration of the newly-opened mine of Indian literature. Having acquired a sound knowledge of Sanskrit, he spent three years in Paris and London, engaged in copying and collating MSS., and collecting materials for future research, especially in reference to the Hindu drama and philosophy. During this period he published, jointly with E. Burnout, his first work, *Essai sur le Pals* (Paris, 1826). On his return to Bonn he studied Arabic, for some time, under Freytag, and took the degree of Ph.D., his dissertation discussing the Arabic notices of the geography of the Punjab (*Commentatio geographica atque historica de Pentapotamia Indica*, Bonn, 1827). Soon after he was admitted privatdocent, and entered on his academic career with an inaugural dissertation *De Taprobane insula*. In 1830 he was appointed "extraordinary" and in 1840 "ordinary" professor to the newly-created chair of Old Indian language and literature, Schlegel continuing to hold (till his death in 1848) the chair of history. In spite of a tempting offer of the Sanskrit chair at Copenhagen, in 1841, Lassen remained faithful to the university of his adoption to the end of his life. He died at Bonn on May 8, 1876, having been affected with almost total blindness for many years. As early as 1864 he was relieved of the duty of lecturing.

The numerous works and essays published by Lassen during half a century of unremitting labour, cover a wide field of Oriental research, and afford ample evidence of the thorough accuracy of his scholarship and the comprehensiveness of his learning. In 1828–31 he brought out, in conjunction with Schlegel, the first critical edition of the *Uttarapades*, the now well-known manual of political ethics in the form of fables, interspersed with moral maxims. The appearance of this edition marks the starting-point of the critical study of the Sanskrit literature. At the same time Lassen assisted his teacher and friend in editing and translating the first two cantos of the epic *Sikandrapurana* (1830–38). In 1839 he brought out the text of the first act of Bharavahita's drama, *Mālatīmādhava*, and a complete edition, with a Latin translation, of the *Sāṅkhya-kārikā*, one of the chief works of the Sāṅkhya philosophy. In 1847 followed his edition and translation of Jayadeva's charming lyrical drama, *Gitaṅgoda*, and his *Institutiones linguae Praeriticae*, which still forms the standard work on the popular dialects of the Indian drama. His *Anthologia Sanscritica*, which came out the following year, contained several hitherto unpublished texts, and did much to stimulate the study of Sanskrit in German universities, where, indeed, it continues to be used, new editions of it having been published by Gildemeister in 1865 and 1868. In 1845 Lassen brought out a new and improved edition of Schlegel's text and translation of the famous philosophical episode of the *Mahābhārata*, the "Bhagavadgītā." He did not, however, confine himself to the study of Indian languages, but acted likewise as a scientific pioneer in other fields of philology. In his *Zeitschrift zur Kunde der Indischen Alterthümer* (1845), he prepared the way for the correct interpretation of the Umbrian inscriptions; and the *Zeitschrift für die Kunde des Morgenlandes* (7 vols., 1837–50), started and conducted by him,—the first three volumes in conjunction with Ewald and Rodiger,—contains, among other valuable papers from his pen, grammatical sketches of the Beluchi and Brakui languages, and an essay on the Lycian inscriptions. Soon after the appearance of Burnout's *Commentaire sur le Yagna* (1838), Lassen also directed his attention to the Zend, and to Iranian studies generally; and in his work *Die altperischen Keilschriftenschriften von Persepolis* (1848) he first made known the true character of the Old Persian cuneiform inscriptions, thereby anticipating, by one month, Burnout's *Mémoire* on the same subject, while Major (Sir Henry) Rawlinson's famous memoir on the Behistun inscription, though drawn up in Persia, independently of contemporaneous European research, at about the same time, did not reach the Royal Asiatic Society until three years later. Subsequently Lassen published, in the sixth volume of his

journal (1845), a complete collection of all the Old Persian cuneiform inscriptions known up to that date. He also was the first scholar in Europe who took up, with signal success, the decipherment of the newly-discovered Babylonian coins, which furnished him the materials for his important essay, *Zur Geschichte der griechischen und indo-egyptischen Könige in Babylon, Kabin, und Indien* (1838). He likewise contemplated bringing out a critical edition of the *Pandua*, but, after publishing the first five targads (1862), he felt that his whole energies were required for the successful accomplishment of the great undertaking of his life, with which his name will always be inseparably connected—his *Indische Alterthümer*. In this work—completed in four volumes, published successively in 1847 (2d ed., 1867), 1849 (2d ed., 1874), 1858, and 1861—which forms one of the greatest monuments of untiring industry and critical scholarship, everything that could be gathered from native and foreign sources, relative to the political, social, and intellectual development of India, from the earliest times down to Mohammedan invasion, was worked up by him into a connected historical account. Only those acquainted with Indian history and literature, where nothing is fixed, can realize the enormous difficulty of the task, but in spite of much that may turn out to be erroneous, and in spite of still more that is, from the nature of the subject, must always be uncertain and hypothetical, there can be no doubt that Lassen has laid in this work a solid foundation for future Indian historical and antiquarian research.

LATAKIA, or **LADIKIYEH**, a seaport town of Syria, situated opposite the island of Cyprus, about 73 miles north of Tlepia, and administratively dependent on the mutasarrif of that city. It is a rather poor-looking place; but, besides being the most important town of a considerable district, the residence of several foreign consuls, and the seat of an American mission, it has considerable historical interest. Remains of the Roman period are still to be seen, the best preserved of which is a sort of triumphal arch hypothetically assigned to the time of Septimius Severus. As a trading port Latakia has recently declined. The harbour, about a mile from the town, is naturally small, and has been silted up so as to be serviceable only for the lesser native craft. The Russian and French steamers, which make Latakia a point of call, lie in the roadstead, and the whole trade of the place, with Egypt and European countries, does not exceed the value of £100,000 per annum. The great article of export is the famous Latakia tobacco, mainly purchased by Egypt and England. It is grown among the Nosairiyeh hills, and the hillmen, each with his little plot of ground, bestow great care on the cultivation of the plant. The best and most fragrant is brought from the districts of Dyrus and Amamareh. Consul Jago gives the population of the town as about 12,000 in 1874; other estimates vary from 5000 to 14,000.

The oldest name of the town, according to Herennius Philo, was *Papusa* or *Aech*, it received that of *Leodice* (*ad mare*) from Seleucus Nicator, who founded it in honour of his mother as one of the four "new" cities of Syrian Tetrarchy (Antioch, Seleucia, Apamea, *Leodice*). In the Roman period it was favoured by Julius Caesar, and took the name of *Julia*, and, though it suffered severely when Dolabella was besieged within its walls (48 B.C.), Strabo describes it as a flourishing port, which supplied, from the vineyards on the mountains, the greater part of the wine imported to Alexandria. The town received the privileges of an Italian colony from Severus, for taking his part against Antioch in the struggle against Niger. *Leodice* was the seat of an ancient bishopric, and even had some claim to metropolitan rights. At the time of the Crusades, "Lacie," as Jacques de Vitry says it was popularly called, was a wealthy city. It fell to Tancred with Antioch in 1109, and was recovered by Saladin in 1188. A Christian settlement was afterwards permitted to establish itself in the town, and to protect itself by fortifications; but it was expelled by Sultan Kildar and the defences destroyed. By the 16th century *Leodice* had sunk very low; the revival in the beginning of the 17th was due to the new trade in tobacco. The town has several times been almost destroyed by earthquakes—in 1170, 1287, and 1822.

LATHE. In its simplest form—a form which is still employed by the natives of India—the lathe consists of two upright posts each carrying a fixed pin or dead centre, between which the work in hand is caused to revolve by an assistant pulling alternately the two ends of a cord passed

round it. A tool held firmly on a bar which forms a "rest" then attacks in succession the projecting parts, and in this way the entire surface is brought to an equal distance from the central axis, in other words, the cross section becomes everywhere circular.

Fig. 1 shows a "dead-centre lathe" of the kind used in Europe during the 18th century, in which the centres are

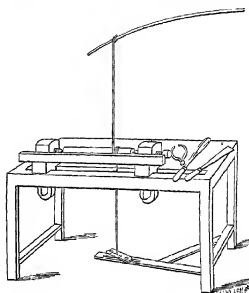


FIG. 1.—Dead-centre Lathe

carried by "puppets" or "poppets" which can be adjusted to suit the length of the work, the tuner giving the rotation by means of the treadle and spring-latch attached to the ceiling. This lathe, having immortalized itself by giving its name to the "lathe," has now almost entirely disappeared, the waste of time in its upward stroke (during which the work revolves in the wrong direction) being a fatal objection to its use in an age in which economy in that respect is of such importance. Dead-centre lathes themselves are now almost things of the past, though within their own limits,—which are of course confined to such articles as are turned on the outside only, and can be supported at the ends (such as fig. 2)—they offer a steadiness of support and a freedom of rotation which others seldom equal and never surpass. The system, however, still survives in the small lathes or "throws" used by Fig. 2. watch and clock makers, and for their purposes it is not likely to be soon superseded.

The lathe seems to have but tardily developed into the "foot-lathe," the application to it of a fly-wheel worked by a crank and treadle having been exceptional rather than usual even in the early part of the present century, though a separate fly-wheel turned by an assistant had long previously been employed, and must have rendered possible the turning of heavy work which could not have been attempted without it. The nave of cart wheels were doubtless a case in point, and for these as well as for many other purposes detached fly-wheels still render good service where steam or other motive power is not available.

The early attempts at modifying the dead-centre lathe so that articles such as fig. 3 could be turned "en l'air," or without the support of a "back-centre," cannot have been very encouraging. The introduction of a spindle or mandrel carrying a pulley for the lathe band and screwed at one



FIG. 3

and so that the work could be attached to it was a tolerably obvious mode of effecting it, a "headstock" resembling fig. 4 being the result. But the discarding of the dead-centre point and the substitution of a front bearing—a step which was essential to setting free the end of the mandrel, and so enabling it to carry the work—must have been accompanied by a loss of power and an amount of unsteadiness which quite account for the tenacity with which the simple pole-lathe and the very similar "spring-bow lathe" survived, and make it improbable that the mandrel was at first ever used in cases for which the older form was admissible. For even if it had been possible with the then existing means to render a mandrel sufficiently true, and to obtain an accurate fit between it and the bearing in which it revolved, wrong ideas prevailed as to the best form to be given to it,—the question indeed having only become a settled one within the memory of persons now living, after various unsatisfactory patterns had been tried and discarded. It is a matter of great importance, since the proper performance of a lathe is mainly dependent on the mandrel's maintaining a thoroughly good fit.

The types of modern lathes are as various as are the occupations of those who use them. The mechanic, the soft-wood turner, and the amateur, for instance, differ so greatly in their requirements that a lathe which would be well suited to the one would be very ill adapted, even if not wholly useless, to the other. Thus the professional turner of soft wood, with a lathe of which the frame and even the fly-wheel are of timber (its value in shillings being not very different from the price of an amateur's lathe in pounds) will use a high rate of speed and sharp tools and

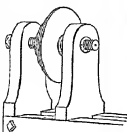


Fig. 4—Headstock.

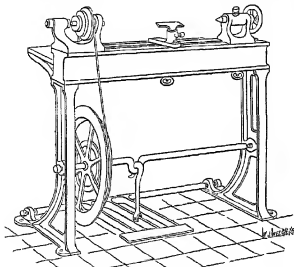


Fig. 5.—Mechanic's Lathe

light cuts, and so obtain results with which the owner of an elaborate instrument cannot at all compete. A modern mechanic's lathe on the other hand, such as fig. 5, has very different demands made upon it. For this the greatest possible steadiness in all the working parts is the main desideratum, and it is of great advantage to have the means of obtaining a slow speed, so as to be able to take the heaviest cuts which its strength and the power available warrant. Timber has accordingly given place either to cast iron or gun-metal or steel in almost every part of a

lathe of this class, the resulting increase of weight and firmness enabling the hand turner successfully to operate on small sizes of wrought iron or even steel, notwithstanding that in driving the fly-wheel his force can be applied only during a portion of each revolution.

In turning hard materials such as these it is of primary importance that the tool should be held more rigidly than it can with the hand when no support is available except that of a narrow T-headed rest. The difficulty of doing this was to some extent got over formerly by employing "heel tools," which transferred most of the strain directly to a flat-topped rest and made correspondingly reduced demands upon the arm of the turner; but it was never completely overcome till the introduction of the "slide-rest," placed the movement of the tool under complete control, and grasped it in a hand that never tires. Fig. 6 shows a

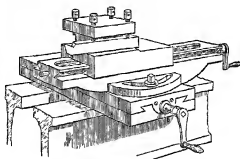


Fig. 6—Slide-Rest

slide-rest such as would be used with the lathe in the previous engraving, for which purpose simplicity of construction and steadiness in all its parts are the points chiefly aimed at. Slide-rests designed for amateurs' use are sometimes very different from this in respect of complication and the number of different movements of which they are capable, but each increase in the number of parts intervening between the lathe-bed and the tool is a source of possible unsteadiness which should not be introduced without reason.

Foremost amongst the more complicated lathes both in utility and in the date of their introduction stand "screw-cutting lathes," in which a regular spiral can be traced upon the work by self-acting means. The traversing mandrel, in which this end was formerly attained by giving a longitudinal motion to the mandrel and the work attached to it, and keeping the tool stationary, is now but little used, the modern plan of causing the slide-rest to travel along the bed automatically being more convenient in most instances. It involves, however, an amount of gearing almost inadmissible in a foot-lathe, and it is for those driven by steam-power that it is chiefly employed. These, being machine tools, do not come within our present subject. It should be mentioned that screws can be cut in foot-lathes by hand-chasing tools without any special arrangement, and they are done in this way to a great extent by telescope makers and others with beautiful regularity.

"Chucks"—a term which embraces most of the contrivances by which the turner establishes connexion between his work and the mandrel—have been made to contribute in various ways to the production of abnormal forms. The oval chuck is used (as its name implies) for giving an elliptical path to the work in lieu of a circular one. The eccentric chuck enables any point or any series of points in succession to be brought into a line with the axis of the mandrel. With the former chuck, therefore, a fixed tool can trace an ellipse on the face of the work, and with the latter a series of intersecting or adjacent circles can be described by it. In this way a great variety of intricate

"engine turned" patterns can be produced in the lathe, some idea of which may be gathered from the comparatively simple one shown in fig. 7. To the complicated apparatus known as the geometric chuck neither straight lines nor irregular curves are impossible. The "rose-engine" is a very old device for producing a somewhat similar kind of ornament, such as fig. 8, by giving a chattering motion to the mandrel, which is specially mounted on a vibrating frame for that purpose. The wavy lines on the backs of watches are engraved in this



FIG 7—An Engine-turned Pattern



FIG 8—Rose-engine Pattern

way, the curvature of the case not preventing the use of the rose-engine, as it would that of the eccentric chuck. But it is probable that these methods of producing face-work ornament will gradually disappear, and that all who still have leisure for doing them will prefer to use elliptic and eccentric and rose cutters fixed in the slide-rest and driven independently of the mandrel by overhead motion. With these similar results can be obtained, and the tool only instead of the entire mass of the work has to follow the desired curve.

Sketches of a few characteristic turning tools are given in fig. 9. A, a chisel, and B, a gouge, for soft wood, C, a heel tool for wrought iron, D, E, the enlarged ends of a pair of chasing tools for cutting outside and inside screw-threads, and F, G, two slide-rest tools. Of these last F is forged from a square bar of steel (an operation which must be repeated from time to time as

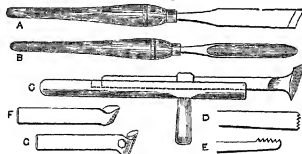


FIG 9—Turning Tools

the edge gets worn away), and G has an iron shank made once for all, from which the steel-cutting portion can be removed for the purpose of sharpening or renewal. The saving of tool-steel thus effected is of course no great consideration in the case of these small tools, but it is very considerable in the large axes used with the power lathes of the present day. Examples of these will be found under the heading MACHINE TOOLS (*q.v.*). (G. P. B. S.)

LATIMER, HUGH (c. 1490-1555), bishop of Worcester, and one of the chief promoters of the Reformation in England, was a native of Thracston, Leicestershire, and the son of a yeoman, who rented a farm "of three or four pounds by year at the uttermost." Of this farm he "filled as much as kept half a dozen men," retaining also grass for a hundred sheep and thirty cattle. The year of Latimer's birth is not definitely known. In the *Life* by Gilpin it is given as 1470, a palpable error, and possibly a misprint

for 1490.¹ Foxe states that at "the age of fourteen years he was sent to the university of Cambridge," and as he was elected fellow of Clare in 1509, his year of entrance was in all likelihood 1505. Latimer himself also, in mentioning his conversion from Romanism about 1523, says that it took place after he was thirty years of age. According to Foxe, Latimer went to school "at the age of four or thereabout." The purpose of his parents was to train him up "in the knowledge of all good literature," but his father "was as diligent to teach him to shoot as any other thing." As the yeomen of England were then in comparatively easy circumstances, the practice of sending their sons to the universities was quite usual, indeed Latimer mentions that in the reign of Edward VI., on account of the increase of rents, the universities had begun wonderfully to decay. He graduated B.A. in 1510, and M.A. in 1514. Before the latter date he had taken holy orders. While a student he was not unaccustomed "to make good cheer and be merry," but at the same time he was a punctilious observer of the minutest rites of his faith and "as obstinate a Papist as any in England." So keen was his opposition to the new learning that his oration on the occasion of taking his degree of bachelor of divinity was devoted to an attack on the opinions of Melancthon. It was this sermon that determined Bilney to go to Latimer's study, and ask him "for God's sake to hear his confession," the result being that "from that time forward he began to smell the word of God, and forsook the school doctors and such fooleries." Soon his discourses exercised a potent influence on learned and unlearned alike; and, although he restricted himself, as indeed was principally his custom through life, to the inculcation of practical righteousness, and the censure of clerical abuses, a rumour of his heretical tendencies reached the bishop of Ely, who resolved to become unexpectedly one of his audience. Latimer on seeing him enter the church boldly changed his theme to a portrayal of Christ as the pattern priest and bishop. The points of comparison were of course deeply distasteful to the prelate, who, though he professed his "obligations for the good admonition he had received," informed the preacher that he "smelt somewhat of the pan." Latimer was prohibited from preaching in the university or in any pulpits of the diocese, and on his occupying the pulpit of the Augustinian monastery, which enjoyed immunity from episcopal control, he was summoned to answer for his opinions before Wolsey, who, however, was so sensible of the value of such discourses that he gave him special licence to preach throughout England. At this time Protestant opinions were being disseminated in England chiefly by the surreptitious circulation of the works of Wickliffe, and especially of his translations of the New Testament. The newleaves had begun to communicate its subtle influence to the universities, but was working chiefly in secret and even to a great extent unconsciously to those affected by it, for many were in profound ignorance of the ultimate tendency of their own opinions. It was perhaps, as regards England, the most critical conjuncture in the history of the Reformation, both on this account and on account of the position in which Henry VIII. then stood related to it. In no small degree its ultimate fate seemed also to be placed in the hands of Latimer. In 1526 the imprudent zeal of Barnes had resulted in an ignominious recantation, and in 1527 Bilney, Latimer's

¹ The only reasons for assigning an earlier date are that he was commonly known as "Old Hugh Latimer," and that Berniet, his Swiss servant, states incidentally that he was "above threescore and seven years" in the reign of Edward VI. Bad health and anxieties probably made him look older than his years, but under Edward VI. his powers as an orator were in full vigour, and he was at his book table and summer at two o'clock in the morning.

most trusted confidant, incurred the displeasure of Walsay, and did humiliating penance for his offences. Latimer however, besides possessing far-seeing sagacity, quick insight into character, and a ready and formidable wit which thoroughly disconcerted and confounded his opponents, had naturally a distaste for mere theological discussion, and the truths he was in the habit of inculcating could scarcely be controverted, although, as he stated them, they were diametrically contradictory of prevailing errors both in doctrine and practice. In December 1529 he preached his two "Sermons on the Cards," which awakened a turbulent controversy in the university, and his opponents, finding that they were unable to cope with the dexterity and keenness of his satire, would undoubtedly have succeeded in getting him silenced by force, had it not been reported to the king that Latimer "favoured his cause," that is, the cause of the divorce. While, therefore, both parties were imperatively commanded to refrain from further dispute, Latimer was invited to preach before Henry in the Lent of 1530. The king was so pleased with the sermon that after it "he did most familiarly talk with him in a gallery." Of the special regard which Henry seemed to have conceived for him Latimer took advantage to pen the famous letter on the free circulation of the Scriptures, an address remarkable not only for what Mr Froude justly calls "its almost unexampled grandeur," but for its striking repudiation of the aid of temporal weapons to defend the faith, "for God," he says, "will not have it defended by man or man's power, but by his word only, by which he hath evermore defended it, and that by a way far above man's power and reason." Though the appeal was without effect on the immediate policy of Henry, he could not have been displeased with its tone, for shortly afterwards he appointed Latimer one of the royal chaplains. In times so "out of joint" Latimer soon became "weary of the court," and it was with a sense of relief that he accepted the living of West Kingston, Wiltshire, conferred on him by the king in 1531. Harassed by severe bodily ailments, encompassed by a raging tumult of religious conflict and persecution, and aware that the faint hopes of better times, which seemed to gild the horizon of the future, might be utterly darkened by a failure either in the constancy of his courage or in his discernment and discretion, he exerted his eloquence with unabating energy in the furtherance of the cause he had at heart. At last a sermon he was persuaded to preach in London exasperated Stokesley, bishop of the diocese, and seemed to furnish that fervent persecutor with an opportunity to overthrow the most dangerous champion of the new opinions. Bilney, of whom Latimer wrote, "if such as he shall die evil, what shall become of me!" perished at the stake in the autumn of 1531, and in January following Latimer was summoned to answer before the bishops in the consistory. After a tedious and captious examination, he was in March brought before convocation, and on refusing to subscribe certain articles was excommunicated and imprisoned, but through the interferences of the king he was finally released after he had voluntarily signified his acceptance of all the articles except two, and confessed that he had erred not only "in discretion but in doctrine." If in this confession he to some extent tampered with his conscience, there is every reason to believe that his culpable timidity was occasioned, not by personal fear, but by anxiety lest by his death he should hinder instead of promoting the cause of truth. After the consecration of Crammer in 1533 his position was completely altered. A commission appointed to inquire into the disturbances caused by his preaching in Bristol severely censured the conduct of his opponents; and, when the bishop prohibited him from preaching in his diocese, he obtained from Crammer a special licence to preach throughout the province of Canter-

bury. In 1534 Henry formally repudiated the authority of the pope, and from this time Latimer was the chief co-operator with Crammer and Cromwell in advising the king regarding the series of legislative measures which rendered that repudiation complete and irrevocable.

It was, however, the preaching of Latimer more than the edicts of Henry that established the principles of the Reformation in the minds and hearts of the people; and from his preaching the movement received its chief colour and complexion. The sermons of Latimer possess a combination of qualities which constitute them unique examples of that species of literature. It is possible to learn from them more regarding the social and political condition of the period than perhaps from any other source, for they abound, not only in exposures of religious abuses, and of the prevailing corruptions of society, but in references to many varieties of social injustice and unwisdom customs, in racy sketches of character, and in vivid pictures of special features of the time, occasionally illustrated by interesting incidents in his own life. The homely terseness of his style, his abounding humour, rough, cheery, and playful, but irresistible in its simplicity, and occasionally displaying sudden and dangerous barbs of satire, his avoidance of dogmatic subtleties and noble advocacy of practical righteousness, his bold and open denunciation of the oppression practised by the powerful, his soothing diatribes against ecclesiastical hypocrisy, the transparent honesty of his fervent zeal, tempered by sagacious moderation—these are the qualities which not only rendered his influence so paramount in his lifetime, but have transmitted his memory to posterity as perhaps that of the one among his contemporaries most worthy of our interest and admiration.

In September 1535 Latimer was consecrated bishop of Worcester. While holding this office he was selected to officiate as preacher when the friar Forest, whom he vainly endeavoured to move to submission, was burned at the stake for teaching treason to his penitents. In 1536, being opposed to the "Act of the Six Articles," Latimer resigned his bishopric, learning from Cromwell that this was the wish of the king. It would appear that on this point he was deceived, but as he now declined to accept the articles he was confined within the precincts of the palace of the bishop of Chichester. After the attainder of Cromwell little is known of him until 1546, when, on account of his connexion with the preacher Crome, he was summoned before the council at Greenwich, and committed to the Tower. Henry died before his final trial could take place, and the general pardon at the accession of Edward VI. procured him his liberty. He declined to resume his see, notwithstanding the special request of the Commons, but in January 1548 again began to preach, and with more effectiveness than ever, crowds thronging to listen to him both in London and in the country. Shortly after the accession of Mary in 1553 a summons was sent to Latimer to appear before the council at Westminster. Though he might have escaped by flight, and though he knew, as he quaintly remarked, that "Smithfield already groaned for him," he at once joyfully obeyed. The pursuivant, he said, was "a welcome messenger." The hardships of his imprisonment, and the long disputations at Oxford, told severely on his health, but he endured all with unbroken cheerfulness. On October 16, 1555, he and Ridley were led to the stake at Oxford. Never was man more free than Latimer from the taint of fanaticism or less dominated by "vainglory," but the motives which now inspired his courage not only placed him beyond the influence of fear, but enabled him to taste in dying an ineffable thrill of victorious achievement. Ridley he greeted with the words, "Be of good comfort, Master Ridley, and play the man; we shall this day light such a candle by God's grace in

The inscription is as follows —
 Jovis Sat dextro qui med matris, not ed endo comis virco ued,
 ased nois Op Totetia pasci vois.

Dreos med fced en manom enom dreosme med mao statod.

The general style of the writing and the phonetic peculiarities make it pretty certain that this work must have been produced not later than 800 A.D., the characters employed prove that the writer was familiar with one of the dialects spoken in the hilly country to the east of Rome, but on the whole the language may be taken as Latin. Some points in its interpretation are still open to doubt, but the probable interpretation is as follows:

Jovi Saturno civis qui (= ei) qua me mitet, ne te endo (= in te) comis virgo at, sed nra Op Totetia pasci vo.

Dreos me fecit in manum enim de nou me mano statod.

"If any one brings me to the gods Jupiter and Saturn, let not any maiden be kindly to thee, except unless thou wilt offer a sacrifice to Ops Tutela."

"Dreos made me for the offering to the dead, therefore on the ninth day place me for the offering for the dead."

The noteworthy phenomena here are the retention not only of *en* but of the much more archaic *on*, apparently taking the place of the former by a dialectic variation, *on* in *comis* for a short *en*; *et* for *e* in *fecit*, *e* before *o*, and *ed* apparently to represent the sound of *dy* (-y).

A bronze tablet recently discovered near the Fucine Lake, and some works of art found at Palestrina, belong to the same period. They are undoubtedly Latin, but the Latin has been mixed with other elements so that it would have been quite unintelligible to a native of Rome.

Of the earlier long inscriptions the most important would be the Columna Rostrata, or column of Duilius, erected to commemorate his victory over the Carthaginians in 260 B.C., but for the uncertainty as to the extent to which it has suffered from the hands of restorers. The shape of the letters plainly shows that the inscription, as we have it, was cut in the time of the empire. Hence Ritschl and Mommsen suppose that the language was modified at the same time, and that, although many archaisms have been retained, some were falsely introduced, and others replaced by more modern forms. The most noteworthy features in it are—C always for G (CÆSET = *gaeset*); D retained in the ablative (*e g*, in *alled marid*), *e* for *u* in inflections (*prinsus*, *exfocent* = *exquingent*), single for double consonants (*desert* = *desertus*), *e* for *i* (*involens* = *involens*, *secund* = *secundus*); of these the first is probably an affected archaism. G having been introduced some time before the assumed date of the inscription. On the other hand, we have *prædes* where we should have expected *prædes*; no final consonants are dropped; and the forms *de*, *es*, and *et* for the consecutive plural are unchanged exceptively. The doubts here arising preclude the possibility of using it with confidence as contemporary evidence for the state of the language.

Of unquestionable genuineness and the greatest value are the *Sarcophagi*, inscribed on stone coffins, found in the monument of the Scipios outside the Capene gate. The earliest of the family whose epitaph has been preserved is L. Cornelius Scipio Barbatus (consul 298 B.C.), the latest C. Cornelius Scipio Hispanus (praetor in 189 B.C.); but there are good reasons for believing with Ritschl that the epitaph of the first was not contemporary, but was somewhat later than that of the son (consul 269 B.C.). The last may therefore be taken as the earliest specimen of any length of Latin as it was written at Rome, it runs as follows—

honouco. plourime. coenobunt. i. comas
 dionoro. optime. fulis. ulro [vervum]
 ludom. seipione. i. barbatu
 coenol. noenno. adilla. hic. fust. a [pud eos]
 he jo. cept. coenno. aleraque. urbe in pugnamodo
 adidet. tempestatibus. aule. mereto [d. votum].

The archaisms in this inscription are—(1) the retention of *e* for *u* in the inflection of both nouns and verbs; (2) the diphthongs *oi* (= *ui*) and *ou* (= *ou*); (3) *et* for *et*, *he* for *hic*, and *obae* for *obae*; (4) the absence of double consonants, and (5) *duon* for *duo*. On the other hand, the dropping of a final *m* in every case except in *Lucum* is a sign of the tendency to lighten final syllables, which is a marked characteristic of the language of this period.

In the epitaph of Scipio Barbatus, a nowhere appears where the later language has *u*, except in the doubtful case of *Sannio* (= *Sannius*). The diphthongs *oi* and *ou*, as well as *et*, are found in the latest of all the Scipio inscriptions (*aid cur* = *aditus curia*), as well as in the *Epistola Cornelium ad Tullianum* (187 B.C.), and in a letter actually contemporary dated of L. Scipio *Horatius*, iii. 248 B.C.; but in a somewhat earlier epitaph to a Scipio (L. Cornelius Ch. F. Ch. n. Scipio) we have *actio*. Of *et* for *et* and the like there are other examples in *dedi* (C. I. R., 69), comp. *dedi* in C. I. R., 82; *novobus* (= *duo*) of the Duilian column.

¹ Comp. Jordan in *Herms*, xvi. 225-60; Bucheler in *Zeitsch. Mus.*, xxxv. 285 sq.

Double consonants first appear in the decree of *Manlius*, though not regularly (comp. *procedunt* by *essent* and *procedere*); in the *Epist. ad Tull.* they are still not used. *Thonus* is not found elsewhere, except in the *Carmen Salutare*, but *Duolonus* for *Tholonus* appears in the *Epist. ad Tull.*; and *duolonus* for *bellum* occurs in *Ennius* and *Plautus*, as a legal archaism in *Cicero*, and as a poetic variation in *Horace*, *Ornd*, and *Jermal*.

A number of precious indications of archaisms on the one hand and mutilated forms on the other are supplied by deducatory tablets of about the same age found in Picenum and Latium. As specimens of the former we may select *Maurie* = *Mauri*, *præidæ* = *præidæ*, *Janus* = *Janus*; of the latter, *deduct* or *deict* or *deict*, *delerat*, *dedat*, *dedat*, *capu* = *caput*; the omission of a final *n* is also common.

It was a turning point in the history of the Latin language when Roman literature took its rise under the influence of the Greek culture. It is a reasonable conjecture that the much greater corruption of the Umbrian dialect as compared with the Latin, and of the Latin as compared with the Oscan, in regard to the precise representation of sound, was due mainly to the varying degrees of contact with Greek civilization. The inscriptions dating from the fifth century of the city show the greatest archaism in such points as the insertion or omission of final *s* and *m*, and of *e* before *s*, and in the distinction of *e* and *u*, and *a*. The language of *Plautus* shows us the struggle of the two tendencies in the plainest manner. On the one hand we have numerous archaisms not only in form but in quantity. Of the old long vowels in final syllables we have the following still retained, not indeed always, but when it is convenient for the verse—

- a* in the nom. and voc. of the first declension:
ne epistula quoniam illa at in ætibus (*Adm.*, 762)
-bae in dat. and abl. plur. [usually where a pause in the sense affords some justification]:
ut ego illic coelis exuriam flammulis ardentes (*Afen.*, 842)
-e in nom. of substantives, and comparatives, and also in verb-nom. quoniam *deus in fingebat, dūm non vixit ram* (*Adm.*, 927)
tantū mī sēgratūo auctū est in animo (*Isoclast.*, 782)
pōi qū quidem expirite ite ut prædes, Prædesio (*Adm.*, 638).
-i in nom. of substantives, and comparatives, and also in verb-nom. *maus fuit pater Antimachus, ego vero Lyconides* (*Adm.*, 772)
-u, not only in the subj. (where it is a contraction for *-ū*) and in the perf. ind., but even in the present:
pōtione aliquid, prius quam pēcipit insana (*Mem.*, 921)

quod quique in animo habet aut habuit, eant (*Trin.*, 806).
 [Ritschl, "in animo habet"]

fundum alium arit, inouum familiarem dēcent (*Ann.*, 874)

On the other hand we have much more commonly traces of the destructive influence which was beginning to affect the tenso powerfully the form of Latin words, especially in their final syllables. From causes which it is now impossible to discover, the freer acoustication of earlier times, the existence of which was proved incidentally by Verner in his famous paper on some exceptions to the law of "Lautverschiebung" (*Kuhn's Zeitschrift*, xxiii. 97-138), had been given up in favour of a more rigid system, which never allowed the accent to fall on the final syllable. Hence there was a constant struggle between the desire to preserve the older quantity of the final vowel and the tendency to shorten an unaccented syllable. This difficulty of preserving the quantity of the final vowel is naturally greatest when the accented syllable is short; hence we are led to the formula that for *Plautus*, and therefore for the spoken language of his time—

This holds good for all vowels, whether in nouns or in verbs, e.g.:
a: *actus* si futurum; *rogū* me viginti minas (*Pœt.*, 114).
e: *carū* præteritis illas ædis quin rogo (*Æpid.*, 438)
i: *ment* bellatoris signum; *quis* hic præsentia sicut (*Mit.*, 1077).
o: *nostrū* libertis quos dēt quod pæpēt. dicitur, præbebo cibum (*Æpid.*, 737).
u: *quod* mandū nequeunt tūgere, tantum illi habent, quō minas appetunt (*Trin.*, 288).

The last case is a rare one; the others are very common.

But further, forms like those quoted above from the inscriptions, *e.g.*, *dedro, oino, cuba*, &c., led Ritschl and his followers to the recognition of the fact that even at this early time there was a strong tendency to drop the final consonant in Latin, and this at once furnished a clue to the proper interpretation of many metrical phenomena in Plautus, which had previously been explained on wholly incorrect assumptions.

In the case of a line like *Trin*, 306,

nô libi segredimâm pater pateram, parsi sêdulo,

it was assumed that *pater* was pronounced like *pâre*, in order to avoid the apparent neglect of the law of position, which would, according to the practice of the classical poets, have lengthened the syllable *ter*. Two considerations suffice to dispose of this hypothesis:—first, there is no evidence whatever that a mute between two vowels was ever dropped in early Latin, secondly, if *pater* became by "compression" *pâre*, it would be natural to find *inter* becoming *ivare*; but in no case does a form with the first syllable long and the second lengthened by position take the place of one long syllable. On the other hand, there is positive evidence of a varied and unquestionable character to show that a final consonant was frequently dropped in pronunciation, especially in an iambic word. Hence it is clear that *pater* was pronounced *pâtr*, not *pâre*. This shows too that it was not the case, as has been asserted, that a final *r* was dropped only when it took the place of an earlier *r*, although this is doubtless the most common instance of its omission. The consonants most commonly dropped are the following:—
1. *g*, *g*, *num*(i) *lêpide fecit verba ad paramoniam* (*Aul*, 468). This licence is retained by Ennius (*g.g.*, *Aen*, 601, *tum laterale*) *dolor, caritumina*(s) *nuntia*(s) *mora*(s), and is common even in Lucretius. Cicero (*Orat*, 48, 161) speaks as if it had been the usual pronunciation in his own earlier days, and he admits it seven or eight times in his version of Aratus, *e.g.*, *magna*(s) *Leo*, &c.
2. *m*, *e.g.*, *dâm quid(m)* *ne qui pœrœtoris quod m* *head* *habet* *proloqui*.

The practice of eliding a syllable ending in *m* before a following vowel shows how lightly this consonant was pronounced even by the classical poets. It is very frequently omitted in inscriptions of every period (comp. Corssen, l. 287-74). As Quinctilian (*ix*, 4, 40) says, "in parum exprimitur" *necne enim eximetur, sed excutitur*." In this respect Umbrian quite agreed with popular Latin, but Oscan and Volscian carefully preserved the *m* (Corssen, l. 276).
3. *t*, *e.g.*, *set arroboi dedit*(i) *quadragesimâ minas* (*Alost*, 648).
So in inscriptions *dê* (*O I L*, i. 5218).
4. *l*, *e.g.*, *lucipid*(s) *Cos magna labe magna famulast* (*Aul*, 340).
r—*as above*, or, *e.g.*, *pater vixit* and *quid pœrtum autem*, *bêlus* (*Ter*, *Phorm*, 601).

5. *s*, *e.g.*, *et stum*(i) *conficiam ficihus ego quod volo* (*Ter*, *Heaut*, 808).
6. *s*, *e.g.*, *ad quid istuo est quod vos agitis? nōn hœst tane(m)* *sêpior* (*Ter*, *Eur*, 874).

It is doubtful whether the last two licences occur in Plautus. Occasionally we find these two tendencies concurring, and producing a short final syllable by the loss of a final consonant and the shortening of a vowel naturally long under the influence of the accent, so that we have forms like *oes*, *iose*, *uies*, *reios*, *maeu*, scanned as two short syllables, not only (a) before vowels, but (b) even before consonants, *e.g.*—

(a) *œni* *mordicus me aduident, bœvœ moursent cœribus* (*Aul*, 293).

(b) *lêpis fore iumbus quo sub tœre arguist modo* (*Aul*, 690)
vêre *noctre quibus tibi nos voluist esse matre famulus* (*Aul*, 98).

Ad pupillas famile ferat, labris & labris insequam afferrat (*Stach*, 480).

The tendency to drop the final consonant of an iambic word is further extended to groups of words of the same scansion, especially when the second is a preposition, as in

quis id fore est? &c. (*Amphitr*, 1014)
Opte id, quod sit contigit tibi vis (*Aen*, 718).

Accent had also an important effect in inducing the voice to hurry over unaccented syllables, even though long by position, in order to lay full stress upon an accented syllable. But this naturally took place only when the syllable thus shortened was itself preceded by a short syllable so that the formula for this process is *-4=* *u u . .*. Under this head we may bring a large number of instances of apparent neglect of quantity. Many of these are cases where the usual spelling is with a double consonant. Some have argued that as doubled consonants were not used in writing before the time of Ennius (*Fest*, s. v.

"*Solitaria*," p. 293, confirmed from inscriptions by Ritschl, *P. L. M. S.*, p. 123), this is an indication that the pronunciation fluctuated, but it is doubtful whether this was ever the case except under the influence of the accent; and this influence was quite as powerful over syllables followed by two different consonants as by a doubled consonant.

Thus, *pei* *innōnem caram dixit me natum pater* (*Stach*, 179)

does not differ in principle from

qua omnia bonas bondaque adcurare dâdœet (*Trin*, 78);

and the unusual quantity of the last two words in *nô potius oneratus noemet vicissim volupstatibus* (*Stich*, 532) is to be explained in precisely the same way, except that in the latter the voice is hurrying on to dwell upon a long accented syllable, in the former the accent has already fallen on a short accented syllable, a fact which naturally tends to elaten the following unaccented one. Compare for this

configo aquilas fides thesaurizans (*Aul*, 395)

where Goetz after Fleckenstein reads "agius" =

The combinations before which position is most commonly neglected are the following:—

ut *si id mea voluntate factum* (*Trin*, 1186).

pe *voluptatē inens tantum* (*Rud*, 459).

et *negligit*, *si que me hanc labore vident* (*Rud*, 477).

rem *claudem in capiti dormio blandam in tabernaculo* (*Trin*, 728).

ps *scio* *lêpide dictum hoc defensores dicere* (*Capt*, 69).

eg *sed* *ans ingento frustra es* . . . (*Pseud*, 378).

It is needless to dwell further upon the details of Platine scansion. The foregoing instances will have made it clear that, while there are some archaisms still retained, on the whole the language was beginning to suffer from that process of disintegration, which has left such marked traces upon almost every modern language.

The introduction of Greek metres for the drama doubtless did much to check this process, and it is probable that, even in the earliest Roman comedies, licences of pronunciation are much less common than they were in the popular language of the time. But the iambic and trochaic measures, especially as employed by the Roman poets, admitted of a free treatment, which left room for much laxity. It was not until the hexameter came to be used for poetry that the laws of prosody were definitely fixed. The rigid canon of dactylic verse required that the pronunciation should be strictly determined; and hence Ennius, although he does not appear to have introduced any marked changes in generally recognized rules of quantity, was compelled to settle positively much which had previously been fluctuating, and so to lay down the line to which subsequent poetical works had to conform. From this time forward the literary language of Rome parted company from the popular dialect. It has been said with truth that even to the classical writers Latin was in a certain sense a dead language. Its vocabulary was not identical with that of ordinary life. Literary works, whether in prose or in verse, had to conform to a fixed standard. Now and again a writer of fresh originality would lend new vigour to his style by phrases and constructions drawn from homely speech. But on the whole, and in ever increasing measure, the language of literature was the language of the schools, adapted to foreign models. The genuine current of Italian speech is lost to view with Plautus and Terence, and reappears only in the semi-barbarous products of the early Roman literature.

This appears the proper place for a rapid survey of the Pronunciation of the Latin language, as spoken in its best classical days.

CONSONANTS.—1. *Capitalis* (a) Sonant G, pronounced as in English, but never softened before about the 6th century after Christ. (b) Sonant G, pronounced always as *g* (except that in some early

¹ The evidence for this pronunciation of *s* will be found best stated in Corssen, l. 43-67, and Roby, l. xlvii-lv. It may be summed up as follows:—(1) In some words the letter following *s* varies in a

inscriptions the character is used for G) until about the 7th century after Christ. K went out of use at an early period, except in a few old abbreviations for words in which it had stood before a, e.g. *kal* for *kalendis*. Q always followed by the consonantal s, except in a few old inscriptions, in which it is followed by the vowel u, e.g. *sequens*. X, an abbreviation for ex, es u, however, sometimes found. (c) Aspirate H, the rough breathing as in English.

3. *Palatal*. The spirit J, like the English y, is only in late inscriptions that we find, in spellings like *Zanavus*, *Olene*, any indication of a pronunciation like the English.

4. *Language*. (a) R as in English, but probably produced more with the point of the tongue. (b) L as in English. (c) S, always euri when initial, but at one time sonant between vowels, and possibly when final. (d) Z only found in the transcription of Greek words in and after the time of Cicero.

5. *Dental*. (a) Sonant, D as in English, but by the end of the 4th century d before a vowel was pronounced like our f (comp. *diurnal* and *journal*). (b) Surd, T as in English. (c) Nasal, N as in English, but also (like the English n) a guttural nasal (ng) before a guttural. Apparently it was very lightly pronounced, and easily fell away before s.

6. *Labial*. (a) Sonant, B as in English, but occasionally in inscriptions of the later empire it is written for b, showing that in some cases b had already acquired the soft sound of the contemporary P. B before a sharp s was pronounced p, e.g., in *uris*. (b) Surd, P as in English. (c) Nasal, M as in English, but very slightly pronounced at the end of a word. (d) Spirit, V like the own Fr. ou, but probably often approximating to the South German w, e.g., a labial, not (like the English v) a labio-dental v.

7. *Labio-dental*. Spirit, F as in English.

II. *Vowels*. — a, e, i, as the English a, oo, ee; o, u, a sound coming nearer to our than the English o; e, an open Italian e, nearly as the vowel of *pet* in English. The short sound of each vowel was probably identical in quality with the long sound, differing only in quantity. Hence a was pronounced as in the French *chaix*, e nearly as in *petit*, i nearly as in *pit*, o as in *dot*, u nearly as in *put*. The diphthongs were produced by pronouncing the vowels of which they were composed very rapidly according to the above scheme. Thus *ae* — somewhat broader than *oe* in *house*, *ai* like *oi* in the Yankee pronunciation of *town*, as like the vowel in *had* lengthened, with perhaps somewhat more approximation to the *i* in *view*; *oe*, a sound intermediate between o and e; *ou*, nearly as in *found*, with the greater stress on the o; *ui*, as the French *oui*.

The changes which may be detected in the Latin language during the period of its literary development may be arranged under the heads of (1) vocabulary, (2) inflexion, (3) word formation, (4) syntax.

These will be best regarded separately in connexion with the four principal stages in the history of the language, which may be given, with their chief writers, as follows: — I. *Ante-Classical* (240–80 B.C.) — Nævius (189–204), Plautus (204–184), Ennius (189–169), Cato (234–149), Terentius (119–159), Pœtius (220–132), Accius (170–84), Lucilius (118–108).

II. *Classical—Golden Age* (80 B.C.–14 A.D.) — Varro (116–28), Cicero (106–44), Lucretius (99–55), Cæsar (100–44), Octavian (87–47), Sallust (86–34), Virgil (70–19), Horace (65–8), Propertius (180–?), Tibullus (14–18), Ovid (43 B.C.–18 A.D.), Livy (59 B.C.–18 A.D.).

III. *Classical—Silver Age* (14–180 A.D.) — Valerius (119 A.D.–131 A.D.), M. Seneca (died c. 30 A.D.), Persius (84–82), Petronius (died 65), Lucan (39–65), L. Seneca (died 65 A.D.), Plinius major (23–79 A.D.), Martial (40–101), Quintilian (42–118), Plinius minor (61–113), Tacitus (16–101), Juvenal (147–138), Suetonius (75–180), Fronto (c. 90–170).

IV. *Post-Classical*.

number which makes it impossible to believe that the pronunciation of the o depended upon this, e.g., *decimus* and *decimæ*, *capit* and *capitæ*; (2) if o was pronounced before e and s otherwise than before a, o, and u, it is hard to see why it should not have been retained for the latter use; (3) as the writer gives every hint of a varying pronunciation of e; (4) a Greek e is always transcribed by e, i, and e; (5) Latin words containing a borrowed or Gothic and early High German are always spelt with æ. To these arguments it may be added that the varying pronunciations of oe, oi in the Romance languages are inseparable except as derived independently from an original *ae*, *ai*.

The additions made to the vocabulary of the Latin Greek language from the Greek belong to four different stages (Corssen, i. 814). The first corresponds to the period of the early intercourse of Rome with the Greek states, especially with the colonies in the south of Italy and Sicily. To this stage belong many names of nations, countries, and towns, as *Siculi*, *Tarentum*, *Græci*, *Acher*, *Karthago*, *Pœnus*; and also names of weights and measures, articles of industry, and terms connected with navigation, as *drachma*, *mana*, *talentum*, *purpura*, *machina*, *patina*, *ancora*, *aplustre*, *navis*. To these may be added names of gods or heroes, like *Apollō*, *Pollux*, and perhaps *Hercules*. These were all freely adapted to the phonetic laws of the Latin language.

A second stage is marked by the closer intercourse resulting from the conquest of southern Italy, and the wars in Sicily, and by the contemporary introduction of imitations of Greek literature into Rome, with its numerous references to Greek life and culture. In this stage, also, Greek words were freely adapted to the forms familiar to Roman ears: we find words like *penulus*, *scutula*, *amurex*, *jugum*, *balineum*, *bucana*, *techina*, *conscium*, *canistrum*, *carcer*, *sona* (*quint*), *tarpessita*, &c. In many cases hybrid forms are freely employed, whether by the addition of Latin suffixes to Greek stems as *ballistarius*, *hepatarius*, *subatellus*, *acus*, *epiphantiorus*, or of Greek suffixes to Latin stems as *piagipatadas*, *peronoides*; or by derivation, as *temopolare*, *supplantans*; or by composition as *meueneche*, *thyrisgera*, *flagitribus*, *seropipacai*. The character of many of these words shows that the comic poets who indulged in them must have been able to calculate upon a fair knowledge of colloquial Greek on the part of a considerable portion of their audience. The most remarkable instance of this is supplied by the burlesque lines in Plautus (*Pœt.*, 702 *sg.*), where Sgaristio describes himself as

Vanilequodens, Virgineuendens,
Nugipalantiquodens, Argentumextrobrovendes,
Tediuguloquodens, Nummosexalpondens,
Quodsemelcapitales, Nunquampostroquodens.

During this period Greek words are generally inflected according to the Latin usage.

But with Accius begins a third stage, in which the Greek inflexion is frequently preserved, e.g., *Hectora*, *Orestes*, *Citlaeron*; and from this time forward the practice wavers. Cicero generally prefers the Latin case-endings, defending, e.g., *Paræum* as against *Piræes* (*Ad Att.*, vii. 3, 7), but not without some fluctuation, while Varro takes the opposite side, and prefers *pœmatia* to the Ciceronian *pœmata*. By this time also y and s were introduced, and words newly borrowed from the Greek were faithfully reproduced.

A fourth stage is marked by the practice of the Augustan poets, who, especially when writing in imitation of Greek originals, freely use the Greek inflexions, such as *Aræides*, *Talys*, *Agida*, *Echda*, &c. Horace probably always used the Greek form in his *Odes*, the Latin in his *Satires* and *Epistles*. Later prose writers for the most part followed the example thus set.

In Plautus we have the best example of the vigorous Italian idiom, enriched, but in no way fettered by grace of imitation of the Greek. His constructions are sometimes free, and do not square with the canons of later grammarians; but there is much life and freshness, and it is very rarely that the right phrase is lacking to set forth his meaning with telling vigor.

The chief peculiarities of his grammar are:—

1. The use of some substantives with a gender different from that afterwards usual, e.g., *dormus*, *colinus*, *scævus*.
2. The retention of inflexions afterwards obsolete or retained only in exalted phrases: æ in the subj. pres., *dicent*, *crederetis*, *poteris*, *desperetis*. With regard to some of these archaic inflexions it is still a question how far they may be safely restored to the text of

Plautus, e.g., *homonem, cabi, cande, &c.*, the ablative *d*, nom. plur. in *-es, -as, -udis*, &c.

3. The use of words excluded from the language of classical literature, but reappearing in the popular dialect e.g., *supplicatio, ira, letuere, elapere, bellus, existerere, cancellare, nautica, savius, &c.* Under this head we may place the very frequent employment of diminutives, e.g., *pugilatum, herculidulum, appressumale, &c.*, especially as terms of endearment, "marum concubum, meliculum, veruculum," "passerculum, lacedilum, melilum, aniculum, monerulum, catellum, pulellum, &c." the use of *con, ad, &c.* de as strengthening particles, and of abstract nouns, especially in the plural, —all marks of the *plebeius sermo*.

4. Syntactical constructions afterwards unusual. e.g., the accusative after verbs like *fugere* and *videre*, the accusative of the object after the gerundive (*aptandum est videri*), the infinitive in indirect questions and with *cum* signifying "since" or "although"; present infinitive instead of future after verbs of promising; *quis* after verbs of feeling, instead of *quid, quoniam* = "since," "after"; infinitive with purpose of motion, *concedo* and *condono* with double accusative; *decuris, equis, &c.* and *exere* with ablative; *veror* with genitive; *similis* with genitive, *quid hoc est hominis*; *facere tuum, compendi*; *face* with a future logically dependent, the frequent use of *Apuro* synonymously, *adus ut, prapram, present*. There is a free use of verbs in the *2d*: *quid tibi hanc curvata est rem aut multatio*. By a laxity common in popular language verbs of seeing, knowing, asking, &c., are followed by a direct, not an indirect, question *scis ego, quis reddidisti?* *Agratulus* is very frequently employed to give life and rapidity to the style. e.g. (*Pseud.*, 168), *legido vobis, vno, unigenito, videri potius pulcherrimo*.

Nervius. In Nervius we find archaisms proportionally much more numerous than in Plautus, especially in the retention of the original length of vowels, and early forms of inflexion, such as the genitive in *-ae*, and the ablative in *-d*; shortenings do not seem so numerous. The number of archaic words preserved is perhaps due to the fact that so large a proportion of his fragments have been preserved only by the grammarians, who cited them for the express purpose of explaining these. The language of Ennius deserves especial study because of the immense influence which he exerted in fixing the literary style. He first established the rule that in hexameter verse all vowels followed by two consonants (except in the case of a mute and a liquid) or a double consonant, must be treated as lengthened by position. The number of varying quantities is also much diminished, and the elision of final *m* becomes the rule, though not without exceptions. On the other hand he very commonly retains the original length of verbal terminations (*ponit, eist, facit*) and of nominatives in *-or* and *-a*, and elides final *s* before an initial consonant. In declension he never uses *-ae* as the genitive, but *-ai* or *-as*; he has an inflexion *Meoos Paphlago*, probably intended for a dative; the shorter form of the gen. plur. is *-um* in common; obsolete forms of pronouns are used, as *me, olit, sum* (= *eam*), *sis, nos, apes*; and in verbal inflexion there are irregularities like *moritur, furimus, potestur, contidit, &c.* Some experiments in the way of trochees (*saxo cere cominit -brum*) and apocope (*divum domus altissum cael*, replet te lastifium gaz) were happily regarded as failures, and never took root in the language. His syntax is simple and straightforward, with the occasional pleonasm of a rude style, and conjunctions are comparatively rare.

Pacuvius. Pacuvius is noteworthy especially for his attempt to introduce a free use of compounds after the fashion of the Greek, which were felt in the classical times to be unsuited to the genius of the Latin language. Quintilian censures severely his line—
Nere repanditrem meumvevricum pecus
Acuvius. Acuvius, though probably the greatest of the Roman tragedians, is only preserved in comparatively unimportant fragments. We know that he paid much attention to grammar and orthography; and his language is much more finished than that of Ennius. It shows no marked archaisms of form, unless the infinitive in *-ier* is to be accounted as such. Lucilius furnishes a specimen of the language of the

period, free from the restraints of tragic diction and the imitation of Greek originals. Unfortunately the greater part of his fragments are preserved only by a grammarian whose text is exceptionally corrupt, but they leave no doubt as to the justice of the criticism passed by Horace on his careless and "muddy" diction. The *urbanitas* which is with one accord conceded to him by ancient critics seems to indicate that his style was regarded as free from the taint of provincial Latinity, and it may be regarded as reproducing the language of the educated circles in ordinary life; even the numerous Greekisms and Greek quotations with which it abounds show the familiarity of his readers with the Greek language and literature. Varro ascribes to him the *gracile genus dicendi*, the distinguishing feature of which were *venustus* and *subrilis*. Hence it appears that his numerous archaisms were regarded as in no way inconsistent with grace and precision of diction. But it may be remembered that Varro was himself something of an archaizer, and also that the grammarians' quotations may bring this aspect of his language too much into prominence. It is to be feared that the disgusting coarseness of many of his lines did not lose them favour with the circle for whom he wrote. He shares with the comic poets the use of many plebeian expressions, the love for diminutives, abstract terms, and words of abuse; but occasionally he borrows from the more elevated style of Ennius forms like *simus* (= *simul*), *novus* (= *non*), *facul* (= *facile*), and the genitive in *-as*, and he ridicules the contemporary tragedians for their *setematis*, their high-flown diction and *aequipedalis verba*, which make the characters talk "not like men but like portents, flying winged snakes." In his ninth book he discusses questions of grammar, and gives some interesting facts as to the tendencies of the language. For instance, when he ridicules a *praetor urbanus* for calling himself *praetor*, we see already the beginning of the confusion of *ae* and *e*, which afterwards became universal. He shows a great command of technical language, and (partly owing to the nature of the fragments) *ἀρχαῖ λέγόμενα* are very numerous.

The treatise of Cato *De Re Rustica* would have afforded Cato invaluable material, but it has unfortunately come down to us in a text greatly modernized. As it is, it is of interest from the point of view of literature rather than of language. We find in it instances of the accusative with *ut*, of the old imperative *praeferamino*, and of the fut. subj. *servasis, prohibeas*; but there is nothing which can be added to what we learn from Plautus.

It is unfortunately impossible to trace the growth of Latin prose diction through its several stages with the same clearness as in the case of poetry. The fragments of the earlier Latin prose writers are too scanty for us to be able to say with certainty when and how a formed prose style was created. But the impulse to it was undoubtedly given in the habitual practice of oratory. The earliest orators, like Cato, were distinguished for strong common sense, biting wit, and vigorous language, rather than for any grace of style; and probably personal *auctoritas* was of far more account than rhetoric both in the law courts and in the assemblies of the people. The first public speaker, according to Cicero, who aimed at a polished style, and elaborate periods, was M. Aemilius Lepidus Porcino, in the middle of the 2d century B.C.¹ On his model the Gracchi and Cato fashioned themselves, and if we may judge from the fragments of the orations of C. Gracchus which are preserved, there were few traces of archaism remaining. A more perfect example of the *urbanitas* at which good speakers aimed was supplied by a famous

¹ Cicero also refers to certain *scriptis distichis* of the son of Scipio Africanus Major, which must have possessed some merits of style.

Lucilius furnishes a specimen of the language of the

speech of C. Fannius against C. Gracchus, which Cicero considered the best of all orations of the time. No small part of the *urbanitas* consisted in a pronunciation equally removed from boorish roughness and from foreign affectations; and the standard of this was found in the language of the women of the upper classes, such as Lælia and Cornelia.

In the earliest continuous prose work which remains to us, the four books *De Rhetorica ad Herennium*, we find the language already almost indistinguishable from that of Cicero. There has been much discussion as to the authorship of this work, now commonly, without very convincing reasons, ascribed to Q. Cornificius; but, among the numerous arguments which prove that it cannot have been the work of Cicero, none has been adduced of any importance drawn from the character of the language. It is worth while noticing that not only is the style in itself perfectly finished, but the treatment of the subject of style, *elocutio* (iv. 12, 17), shows the pains which had already been given to the question. The writer lays down three chief requisites—(1) *elegantia*, (2) *compositio*, and (3) *dignitas*. Under the first come *Latinities*, a due avoidance of solecisms and barbarisms, and *explanatio*, clearness, the employment of familiar and appropriate expressions. The second demands a proper arrangement, free from hiatus, alliteration, rhyme, the repetition or displacement of words, and too long sentences. Dignity depends upon the selection of language and of sentiments.

Clarity-
tenacious
of Latin
prose

Hence we see that by the time of Cicero Latin prose was fully developed. We may, therefore, pause here to notice the characteristic qualities of the language at its most perfect stage. The Latin critics were themselves fully conscious of the broad distinction in character between their own language and the Greek. Seneca dwells upon the stately and dignified movement of the Latin period, and uses for Cicero the happy epithet of *gradarius*. He allows to the Greeks *gratia*, but claims *potestas* for his own countrymen. Quintilian (xii. 10, 27 *sq.*) concedes to Greek more euphony and variety both of vocalization and of accent; he admits that Latin words are harsher in sound, and often less happily adapted to the expression of varying shades of meaning. But he too claims "power" as the distinguishing mark of his own language. Feeble thought may be carried off by the exquisite harmony and subleness of Greek diction; his countrymen must aim at fulness and weight of ideas if they are not to be beaten off the field. The Greek authors are like lightly moving skiffs; the Romans spread wider sails and are wafted by stronger breezes, hence the deeper waters suit them. It is not that the Latin language fails to respond to the calls that are made upon it. Lucretius and Cicero concur, it is true, in complaints of the poverty of their native language, but this was only because they had had no predecessors in the task of adapting it to philosophic utterance; and the long life of Latin technical terms like *qualitas*, *species*, *genus*, *ratio*, shows how well the need was met when it arose. Mr Munro has said admirably of this very period—

"The living Latin for all the higher forms of composition, both prose and verse, was a far nobler language than the living Greek. During the long period of Grecian pre-eminence and literary glory, from Homer to Demosthenes, all the manifold forms of poetry and prose which were invented came after the others were brought to such exquisite perfection that their beauty of form and grace of language were never afterwards rivalled by Latin or any other people. But hardly had Demosthenes and Aristotle ceased to live when that Attic which had been gradually formed into such a noble instrument of thought in the hands of Aristophanes, Euripides, Plato, and the orators, and had expressed for general use all the other dialects, became at the same time the language of the civilized world and was stricken with a mortal decay. . . . Epicurus, who was born in the same year as Menander, writes a harsh jargon that does not deserve to be called a style; and others of whose writings anything is left entire or in fragments, historians and

philosophers alike, Polybius, Chrysippus, Philodemus, are little if any better. When Cicero deigns to translate any of their sentences, we wist grace and life he infuses into their dimly expressed thoughts, how satisfying to the ear and taste are the periods of Livy when he is putting into Latin the heavy and uncouth clauses of Polybius! This may explain what Cicero means when at one time he gives to Greek the preference over Latin, at another to Latin over Greek, in reading Sophocles or Plato he could acknowledge their unrivalled excellence, in translating Themistius or Philodemus he would feel his own immeasurable superiority."

The greater number of long syllables, combined with the paucity of diphthongs and the consequent monotony of vocalization, and the uniformity of the accent, lent a weight and dignity of movement to the language which well suited the national *gravitas*. The precision of grammatical rules and the entire absence of dialectic forms from the written literature contributed to maintain the character of unity which marked the Roman republic as compared with the multiplicity of Greek states. It was remarked by Bacon that artistic and imaginative nations indulge freely in verbal compounds, practical nations in simple concrete terms. In this respect, too, Latin contrasts with Greek. The attempts made by some of the earlier poets to indulge in novel compounds was felt to be out of harmony with the genius of the language. Composition, though necessarily employed, was kept within narrow limits, and the words thus produced have a sharply defined meaning, wholly unlike the poetical vagueness of some of the Greek compounds. The vocabulary of the language, though receiving accessions from time to time in accordance with practical needs, was rarely enriched by the products of a spontaneous creativeness. In literature the taste of the educated town circles gave the law; and these, trained in the study of the Greek masters of style, required something which should reproduce for them the harmony of the Greek period. Happily the orators who gave form to the Latin prose were able to meet the demand without departing from the spirit of their own language, and the periods of Cicero and Livy, though very different in structure from those of Plato and Demosthenes, are not less satisfying to the ear, or less adequate to the full expression of thought. To Cicero especially the Romans owed the realization of what was possible to their language and in the way of artistic finish of style. He represents a protest at one and the same time against the imbroils of the *plebeus sermo*, vulgarized by the constant influx of non-Italian provincials into Rome, and the "jargon of spurious and partial culture" in vogue among the Roman pupils of the Asiatic rhetoricians. His essential service was to have caught the tone and style of the true Roman *urbanitas*, and to have fixed it in extensive and widely read speeches and treatises as the final model of classical prose. The influence of Cæsar was wholly in the same direction. His cardinal principle was that every new-fangled and affected expression, from whatever quarter it might come, should be avoided by the writer, as rocks by the mariner. His own style for straightforward simplicity and purity has never been surpassed, and it is not without full reason that Cicero and Cæsar are regarded as the models of classical prose. But, while they fixed the type of the best Latin, they did not and could not alter its essential character. In subtlety, in suggestiveness, in many-sided grace and versatility, it remained far inferior to the Greek. But for dignity and force, for cadence and rhythm, for clearness and precision, the best Latin prose remains unrivalled. These qualities make it pre-eminently the language of legislation and of commerce. There is no business about a Latin sentence, directness, concreteness, and lucidity stamp it as the utterance of men who knew precisely what they wished to say, and said it with all the force at their command.

It is needless to dwell upon the grammar or vocabulary of Cicero. His language is universally taken as the normal type of Latin, and, as hitherto the history of the language has been traced by marking differences from his usage, so the same method may be followed for what remains.

Varro. M. Terentius Varro, "the most learned of the ancients," a friend and contemporary of Cicero, seems to have rejected the periodic rhythmical style of Cicero, and to have fallen back upon a more archaic structure. Mommsen says of one passage "the clauses of the sentence are arranged on the thread of the relative like thrushes on a string." But, in spite (some would say, because) of his old-fashioned tendencies, his language shows great vigour and spirit. In his Menippean satires he intentionally made free use of plebeian expressions, while rising at times to a real grace and showing often fresh humour. His treatise *De Re Rustica*, in the form of a dialogue, is the most agreeable of his works, and where the nature of his subject allows it there is much vivacity and dramatic picturesqueness, although the precepts are necessarily given in a terse and abrupt form. His sentences are as a rule co-ordinated, with but few connecting links; his diction contains many antiquated or unique words.

Salust. In Salust, a younger contemporary of Cicero, we have the earliest complete specimen of historical narrative. It is probably due to his subject-matter, at least in part, that his style is marked by frequent archaisms; but something must be ascribed to intentional imitation of the earlier chroniclers, which led him to be called "præcorum Catonisque verborum insatitissimus fur." His archaisms consist partly of words and phrases used in a sense for which we have only early authorities, e.g., *cum animo habere*, &c., *animos tollere*, *bene factum*, *consulatio*, *prospexia*, *dolus*, *venenum*, *obsequia*, *inquies*, *sellere*, *ocerpere*, *collibere*, and the like, where we may notice especially the fondness for frequentatives, which he shares with the early comedy, partly in inflections which were growing obsolete, such as *emati*, *solui*, *comperior* (dep.), *neglegisset*, *vis* (acc. pl.), *negatur*. In syntax his constructions are for the most part those of the contemporary writers.¹

Catullus. In Lucretius and Catullus we have examples of the language of poetry of the same period. The former is undoubtedly largely archaic in his style. We find *im* for *eum*, *endo* for *in*, *illac*, *illuc*, *unas*, and *alias* as genitives, *alid* for *aliud*, *rabies* as a genitive by the side of genitives in *-is*, ablatives in *-i* like *colis*, *orbi*, *parti*, nominatives in *s* for *r*, like *colis*, *vaporis*, *humoris*. In verbs there are *acutis*, *fulgitis*, *quæsit*, *confuscel* = *confusisset*, *recessu* = *recessisse*, *indiviscere* for *inmiscere*; simple forms like *figere*, *lacerare*, *cedere*, *stinguere* for the more usual compounds, the infinitive passive in *-er*, and archaic forms from *esse* like *siet*, *acit*, *fuat*. Sometimes he indulges in tmesis which reminds us of Ennius: *aque poturi*, *disque supata*, *orvis prima*. But this archaic tinge is adopted only for poetical purposes, and as a practical proof of his devotion to the earlier masters of his art; it does not affect the general substance of his style, which is of the freshest and most vigorous stamp. But the purity of his idiom is not gained by any slavish adherence to a recognized vocabulary: he coins words freely. Mr Munro has noted more than a hundred ἀνὰ λέγουσα, or words which he alone among good writers uses. Many of these are formed on familiar models, such as compounds and frequentatives; others are

directly borrowed from the Greek apparently with a view to sweetness of rhythm (ii. 412; v. 834, 505); others again (forty or more in number) are compounds of a kind which the classical language refused to adopt, such as *sihiſtragis*, *terroloquus*, *perterrepreps*. He represents not so much a stage in the history of the language as a protest against the tendencies fashionable in his own time. But his influence was deep upon Virgil, and through him upon all subsequent Latin literature. In Catullus we have the type of the language of the cultivated circles, lifted into poetry by the simple directness with which it is used to express emotion. In his heroic and elegiac poems he did not escape the influence of the Alexandrian school, and his genius is ill suited for long-continued flights, but in his lyrical poems his language is altogether perfect. As Macaulay says, "No Latin writer is so Greek. The simplicity, the pathos, the perfect grace, which I find in the great Athenian models are all in Catullus, and in him alone of the Romans." The language of these poems comes nearest perhaps to that of Cicero's more intimate letters. It is full of colloquial idioms and familiar language, of the diminutives of affection or of playfulness. Greek words are rare, especially in the lyrics, and those which are employed are only such as had come to be current coin. Archaisms are but sparingly introduced; but for metrical reasons he has four instances of the inf. pass. in *-er*, and several contracted forms; we find also *alis* and *alid*, *um* (gen.), and the antiquated *telus* and *recepto*. There are traces of the popular language in the shortened imperatives *acel* and *manē* in the analytic perfect *paratam habes*, and perhaps in the use of *venis* approaching that of the indefinite article.

The poets of the Augustan age mark the opening of a new chapter in the history of the Latin language. The influence of Horace was comparatively slight; he worked in a field of his own, and, although Statius imitated his lyrics, and Persius and Juvenal, especially the former, his satires, on the whole there are few traces of any deep marks left by him on the language of later writers. In his *Satires* and *Epistles* the diction is that of the contemporary *urbanitas*, differing hardly at all from that of Cicero in his epistles and dialogues. The occasional archaisms, such as the syncope in *errepemus*, *evasee*, *surrexe*, the infinitives in *-er*, and the genitives *deum*, *divum*, and *nummum* may be explained as still conversationally allowable, though ceasing to be current in literature; and a similar explanation may account for plebeian terms, e.g., *balatro*, *biatro*, *garrio*, *matto*, *vappa*, *caldus*, *soldus*, *surpate*, for the numerous diminutives, and for such pronouns, adverbs, conjunctions, and turns of expression as were common in prose, but not found, or found but rarely, in elevated poetry. Greek words are used sparingly, not with the licence which he censures in Lucilius, and in his hexameters are inflected according to Latin rules. In the *Odes*, on the other hand, the language is much more precisely limited. There are practically no archaisms (*spargere* in Carm. iv. 11, 8 is a doubtful exception), or plebeian expressions; Greek inflections are employed, but not with the licence of Catullus; there are no datives in *r* or *is* like *Tethyi* or *Dryasii*; Greek constructions are fairly numerous, e.g., the genitive with verbs like *regnare*, *abstinere*, *desinere*, and with adjectives, as *integer vitæ*, the so-called Greek accusative, the dative with verbs of contest, like *luctari*, *decertare*, the transitive use of many intransitive verbs in the past participle, as *regnatu*, *triumphatu*; and finally there is a "prolative" use of the infinitive after verbs and adjectives, where prose would have employed other constructions, which, though not limited to Horace, is more common with him than with other poets. Compounds are very sparingly employed, and apparently only when sanctioned by author-

¹ The character of archaism has been denied to his style by Dean Merivale; and it is true that in the matter of orthography the forms which Salust adopts, as *Crescen* has shown, were at least as common in his time as those which became afterwards the rule, but, when we compare his diction with that of Cicero, there is quite enough difference to justify the usual view, and the fact that some of his expressions are found in later writers only goes to show that they imitated him in this respect.

nty. His own innovations in vocabulary are not numerous. About eighty *novae verba* have been noted, but for the most part there is nothing very distinctive about their character, and perhaps we should find them almost entirely disappearing if the remains of contemporary literature were more extensive. Like Virgil, he shows his exquisite skill in the use of language rather in the selection from already existing stores, than in the creation of new resources. *tantum series iuncturaque pollet*. But both his diction and his syntax left much less marked traces upon succeeding writers than did those of either Virgil or Ovid.

Virgil.

In Virgil the development of the Latin language reached its full maturity. What Cicero was to the period, Virgil was to the hexameter, indeed the changes that he wrought were still more marked, inasmuch as the language of verse admits of greater subtlety and finish than even the most artistic prose. For the straightforward idiomatic simplicity of Lucretius and Catullus he substituted a most exact and felicitous choice of diction, rich with the suggestion of the most varied sources of inspiration. Sometimes it is a phrase of Homer's "conveyed" literally with happy boldness, sometimes it is a line of Ennius, or again some artistic Sophoclean combination. Virgil was equally familiar with the great Greek models of style and with the earlier Latin poets. This learning, guided by an unerring sense of fitness and harmony, enabled him to give to his diction a music which recalls at once the fullest tones of the Greek lyre and the lofty strains of the most genuinely national song. His love of antiquarianism in language has often been noticed, but it never passes into pedantry. His vocabulary and constructions are often such as would have conveyed to his contemporaries a grateful flavour of the past, but they would never have been unintelligible. Forms like *sueso, olle, or admittit* can have delayed no one.

In the details of syntax it is difficult to notice any peculiarly Virgilian points, for the reason that his language, like that of Cicero, became the canon, departures from which were accounted irregularities. But we may notice as favourite constructions a free use of oblique cases in the place of the more definite construction with prepositions usual in prose, e.g., *et clamor caelo, flet noctem, rivis currentia vina, baccatam rugie Naevon*, and many similar phrases; the employment of some substantives as adjectives, like *senator canis*, and vice versa, as *plurimus volitans*; a proleptic use of adjectives, as *tristia torquetis*; idioms involving *ille, atque, deinde, haud, quin, via*, and the frequent occurrence of passive verbs in their earlier reflexive sense, as *induor, velor, pascor* (comp. Dr Kennedy's Appendix on "Virgilian Syntax").

Livy

In Livy's singularly varied and beautiful style we have Latin prose in that rich maturity which seems to portend and almost to necessitate an early decline. To a training in the rhetorical schools, and perhaps professional experience as a teacher of rhetoric, he added a thorough familiarity with contemporary poetry and with the Greek language; and these attainments have all deeply coloured his language. It is probable that the variety of style naturally suggested by the wide range of his subject matter was increased by a half-unconscious adoption of the phrases and constructions of the different authorities whom he followed in different parts of his work; and the industry of German critics has gone far to demonstrate a conclusion likely enough in itself. Hence perhaps comes the fairly long list of archaisms, especially in formulae, which scholars have collected (cf. Kühnast, *Lin. Synt.*, pp. 14-18). These are, however, purely isolated phenomena, which do not affect the general tone. It is different with the poetical constructions and Gracianisms, which appear on every page. Of the latter we find numerous instances in the use of the cases, e.g., in genitives like *ad Spei* (sc. *templum*), *pars altera regnas*

utulationis erat, oratores pacis petendae, ira praedae omnesae, oppidum Antiochiae, aequum campi, qui capti-vorum, in dative like aeneum pectori tegumen, comitia collegas creando, quibusdam solentibus erat, prompsum veniae danda; in accusatives like *irare calumniam, certare multam, distendere hostem*; an especially frequent use of transitive verbs absolutely, and the constant omission of the reflexive pronoun as the subject of an infinitive in reported speech. To the same source must be assigned a very frequent pregnant construction with prepositions, an attraction of relatives, and a great extension of the employment of relative adverbs of place instead of relative pronouns, e.g., *quo=in quem*. Among his poetical characteristics we may place the extensive list of words which are found for the first time in his works and in those of Virgil or Ovid, and perhaps his common use of concrete words for collective, e.g., *equus for equitatus*, of abstract terms such as *remigium, servitia, robora*, and of frequentative verbs, to say nothing of poetical phrases like "*haec ubi dicte dedit*," "*adversum montium*," &c. Indications of the extended use of the subjunctive, which he shares with contemporary writers, especially poets, are found in the construction of *ante quam, post quam* with this mood, even when there is no underlying notion of purpose, of *donec*, and of *cum* meaning "whenever." On the other hand *forntan* and *quamvis*, as in the poets, are used with the indicative in forgetfulness of their original force. Among his individual peculiarities may be noticed the large number of verbal nouns in *-us* (for which Cicero prefers forms in *-io*) and in *-tor*, and the extensive use of the past passive participle to replace an abstract substantive, e.g., *ex dictatorio imperio concussio*. In the arrangement of words Livy is much more free than any previous prose writer, aiming, like the poets, at the most effective order rather than at that which is logically suggested. His periods are constructed with less regularity than those of Cicero, and gain at least as much in variety and energy as they lose in uniformity of rhythm and artistic finish. His style cannot be more fittingly described than in the language of Quintilian, who speaks of his *miris inveniat et lactea ubertas*.

The language of Propertius is too distinctly his own to Proper-call for detailed examination here. It cannot be taken as ^{thus} a specimen of the great current of the Latin language; it is rather a tributary springing from a source apart, tingling to some slight extent the stream into which it pours itself, but soon ceasing to affect it in any perceptible fashion. "His obscurity, his indirectness, and his incoherence" (to adopt the words of Professor Postgate) were too much out of harmony with the Latin taste for him to be regarded as in any sense representative; sometimes he seems to be hardly writing Latin at all. Partly from his own strikingly independent genius, partly from his profound and not always judicious study of the Alexandrian writers, his poems abound in phrases and constructions which are without a parallel in Latin poetry. His archaisms and Gracianisms, both in diction and in syntax, are very numerous; but frequently there is a freedom in the use of cases and prepositions which can only be due to bold and independent innovations. His style well deserves a careful study for its own sake (cf. Postgate's *Introduction*, pp. lvii-cxxv.); but it is of comparatively little significance in the history of the language.

The brief and few poems of Tibullus supply only what Ovid. is given much more fully in the works of Ovid. In these we have the language recognized as that best fitted for

¹ Kühnast (p. 146) holds that of more than three hundred and twenty dative in book xxix, about thirty show the influence of Greek constructions.

poetry by the fashionable circles in the later years of Augustus. The style of Ovid bears many traces of the imitation of Virgil, but it is not less deeply affected by the rhetoric of the schools. His never-failing fertility of fancy and command of diction often led him into a diffuseness which mars the effect of his best works; according to Quintilian it was only in his (lost) tragedy of *Medea* that he showed what real excellence he might have reached if he had chosen to control his natural powers rather than to give them full rein. His influence on later poets was largely for evil: if he taught them smoothness of versification and polish of language, he also co-operated powerfully with the practice of recitation to lead them to aim at rhetorical point and striking turns of expression, instead of a firm grasp of a subject as a whole, and due subordination of the general parts to the general impression. Ovid's own influence on language was not great: he took the diction of poetry as he found it, formed by the labours of his predecessors, the conflict between the archaistic and the Graecising schools was already settled in favour of the latter; and all that he did was to accept the generally accepted models as supplying the material in moulding which his luxuriant fancy could have free play. He is the pattern of the poet of society, never rising above that which was readily intelligible to the circle in which he moved, but achieving what all were attempting with consummate ease and grace. He has no deviations from classical syntax but those which were coming into fashion in his time (e.g., *fortiter* and *quoniam* with the indicative, the dative of the agent with passive verbs, the ablative for the accusative of time, the infinitive after adjectives like *certus*, *apertus*, etc.), and but few peculiarities in his vocabulary. It is only in the letters from the Pontus that luxuries of construction are detected, which show that the purity of his Latin was impaired by his residence away from Rome, and perhaps by increasing carelessness of composition.

While the leading writers of the Ciceronian and Augustan eras enable us to trace the gradual development of the Latin language to its utmost finish as an instrument of literary expression, there are some less important authors who supply valuable evidence of the character of the *sermo plebeius*. Among them may be placed the authors of the *Bellum Africanum* and the *Bellum Hispaniense* appended to Caesar's commentaries. These are not only far inferior to the exquisite *urbanitas* of Caesar's own writings; they are much rougher in style even than the less polished *Bellum Alexandrinum* and *De Bello Gallico Liber VIII.*, which are now with justice ascribed to Hirtius. There is sufficient difference between the two to justify us in assuming two different authors; but both freely employ words and constructions which are at once antiquated and vulgar. The writer of the *Bellum Alexandrinum* uses a larger number of diminutives within his short treatise than Caesar in nearly ten times the space: *postquam* and *ubi* are used with the pluperfect subjunctive; there are numerous forms unknown to the best Latin, like *tristimonia*, *exporrigere*, *cruciohitter*, and *convulnere*; *petior* is followed by the accusative, a simple relative by the subjunctive. There is also a very common use of the pluperfect for the imperfect, which seems a mark of this *plebeius sermo* (Nipparday, *Quaest. Caes.*, pp. 13-30).

Another example of what we may call the Latin of business life is supplied by Vitruvius. Besides the obscurity of many of his technical expressions, there is a roughness and looseness in his language, far removed from a literary style; he shares the incorrect use of the pluperfect, and uses plebeian forms like *calefactantur*, *faciliter*, *expertiores*, and such careless phrases as "rogavit Archimodem uti in se sumeret sibi de eo cogitationem." At a somewhat later stage we have, not merely plebeian, but also

provincial Latin represented in the *Satyricon* of Petronius. The narrative and the poems which are introduced into it are written in a style distinguished only by the ordinary peculiarities of silver Latinity, but in the numerous conversations the distinctions of language appropriate to the various speakers are accurately preserved; and we have in the talk of the slaves and provincials a perfect storehouse of words and constructions of the greatest linguistic value. Among the unclassical forms and constructions may be noticed masculines like *fatus*, *vinus*, *baineus*, *fericulus*, and *lactem* (for *lac*), *striga* for *strux*, *goudimonium* and *tristimonium*, *sanguen*, *manducare*, *nutricare*, *molestare*, *vespius* (*vespius* = Fr. *sage*), *rostrum* (= *os*), *spumas* (= *master*), *scordialis*, *baro*, and numerous diminutives like *camella*, *audaculus*, *potiuncula*, *somnuculum*, *effla*, *peduculus*, *corallum*, with constructions such as *maleducere* and *persuadere* with the accusative, and *aditulus* with the dative, and the deponent forms *pudetur* and *rideitur*. Of especial interest for the Romance languages are *astrum* (*diastre*), *berbea* (*bréba*), *botallus* (*boyau*), *improperare*, *mutua*, *naufragare*.

Suetonius (*Aug.*, c. 87) gives an interesting selection of plebeian words employed in conversation by Augustus, who for the rest was something of a purist in his written utterances: "ponit asidue et pro stulto baculum, et pro pullo pulleocum, et pro cerrito vacrosum, et rapide as habere pro male, et belizare pro languere, quod vulgo lachianzare dicitur."

The inscriptions, especially those of Pompeii, supply abundant evidence of the corruptions both of forms and of pronunciation common among the vulgar. It is not easy always to determine whether a mutilated form is evidence of a letter omitted in pronunciation, or only in writing; but it is clear that there must have been a great tendency to drop final *m*, *s*, and *t* to omit *n* before *e*, and to dull the vowel sounds, *e* and *i* being especially frequently interchanged, and *u* taking the place of *e* even in inflections. There are already signs of the confusion of *ae* and *e*, which later on became almost universal. The additions to our vocabulary are slight and unimportant (*cf. Corpus Inscr. Lat.*, vol. iv., with Zangemeister's *Indices*).

To return to the language of literature. In the dark days of Tiberius and the two succeeding emperors a paralysis seemed to have come upon prose and poetry alike. With the one exception of oratory, literature had long been the utterance of a narrow circle, not the expression of the energies of national life; and now, while all free speech in the popular assemblies was silenced, the nobles were living under a suspicious despotism, which whatever the advantage which it brought to the poorer classes and to the provincials, was to them a reign of terror. It is no wonder that the fifty years after the accession of Tiberius are in blank as regards all higher literature. Velleius Paterculus, Valerius Maximus, Celcius, and Phaedrus give specimens of the Latin of the time, but the style of no one of these, classical for the most part in vocabulary, but occasionally approaching the later usage in syntax, calls for special analysis. The elder Seneca, in his collection of *exhortationes* and *controversiae* supplies examples of the barren quibblings by which the young Romans were trained in the rhetorical schools. A course of instruction, which may have been of service when its end was efficiency in active public life, though even then not without its serious drawbacks, as is shown by Cicero in his treatise *De Oratore*, became seriously injurious when its object was merely idle display. Prose came to be overloaded with ornament, and borrowed too often the language, though not the genius, of poetry; while poetry in its turn, partly owing to the fashion of recitation, became a string of rhetorical points.

In the writers of Nero's age there are already plain

the age indications of the evil effects of the rhetorical schools upon Seneca. language as well as literature. The leading man of letters was undoubtedly Seneca the younger, "the Ovid of prose"; and his style set the model which it became the fashion to imitate. But striking and popular as it was it could not commend itself to the judgment of sound critics like Quintilian, who held firmly to the great masters of an earlier time. He admits its brilliance, and the facility of its pointed reflections, but charges the author justly with want of self-restraint, jerkiness, frequent repetitions, and tawdry tricks of rhetoric. He was the worst of models, and plagued by his very faults. In his tragedies the rhetorical elaboration of the style only serves to bring into prominence the frigidity and frequent bad taste of the matter. But his diction is on the whole fairly classical; he is, in the words of Muretus, "retutus ærmonis diligenter quam quidam inepite fastidiosi supplicatur."

Persius. In Persius there is a constant straining after rhetorical effect, which fills his verses with harsh and obscure expressions. The careful choice of diction by which his master Horace makes every word tell is exaggerated into an endeavour to gain force and freshness by the most contorted phrases. The sin of allusiveness, that besets so many young writers, is fostered by the fashion of the day for epigram, till his lines are barely intelligible after repeated reading. Conington happily suggested that this style was assumed only for satiric purposes, and pointed out that when not writing satire Persius is as simple and unaffected as Horace himself. This view, while it relieves Persius of much of the censure which has been directed against his want of judgment, makes him all the more typical a representative of this stage of silver Latinity. In his contemporary Lucan we have another example of the faults of a style especially attractive to the young, handled by a youth of brilliant but ill-disciplined powers. The *Pharsalia* abounds in spirited rhetoric, in striking epigram, in high sounding declamation, but there are no signs of sustained imagination, no ripe wisdom, no self-control in avoiding the exaggerated or the repulsive, no mature philosophy of life or human destiny. Of all the Latin poets he is the least Virgilian, so that Mervale remarks "he had never studied, one is almost tempted to believe that he had never read, Virgil."

Lucan. It has been said of him that he corrupted the style of poetry, not less than Seneca that of prose. It may be doubted whether his influence was ever great enough to produce such an effect; it is safer to say that he is the earliest poet in whom the characteristics of the silver Latinity are clearly marked.

In the silver Flavian the same tendencies are seen occasionally breaking out in the midst of the prosaic and inartistic form in which he gives out the stores of his cumbersome erudition. Wherever he attempts a loftier tone than that of the mere compiler, he falls into the tricks of Seneca. The nature of his encyclopaedic subject matter naturally makes his vocabulary very extensive; but in syntax and general tone of language he does not differ materially from contemporary writers.

Quintilian. Quintilian is of interest especially for the sound judgment which led him to a true appreciation of the writers of Rome's golden age. He set himself strenuously to resist the tawdry rhetoric fashionable in his own time, and to hold up before his pupils purer and loftier models. His own criticisms are marked by excellent taste, and often by great happiness of expression, which is pointed without being unduly epigrammatic. But his own style did not escape, as indeed it hardly could, the influences of his time; and in many small points his language falls short of classical purity. There is more approach to the simplicity of the best models in Frontinus, who furnishes a striking proof that it was rather the corruption of literary taste than any serious change in the language of ordinary

cultivated men to which the prevalent style was due. Writing on practical matters—the art of war, and the water-supply of Rome—he goes straight to the point without rhetorical flourishes; and the ornaments of style which he occasionally introduces serve to embellish but not to distort his thought.

The epic poets of the Flavian age present a striking contrast to the writers of the Claudian period. As a strained originality was the cardinal fault of the one school, so a tame and slavish following of authority is the mark of the other. The general correctness of this period may perhaps be ascribed (with Mervale) partly to the political conditions, partly to the establishment of professional schools. Teachers like Quintilian must have done much to repress extravagance of thought and language; but they could not kindle the spark of genius. Valerius Flaccus, Rutilius Silius Italicus, and Papirius Statius are all correct in their diction and in rhythm, and abound in learning; but their inspiration is drawn from books and not from nature or the heart; details are elaborated to the injury of the impression of the whole; every line is laboured, and overcharged with epigrammatic rhetoric. Statius shows by far the greatest natural ability and freshness; but he attempts to fill a broad canvas with drawing and colouring suited only to a miniature. Juvenal exemplifies the tendencies of the language of his time, as moulded by a singularly powerful mind. A careful study of the earlier poets, especially Virgil and Lucan, has kept his language up to a high standard of purity. His style is eminently rhetorical; but it is rhetoric of real power. This concisely by which it is marked seems to have been the result of a deliberate attempt to mould his natural diffuseness into the form recognized as most appropriate for satire. In his verses we notice a few metrical licences common to his age, especially the shortening of the final -o in verbs, but as a rule they are as correct as they are sonorous. In Martial the tendency of this period to witty epigram finds its most perfect embodiment, combined with finished versification. The typical prose-writers of this time are Pliny the younger and Tacitus. A study of their diction and syntax will best disclose the characteristics of the silver Latinity. Some of the features of the style of Tacitus are peculiar to himself, but on the whole the following statement represents the tendencies shared in greater or less degree by all the writers of this period. The guns he mainly in the direction of a more varied and occasionally more effective syntax, its most striking defect is a lack of harmony in the periods, of arrangement in words, of variety in particles arising from the loose connexion of sentences. The vocabulary is extended, but there are losses as well as gains. Quintilian's remarks are fully borne out by the evidence of extant authorities: on the one hand, "quid quid nihil iam proprium placet, dum parum creditur disertum, quod et alius dixisset" (viii, proem, 24); "sacrificissimum quoque poetarum figuras seu translationes mutantur; tum demum ingeniosi scilicet, si ad intelligendos nos opus est ingenio" (ib, 20); "aeridet omne quod natura detrahit" (ib, 26); on the other hand, "anne utique, cum hæc exereatit proelæ a veritate senectæ laboris inderabili verborum fastidio, ac sibi magnam partem ærmonis abscedit?" (viii, 3, 28), "multa cotidie ab antiquis facta morituræ" (ib, 6, 32).

A writer like Suetonius therefore did good service in introducing into his writings terms and phrases borrowed, not from the rhetoricians, but from the usage of daily life. In the vocabulary of Tacitus there are to be noted—
1. Words borrowed (occasionally or unconsciously) from the classical poets, especially Virgil, coming for the most part also in contemporary prose. Of these Dräger gives a list of ninety-five (*Syntax und Stil des Tacitus*, p. 56).
2. Words occurring only, or for the first time, in Tacitus. These according to the same authority number eighty-eight. For the most

Frontinus. striking proof that it was rather the corruption of literary taste than any serious change in the language of ordinary

past new formations or compounds from stems already in use, especially verbal substantives in *-io* and *-or*, *-tus* and *-ura*, *-tus* and *-endus*, with new frequentatives.

3 Words used with a meaning (e) not found in earlier prose, but sometimes (in more than eighty instances) borrowed from the poets, e.g., *conspicere*, "to bury"; *scriptura*, "a writing"; *ferax*, "armed with a sword"; (f) peculiar to later writers, e.g., *numerosus*, "numerous"; *fanctus*, "famous"; *desultor*, "to be head"; *impulserat*, "to take credit for," etc.; (g) restricted to Tacitus himself, e.g., *dispergere=disolvare*; of these Boettacher quotes one hundred and twenty-two.

Generally speaking, Tacitus likes to use a simple verb instead of a compound one, after the fashion of the poets, employs a perfect for a perfect, and (like Livy and sometimes Caesar) aims at vividness and variety by employing the present and perfect conjunctive in indirect speech even after historical tenses. Collective verbs are followed by a plural far more commonly than in Cicero. The ellipse of a verb is more frequent. The use of the cases approximates to that of the poets, and is even more free. The sensitive of limitation is common in Tacitus, though never found in Quintilian. Compound verbs are frequently followed by the accusative where the dative might have been expected, and the Virgilian construction of an accusative with infinitive and passive verb is not unusual. The dative "absolute" is shared by Tacitus with Livy, the dative of purpose and the dative with a substantive in place of a genitive are more common with him than with any writer. The ablative of separation is used without a preposition, even with names of countries and with common nouns; the ablative of place is employed similarly without a preposition, the ablative of time has sometimes the force of duration, the matricularial ablative is employed even of persons. A large extension is given to the use of the quantitative genitive after neuter adjectives and pronouns, and even adverbs, and to the genitive with active participles, and the genitive of relation after adjectives (probably by a Greekism) very freely employed. In regard to prepositions, there are special uses of *circa*, *erga*, *intra*, and *tenuis* to be noted, and a frequent tendency to interchange the use of a preposition with that of a simple case in corresponding clauses. In subordinate sentences *ut* is used for "that" and *quod*, and sometimes approaches the later use of "that"; the infinitive follows many verbs and adjectives that do not admit of this construction in classical prose, the accusative and infinitive are used after negative expressions of doubt, and even in modal and hypothetical clauses.

Like Livy, the writers of the time freely employ the conjunctive of repeated action with a relative, and extend its use to relative conjunctions, which he does not. In clauses of comparison and proportion there is frequently an ellipse of a verb (with *nihil aliud* *placuit*, *ut*, *consequens*), *tantum*, *quoniam*, and *velut* are used to imply not comparison but alleged reason; *quoniam* and *quoniam* are interchanged at pleasure. *Quoniam* and *quoniam* are commonly followed by the subjunctive, even when denoting facts. The free use of the genitive and dative of the gerundive participle to denote purpose is common in Tacitus, the former being almost limited to him. Livy's practice in the use of participles is extended even beyond the limits to which he restricts it. It has been calculated that while Caesar uses five principal clauses, Livy has sixteen, Tacitus twenty-four.

In his compressed brevity Tacitus may be said to be individual; but in the poetical colouring of his diction, in the rhetorical cast of his sentences, and in his love for picturesque and variety he is a true representative of his time.

The language of Suetonius is of interest as giving a specimen of silver Latin almost entirely free from personal idiosyncrasies; his expressions are regular and straightforward, clear and business-like; and, while in grammar he does not attain to classical purity, he is comparatively free from rhetorical affectations.

A new era commences with the accession of Hadrian (117 A.D.). As the preceding half century had been marked by the influence of Spanish Latinity (the Senecae, Lucan, Martial, Quintilian), so in this the African style was paramount. This is the period of affected archaism and pedantic learning, combined at times with a reckless love of innovation and experiment, resulting in the creation of a large number of new formations and in the adoption of much of the plebeian dialect. Fronto and Appuleius mark a strong reaction against the culture of the preceding century, and for evil far more than for good the chain of literary tradition was broken. The language which had been unduly refined and elaborated now relapsed into a

tasteful and confused patch-work, without either harmony or brilliance of colouring. In the case of the former the Proba subject matter is no set-off against the inferiority of the style. His latest editor is quite pathetic in lamenting the worthlessness of his author, and says that it would have conduced to his reputation if his works had never been unearthed. He deliberately attempts to go back to the obsolete diction of writers like Catto and Ennius. We find compounds like *altipendulus*, *rudistetrastus*, *telutiquentia*, diminutives such as *matercula*, *aulula*, *passerculus*, *sticholus*, forms like *congarrire*, *dicomancus*, *pedetentus*, *desiderantissimus* (passive), *conticinium*; *gaudio*, *oboeio*, and *pe-fungor* are used with an accusative, *modestus* with a genitive; and, if our MS. is to be trusted, the interchange of *b* and *v* has already begun. On the other hand he actually attempts to revive the form *cas* for *ara*. In Appuleius the archaic element is only one element in the Appuleian mixture which constitutes his style, and it probably ^{was} not intended to give the tone to the whole. Poetical and prosaic phrases, Greekisms, solecisms, jingling assonances, quotations, and comings apparently on the spur of the moment, all appear in this wonderful medley. There are found such extraordinary expressions as *sitire bestitudinis*, *cenae pugnatoris*, *meorum omnium*, *foras corporis*, sometimes heaped one upon another, as *fluores vetustis Araeidae et frugum pauperis Ilyraeos et odorum divites Arabas*. Diminutives are coined with reckless freedom, e.g., *autule*, *longule*, *mundule amicta et alivacule et spae papillas succinctula*. He confesses himself that he is writing in a language not familiar to him—"In urbe Latina advena stidorum Quiritium indigenam sermonem acrumabili labore, nullo magistro praesente, aggressus excolui"; and the general impression of his style fully bears out his confession. Melanchthon is hardly too severe when he says that Appuleius brays like his own ass. The language of Anlus Lucilius is much superior in purity; but still it Gellius, abounds in rare and archaic words, e.g., *edulcar*, *reccator*, *arrestator*, and in meaningless frequentatives like *solitativus*. He has some admirable remarks on the pedantry of those who delighted in obsolete expressions (xi 7) such as *apiada*, *flocus*, and *bonnator*; but his practice falls far short of his theory.

The style of the eminent lawyers of this period, foremost of whom is Gaius, deserves especial notice as showing ^{the} true literary tradition was lost; and even the poets who aimed at imitating the best models, by far the best of whom was Claudian, were led into many faults by the defective taste of their time. The sense of quantity was lost, and the practice of regarding accent as the ruling principle in metre, which had doubtless never been extinct in popular songs, and which has left plain traces in a poem quoted by Gellius (xii 11), became gradually predominant. Its effects are sometimes to be observed even in the poems of Ausonius (flor. 260 A.D.) and are plain in those of Sedulius in the next century. In Gellius the rhetorical school, which flourished greatly in the 4th century, maintained a tradition of learning, which preserved some classical range of language, but it sank by degrees into tom-

It is needless to trace in detail the gradual impoverishment and decay of disorganization of literary Latin. After the time of Gellius, there literary is no writer who deserves in any sense to be called classical. The Latin true literary tradition was lost; and even the poets who aimed at imitating the best models, by far the best of whom was Claudian, were led into many faults by the defective taste of their time. The sense of quantity was lost, and the practice of regarding accent as the ruling principle in metre, which had doubtless never been extinct in popular songs, and which has left plain traces in a poem quoted by Gellius (xii 11), became gradually predominant. Its effects are sometimes to be observed even in the poems of Ausonius (flor. 260 A.D.) and are plain in those of Sedulius in the next century.

In Gellius the rhetorical school, which flourished greatly in the 4th century, maintained a tradition of learning, which preserved some classical range of language, but it sank by degrees into tom-

The African Latinity

¹ Mr Munro (Cambridge Philosophical Society, 1860) has discussed an inscription in accented hexameters, from Cirta, dating from the 4th century of our era.

basic extravagance, and the style of Sidonius Apollinarius displays, with a profusion of erudition, an entire absence of correctness. Latin was to him no living language; his natural medium of expression was the *sermo rusticus*, and this has left its mark on every page.

Ecclesi-
astical
Latin

The influence of the Christian church in the development of the Latin language was mainly in two directions. In the first place the new conceptions introduced brought about a large extension of the vocabulary. As it is well known, the languages of the African peoples belonged to Africa (Tertullian), Cypran, Amelous, Augustine), this extension was made under the influence of the African Latinity; the newly-coined terms took an awkward and almost barbarous form, and the tendency of the time to shewmet expression and direct composition was heightened by the needs of the writers. Secondly, Christian teaching, as seen in the writings of Tertullian, thought little of the grammatical categories of their language; provided they could make themselves readily intelligible to the common people; e.g. Augustine confesses "Melius est reprehendunt vos grammatice quam non intelligent populi," and again, "Secpe mecum cogito quid esset si loquerer ut vulgus." The numerous writings of the early fathers we find a direct effect of plebeian Latinity introduced into the clumsy and affected rhetoric and the bold linguistic experiments of the African schools. Perhaps it is Tertullian who represents this stage of the language in its most extreme form. He has genuine like *vulgum* used with such words as *Congregatio fratrum*, *congregatio*, *congregatus*, *congregationis*. The plural forms employed in the boldest fashion (*e.g.*, *adulator*, *astutus*, *carnis*, *continentiosus fuisse*, *communiore*, &c.) numerous abstract words often in the plural, like *corruptioles*, *dissensioles*, *insuperabilis*, and finally the most extraordinary compounds, such as *interdubio*, *inconspicibilioribus*, *indiscutibile*, *extremulus*, *familiaritudo*.

The language of the *Vetus Italia* (a version of the Bible, made in Africa) and of the *Vulgate* has been made the subject of an admirable study by Hermann Ronsch (*Italia und Vulgata*, 21 ed., Marburg, 1875), from whom the following sketch of its leading characteristics has been mainly derived (comp. also Bernhardt, *Röm. Lit.*, pp. 384, 385). Many of the phenomena are common to the plebeian language generally, and have been already noticed as appearing occasionally in earlier writings.

1 In the formation of substantives there appears a preference for full-sounding forms, constructed by a free use of the suffixes -mentum, -nium, -arium, -orium, -ulum, -ilium, -aneum, -isum, -ura, -udo, -ntia, -itas. e.g. *nugamentum* for *nugas*, *sestionium*, *sestibulum*, or *sestorium* for *sedes*, *calenium* for *calis*, *noctibulum* for *noctes*, *dolentia* for *dolus*.

2. Plebeian terms take the place of their classical equivalents
e.g., *caballus* (=cheval), *mansio* (=maison), *bracca* (=brouche), *testa*
(=tête), *in curram* (=enfuir).

8. Substantives in *-or* and *-io* receive large additions (Ronsch gives more than one hundred and eighty of the first kind, and more than two hundred and seventy of the second kind, found either now for the first time, or previously only in writers like Plautus and Petronius).

4. Adjectives are turned into substantives. From this class are formed many Romance words: e.g., *montana* (= *montagne*), *hibernum* (= *hiver*), *diurnum* (= *giorno*), *volatile* (= *volant*, *volaille*), *matutinum* (= *mattino*, *matin*), *murale* (= *muraille*).

5 Adjectives in *-alis* and *-bilis*, *-urnus*, *-bundus*, *-lentus*, and *-osus* are largely introduced, often replacing simpler forms: e.g., *placidus* = *placens*, *aestivialis* = *aestivus*, *longiturnus*, *amarulentus*, *meticulosus*, *dignissimus*; and verbals in *-or* give rise to participial forms like *expudoratus*, *tatimoratus*, *caloratus*.

6. The terminations *-um* and *-iter* largely replace *e* in adverbs: e.g., *ordinatio*, *pressum*, *avariter*, *improbiter*.

7. Verbs of secondary derivation take the place of simple verbs, thus meeting the love for fuller forms: as *mensurare*, *amareggiare*, *tacitare*, *postulare*, *deteriorare*; an intensive force is given by composition with *ad*, *co*, *cum*, *ex*, *in*, and *ob*: e.g. *admirari*, *conquiescere*, *confortare*, *deplanare*, *elonguare*, *incrassare*, *obdilatare*; and sometimes, in imitation of the Greek, there is a double prefix, as in *admiraresecere*, *perconterere*, *obrelinguere*, *discooperire* (= *discu-*

8. Intensive and frequentative verbs are especially common, and have given rise to many Romance words; e.g., *compréssare, proiettare, raccogliere*.

9. In composition there is great freedom, and the use of the negative *in-* is very common, e.g., *imbonikos*, *discommensidatos*, *radio-audentius*, *quaterdecimus* (= *isetrarchi*), *admanuandus*. Hybrid forms are common, like *thalotheros*, *acoidia* (for *aridia*), *oxiplegatio* (*καταληψή*), *aportari* (*ἀπορρίπειν*). Especially noteworthy is the use of two prepositions or an adverb with a preposition, e.g., *de mane* (= *de mane*), *de foris* (= *de foris*), *de intus*, and *ab intus* (*domus* = *de ab intus*), *de retro* (= *de retro*), *de sursum* (= *de sursum*), *ab ante* (= *ab ante*).

10. In inflexion there are many irregularities, largely due to the reappearance of forms which had long been obsolete in the literary language, but partly produced by the love of fuller forms, often

resulting in both double words. To the first class belong *s-terms* inflected according to the second declension, e.g., *fructus, cibus, streptus*, etc.; masculine for neutors, e.g., *facinus, fignus, lignus*, etc. and, on the other hand, *nocturnus, popularis*, etc.; numerous pronominal forms, such as *alius, suus, alio* and *alio* (dat.), etc. To the second class belong *as-terms* for *as* (comp. August, *Joel* Christ, iii 8. *mallem* *quam ut alio eodem mense apertum, quia magis Labrum est*, *principes* for *princeps*, *praesumption* for *praesep*, *lampada* for *lampas*, *rete* for *rete*, etc. Comparatives and superlatives are largely invented, often with the aid of *magis* and *plus*, sometimes used pleonastically, e.g., *magis magis*. The *as-terms* have often replaced the classical forms by others which seemed more appropriate, e.g., *alio* instead of *alio* like *alio*, verbs are transferred from one conjugation to another, e.g., *florere, fugere, lignum, extergere*; compare perfects like *conatus, porrigi, collati, granditerum*, futures like *augere, porrigere, collaturo, collatus, porre, sub, equo*. Many deponents appear with *as-* forms, as so commonly in archaic Latin, and less frequently in the

[illegible][illegible]

Of Græcisms, which are very numerous in the literal versions of the Bible, the only one requiring notice here is the frequent use of *habes* with the infinitive (not unknown even to Cicero), which has given rise to the Romance future.

The changes of pronunciation which had been effected by this time consisted partly in the vulgar extension given to tondenses previously existing in the popular speech, partly in that gradual disintegration and weakening of sounds always observable in the history of a language. Our knowledge of them has to be derived almost wholly from inscriptions; for, although the conclusions deduced from the study of the popular literature of the Middle Ages afford evidence of numerous, there is usually a double doubt in the latter case whether the forms occurring bear witness to the pronunciation of the author or to that of the copyist in a later age. Interesting evidence is sometimes furnished by the rhymes found in the poets who discarded the classical forms of verse for rhyming metres. For instance, the tendency to drop a final consonant, shown in the popular literature of the Middle Ages, is illustrated by that of Sothius, who had the following rhymes: *gasterio—de, impe—time, videram—præsum, personal—pignora, militum—codicem, fœdore—originem, torridi—obstrui*. The following table (mainly from Schuchardt, *Vocalismus des Vulgarlateins*, I. 104-5) gives the principal facts of the popular pronunciation, with an indication of the periods at which the change can be proved to have taken place. The most important changes which are possible in the popular pronunciation may have been retained side by side with the corruption long after the latter make its first

I. 100-50
B.C. { *o=ae* (plosium for *plausium*).
 s=ae (see above).
 m obscured before labials (*Dacryis*, *O. I. L.*, i. 980).
 n obscured before dentals and gutturals (*parotes*).
 m, s, t dropped when final.

- | | |
|-------------------------|---|
| | <p>{ Surds changed to sonants (<i>hulose, graues</i>, &c.).</p> <p>{ Aspiration neglected (often even in the Augustan age, and common in Pompeian inscriptions)</p> |
| II.
100-150
A.D. | <p>{ <i>u</i> for <i>z</i>.</p> <p>{ <i>u</i> for <i>ð</i> (very common in 3d century).</p> <p>{ <i>e</i> for <i>i</i> (rare before 4th century).</p> <p>{ <i>e</i> for <i>i</i> for <i>a</i> (<i>uider</i> for <i>uider</i>; later <i>prefecto</i> for <i>prefecto</i>)</p> <p>{ <i>u</i> and <i>i</i> interchanged (only under special circumstances before the next period).</p> |
| III.
300-350
A.D. | <p>{ Assimilation of <i>n</i> and <i>c</i>, and of <i>g</i> and <i>f</i>.</p> <p>{ <i>g</i> for <i>f</i>; before <i>e</i> and <i>i</i> (comp. <i>Gross, compungo</i>).</p> <p>{ <i>g</i> pretreated to <i>s</i> followed by a consonant (<i>uocifer</i> = <i>uocifer</i>; <i>apertus</i> = <i>apertus</i>).</p> <p>{ <i>u</i> for <i>ph</i>.</p> <p>{ <i>u</i> for <i>se</i>.</p> |
| IV.
500-550
A.D. | <p>{ <i>u</i> assimilated before <i>e</i> and <i>a</i>.</p> <p>{ <i>se</i> for <i>st</i>.</p> <p>{ <i>mu</i> for <i>gn</i>.</p> <p>{ <i>p</i> inserted between <i>m</i> and <i>n</i>.</p> <p>{ <i>e</i> assimilated before <i>e</i> and <i>i</i>.</p> <p>{ <i>u</i> for <i>z</i>.</p> |
| V. | <p>{ <i>u</i> for <i>z</i>.</p> |

The assimilation of *ai* commenced in Africa, not before the time of Alexander Severus (232-235 A.D.), and was late in extending to Italy; in Gaul it was common in the 7th century; that of *ti* was generally adopted even by the educated in the 5th century. In the 6th and 7th century *g* was dropped after vowels before *e* or *i* (*unviginti* = *viginti*) in Africa. This phenomenon had been common in Umbrian and Oscan.

The exact date of some of these changes is open to question, but it would be impossible to attempt to determine it without a fuller discussion of the evidence than is here possible. On the whole, it may be asserted with confidence that all these changes have taken place within the last two or three centuries.

The question of the relation of the Latin language to the various Romance tongues which have been derived from it is one which can be discussed in detail only under the head of the several languages. The general character of the relation is all that can be touched upon here. But it is important to notice that the Romance languages have a common origin in the mother and daughter languages "holds good only for literature. From this point of view M. Lettæ writes with justice: "Latin aïtne without doubt towards the end of the empire and after the arrival of the barbarians, and the style of Gregory of Tours is very far removed from the purity of the Latin of the first century. The language of the century of the empire. Then all at once it disappears, and we see arising, as if from under the ground, the various idioms to which it has given birth. It does suddenly and without transformation, so that these secondary languages cannot be considered as the metamorphosis or the evolution of Latin, but as new languages, born of the Latin in the new language; it died without developing itself, but it died leaving children and heirs. Such a breach of continuity is wholly unmovable as an historical procedure. From the popular Latin various dialects were gradually formed, assuming forms differing widely from the Latin of the first century. . . ."

It is true that there was much in the derived languages which cannot be shown to have existed in the popular Latin; but if we set aside what is evidently due to the action of foreign, especially Teutonic idioms—and this is to be found far more in the vocabulary than in the syntax of the Romance languages—we may not be far from the truth in saying that the Romance languages already contain the phenomena by degrees the custom grew up of confining the name *Latine* to the literary language, while the popular speech was known as *lingua Romana*. As early as 660 A. D. Minutolinus was elected bishop of Troyes. "Quia preterea, sed, non tantum in Teutonico, sed et sian in Romano, id est in Latina lingua, nonnulli sunt qui loquuntur, *Sanderum*, speaking of St. Adalard, abbot of Corbey, brings out the distinction still more clearly. "Si quis vulgaris, id est, *Romana* lingue loqueretur, omnium aliarum putaretur insonare; si aut Teutonice, alioquin perfectus, et *Latine*, in nulla omnino absonaret." The same distinction is made by the French writers of the 16th century. The words of the Latin vulgaris in the popular language *populi*, *communi*, *tertili*=*maiores* (*magis*). In the beginning of the 9th century the church ordered the priest to preach, not in literary Latin, but in the popular tongue. The oath of Strasbourg (842 A. D.), happily preserved, is a specimen of the popular Latin of the 9th century, and called with equal justice the latest specimen of the Latin of the earliest; example of the French language.

Pro Deo amur et pro christian poplo et nostro
(Latin) *Pro Dei amore et pro christiano populo et nostro*
(French) *Pour l'amour de Dieu, et pour le salut du peuple chrétien*
et de nous

Commun salvament, d'ist di en avant, in quant Deus
Comensun salvamento de isto die in ad-ante in quantum Deus
Commun salvut de es dier in avant, cadent que Deus

Savir et podir me dnnat, si salvarai eo cist meon fradre
*Sapere et posse mihi donabit, si salvare habeo ego ecc'isum
 meum fratrem*

Me donne savoir et pouvoir, je sauve ai mon frère

Karlo et in aduoc

Carolus et in adiutus et in quaque una causa, sic

l'omo per

Charles et en aide et en chaque chose, ainsi qu'on do

Dreit son fradre salvar dist, in o quid il mi altresì
 Diastore euen fustore salvore d'istore ad in o quid ille

*Directum suum fratrem saluare debitus est, in eo quod ille
maius alterum etc.*

Selon la justice sauver son frère, à condition qu'il en fasse

assistant

Faret; et ab Ludher nul plaïd numquam prindrai .

Faciet, et ab Lothario nullum placitum nunquam prehendere

Pour moi, et je ne ferai avec Letham aucun accord.

Pour moi, et je ne jurerai avec Luchini et aucun de ses
amis, mais j'ai bien peur que les Russes ne soient pas

Quod mea voluntate occ'iso meo fratri Carolo in danno sit.

Qua par ma volonté porte préjudice, à mon frère Charles ici

in d'ont

[illegible]

It is needless to add that assimilation, syncope, and the avoidance of a harsh concurrence of consonants, either by the rejection of one or more of them, or by the insertion of a vowel, have all played a great part in the consonantal system of the Romance languages. A table of the chief changes of consonants in combination will be found in Dies, *Grammaire des Langues Romanes*, vol. 1. p. 282.

In nouns the inflexions denoting case were generally lost and changes in their functions supplied in the genitive, dative, and ablative by the use of prepositions, and thus in two ways. On the one hand French *proposition* and Provençal, following a tendency common in popular Latin, took the accusative as the typical oblique case, and used forms thence derived for the objective case, while forms derived from the nominative constituted the subjective case; e.g., sing. subj. *murs* (= *murus*), obj. *mur* (= *murum*), plur. subj. *murs* (= *muri*), obj.

one of these, Gasparino da Barziza (died 1491), has commonly been assigned the distinction of being the father of the pure and elegant Latinity of the Renaissance. His devotion to the study of Cicero is shown by the plan which he formed to fill up, by conjectural links, the numerous deficiencies in the MSS. of the *De Oratore* then known to scholars, a design happily superseded by the discovery of the famous *Cicero Laurentinae*. Additional material was furnished by the recovery of not a few authors or portions of authors of the best period by the unreversed diligence of Poggio Bracciolini; and from henceforward the study of the Latin classics was pursued with the happiest results. Throughout the 15th century no literary acquisition was more eagerly sought than the Latin language which won for them the enthusiastic admiration of their contemporaries, and, though the learning of these eminent scholars proved not unfrequently injurious to their style by inducing an affectation of obsolete or unfamiliar words, there is no reason to deny that on the whole this acquisition was well deserved. In Germany they had a worthy rival, by some even ranked before them, in Agostino in France and England there was as yet no one who, in the judgment afterwards expressed by Erasmus, could be said to write Latin at all. As far as purity of style went, the highest pitch of excellence was doubtless reached by the Italians towards the beginning of the 16th century. Schiotti, Bembo, Petrus Martyr, and, we need not justise add, Longolius in France, wrote Latin with a grace and finish which place their works in respect of style almost on a level with those of their great model Cicero. But it cannot be denied that their fastidiousness of language often led them to sacrifice the fruits to the flowers of learning, and justly drew down upon them the witty and biting censures of Erasmus in his *Ciceronism*. In the controversy between the men of learning and the men of taste, the best tendencies of the age were decidedly on the side of the former; and the Italian scholars whose object, as Hallam well expresses it, was "to write pure Latin, to glean little morsels of Roman literature, to imitate the phrases in prose, and to leave the world to its own abuses," had little influence on the next generation in comparison with the wider culture and loftier aims of scholars like Erasmus and Melancthon. The rapid extension of a knowledge of Greek literature, especially in England, France, and Germany, from its close connection with the classics, threw themselves into the new world of thought thus revealed with an eager avidity which left little leisure for that elaborate polishing of periods which had been the delight of the Ciceronians. The 16th century saw enormous advances in the knowledge of antiquity; but the most learned were by no means always equally famous for their skill in the use of the Latin language. Even in Italy itself the most eminent writers on classical subjects approach rather to the German than to the Ciceronian type, and are more distinguished for the width of their erudition and the abundance of their quotations than for elegance or purity of style. On this side of the Alps the prevalence of the same type was, as might have been expected, all but universal. Moretus alone perhaps maintained in this generation the best traditions of style, and was pronounced, even by the judgment of the censorious Scaliger, to have written better Latin than any one since Cicero; in Italy, however, he had a formidable rival in the poet of the Ciceronians, Petrus Marsus. It shows how little Latin was now a living language that the latter, like all his school, refused to speak in Latin, for fear that the necessities of daily conversation should make him familiar with barbarous phrases, which would hardly fail to taint his written style. Others for a similar reason always resorted to the literary Greek, just as in later days some have refused to read the New Testament in the original language for fear of spoiling the purity of their Italian prose. In Germany especially the influence of Lysius founded a new school of Latinitas, based on the imitation of the silver Latinity of Tacitus and Seneca, and conspicuous for some of the merits, and more than all the faults, which have been noticed above as marking those authors. In Britain the only scholar whose style merits especial notice is George Buchanan, whose prose is hardly less admirable than his famous poetical version of the Psalms. On the whole it must be said that, while the improvement in works of reference, and in subjects of education generally (especially through the activity of the Jesuits), raised the average of correctness and purity, there is less grace and power than may be found among the best of the writers of an earlier time. As yet the use of Latin as a means of literary expression and of public business showed no signs of decline, except perhaps in Germany, where the version of the Bible by Luther and his popular works in the vernacular had given a model for literary German, and in England, where some of the great works of controversial theology, notably Hooker's *Ecclesiastical Polity*, were already published in English, doing thereby incontestable service to the dignity and the enrichment of the native tongue. But during the 17th century, as a consequence of the steady develop-

ment of the various national literatures, Latin came to be more and more merely the language of the learned. Some of the most eminent scholars belong to this period, and among them Heinsius, Grotius, Salmasius, and his more illustrious antagonist Milton are all famous for the elegance of their diction, while Scapellato and Vossius contributed largely to the scientific knowledge of grammar. But towards the end of the century complaints as to the general decay of learning frequently occur. In Germany it was almost extinct. In France the Jesuit colleges maintained the traditions of a pure Latinity with some success, and were noted for the polished though sometimes too rhetorical style in which their exercises were conducted. In England the decay of Latin was never so complete as that of Greek; and the great name of Bentley shines out conspicuous, set off, it must be admitted, by the school-boy dullness of most of his rivals. Even he did not escape the ferule of the schoolmasters; Richard Johnson of Nottingham, who claims in his *Anti-Groterius* due to have pointed out more than ninety errors in the great scholar's Latinity. In the 18th century we still find Latin used for works on science and philosophy, which appealed to the learned in all countries; to say nothing of Newton's *Principia* (1689), Burnet's *History of the Reformation* (1684), and Ray's *Synopsis* (1685), and in natural and botanical works, we find even Linnaeus in 1760 securing his *Systema Naturae* in Latin. But as an organ of general literature it may be said to have expired in the course of the 17th century. The last great philosopher who habitually employed Latin for his works was Leibnitz (1646-1716), perhaps the last important work in English theology written in Latin was Baillet's *Defence d'Adam* (1685).

The use of Latin in diplomacy did not towards the end of the 17th century. The Spanish embassy sent to the court of James I. in 1605 used sometimes Latin and sometimes French, the Latin state-papers written by Milton during the Commonwealth are well known, and in the negotiations at Münster (1648) even the French representative, M. d'Avaux, prided himself on his skill in writing Latin. But at Nymegen (1677) the Danish ambassador's claim that the Latin language should be used between the French representative and himself was rejected as an impertinence, and he was obliged to agree that, while he might employ Latin himself, French was to be the only language. At Vienna, too, the opening of the proceedings in French, he was answered by the bishop of Gurk in Latin, but the French envoy pleaded that they had forgotten their Latin, and the subsequent proceedings were conducted in French (cf. Bernard's *Lectures on Diplomacy*, pp. 158-165). Long after this time the German ambassador insisted that all negotiation should be conducted in Latin, and, although Joseph II. attempted to make German the official language of Hungary in its place, he was compelled to give way, and it was only in 1826 that Latin was for the first time displaced by Magyar in the debates of the Diet (p. 87). It may be said that the universal practice of that written communications from any European power should be made in the language of that power, but oral intercourse is carried on in French, with rare exceptions.

Authorities.—For the earliest stage of the Latin language the *Corpus Inscriptionum Latinarum*, vol. 1, of Gruenert's *Syllabus Inscriptionum Latinarum*, is indispensable. Wodeworth's *Diagnosia and Specimens of Early Latin* is very useful. Hubner's *Grundriss zu Vorlesungen über die Lateinische Grammatik* (Berlin, 1860, p. 104) contains a very complete list of all works of value upon the language. Corssen's *Ausprache Vokalismus und Betonung der Lateinischen Sprache* (2 vols., Leipzig, 1870) contains a valuable collection of the evidence as to the history of the pronunciation. Neue's *Formelnreihe* (2 vols., Berlin, 1877) is a complete storehouse of the inflexional forms. Dräger's *Historische Syntax* (2 vols., Leipzig, 1880) is extremely valuable, especially for the classical writers. Kühner's *Ausführliche Grammatik der Lateinischen Sprache* (2 vols., Hanover, 1877-78) is the most complete of recent grammars. In English the best grammars are those of Madrig, Dr Kenney, and Mr Roby. The first is excellent in the syntax, and well represents the most complete knowledge of the Latin language in its classical form to be gained without the aid of comparative philology; the second in respect of etymology too frequently adopts not only the facts but the less trustworthy theories of Corssen, while in syntax the full collection of examples is sometimes encumbered by an awkward terminology; the last is equally admirable for the clearness and fulness of its discussion of phonetics, the careful historical treatment of inflections, and the freedom and precision of its syntax. For later Latin and its connection with the Romance languages, Schuchardt's *Vokalismus des vulgärlateinischen, Ronsch's Italia und Palägia*, and Dietz's *Grammatik der Lateinischen Romanen* are the chief text-books. The diction of the most important writers can best be studied in the numerous editions of the classical authors and grammars devoted to them severally, most of which will be found mentioned in the *Index*. For the study of the Germanic languages, see the edition of Hubner's *Guida to Latin Literature*, Bernhardy's *Grundriss der Römischen Literatur* and Teuffel's *History of Roman Literature* have many useful hints as to the growth of the language. (A. S. W.)

LATIN LITERATURE. See *ROMA*.

LATITUDE. See *ASTRONOMY*, *GEODESY*, and *GEOGRAPHY* (*MATHEMATICAL*).

LATIUM, in ancient geography, was the name given to the portion of central Italy which adjoined the Tyrrhenian Sea on the west, and was situated between Etruria and Campania. The name was, however, applied in a very different sense at different times, and the extent of country comprised under this appellation varied materially. Latium originally means the land of the Latini, and in this sense, which is that alone in use historically, it was a tract of comparatively limited extent, but after the overthrow of the Latin confederacy, when the neighbouring tribes of the Hemicans, Volscians, and Auruncans, as well as the Latins properly so called, were reduced to the condition of subjects and citizens of Rome, the name of Latium was extended so as to comprise them all, and include the whole country from the Tiber to the Liris. The change thus introduced was not formally established till the reign of Augustus; but it is already recognized by Strabo (v. p. 228), as well as by Pliny, who terms the additional territory thus incorporated Latium Adjacent, while he designates the original Latium, extending from the Tiber to Circei, as Latium Antiquum. We shall confine ourselves in the first instance to the description of Latium in this limited sense, in which it figures in Roman history from the foundation of the city to the days of Cicero.

I. LATIUM ANTIQVVM. In this original sense Latium was a country of but small extent, and consisted principally of an extensive plain, now known as the Campagna di Roma, bounded towards the interior by the lofty range of the Apennines, which rise very abruptly from the plains at their foot to a height of between 4000 and 5000 feet. Several of the Latin cities, including Tibur and Praeneste, were, however, situated on the terrace-like underfalls of these mountains, while Cora, Norba, and Setia were placed in like manner on the slopes of the Volscian mountains or Monti Lepini, a rugged and lofty range, which branches off from the Apennines near Praeneste, and forms a continuous mountain barrier from thence to Terracina. In the midst of the plain thus limited rises a group of volcanic mountains, of about 30 miles in circuit, and attaining to a height of over 3000 feet, now commonly known as the Alban hills, though the designation of Albani Montes is not found in any ancient writer. But the highest summit, now called Monte Cavo, on which stood the temple of Jupiter Latiaris, was known as Mons Albanus; while the north-east summit, which almost equalled it in height, bore the name of Mount Algidus, celebrated in all ages for the dark forests of ilex with which it was covered. No volcanic eruptions are known to have taken place in these mountains within the historic period, but the remains of a crater are distinctly seen near the summit of the Mons Albanus, forming the basin now known as the Campo di Annibale, while the cup-shaped lakes known as the Alban Lake and the Lake of Nemi unquestionably occupy the basins of similar craters at a lower level on the southern slope of the mountain, and the adjacent Lacus Aricinus, now drained, was another vent of a similar character.

But, besides this distinctly volcanic group, by far the greater part of the plain now called the Campagna di Roma was formed by volcanic deposits, consisting for the most part of the rock called *tuffi*, an aggregate of volcanic sand, pebbles, and clinders or scoria, varying greatly in hardness and consistency, from a compact rock well adapted for building stone to a loose disintegrating sand known by the local name of *puzzolana*. In a few places only beds of lava are found, the most distinct of which is a continuous stream extending from the foot of the Alban hills to within 2 miles from Rome, along which the line of the

Appian Way was carried. These deposits have been formed upon previously existing beds of Tertiary formation, which here and there rise to the surface, and in the Monte Mario, a few miles north of Rome, attain to the height of 400 feet. The surface is by no means an uniform plain, like that of the Terra di Lavoro (the ancient Campania), but is a broad undulating tract, furrowed throughout by numerous depressions, with precipitous banks, serving as water-courses, though rarely traversed by any considerable stream. As the general level of the plain rises gradually, though almost imperceptibly, to the foot of the Apennines, these channels by degrees assume the character of ravines of a formidable description.

Between the volcanic tract of the Campagna and the sea there intervenes a broad strip of sandy plain, evidently formed merely by the accumulation of sand from the sea, and constituting a barren tract, still covered, as it was in ancient times, almost entirely with wood. This long belt of sandy shore extends without a break for a distance of above 30 miles from the mouth of the Tiber to the promontory of Antium (Porto d'Anzo), which is formed by a low but rocky headland, projecting out into the sea, and giving rise to the only considerable angle in this line of coast. Thence again a low sandy shore of similar character extends for about 24 miles to the foot of the Monte Circeo, an isolated mountain mass of limestone of about 9 miles in circumference, and rising to a height of 2000 feet. From the almost insulated character of this remarkable promontory, which is united to the Apennines at Terracina by a similar strip of sandy coast, between the Pontine Marshes and the sea, there can be no doubt that it was once an island, which has been gradually united to the mainland by alluvial deposits. But it is certain that these deposits must have commenced long before the historical period, and the assertion strangely ascribed by Pliny to Theophrastus, that the Circean promontory was in the days of that philosopher still an island, is certainly erroneous. The region of the Pontine Marshes, which occupies almost the whole tract between the sandy belt on the sea-shore and the Volscian mountains, extending from the southern foot of the Alban hills below Velletri to the sea near Terracina, a distance of about 30 miles, is a perfectly level plain, rendered pestilential by the stagnation of numerous streams that descend from the neighbouring mountains, and are unable to find their way through this extremely low and level tract, while their outlet to the sea is barred by the sands of the coast between Monte Circeo and Terracina.

At the earliest period of which we have any historical record the whole of the country that we have thus described, or Latium in the proper sense of the term, was inhabited by the people known to the Romans as Latini. Of their origin or ethnical affinities we have very little information, except that they belonged to the same branch of the Italian races with the Umbrians, Oscans, and Sabellians (see *ITALY*). At the same time they constituted, according to the general testimony of ancient writers, a distinct people from their neighbours the Sabines and the Volscians, who held the mountain districts adjoining their territory, as well as (in a much higher degree) from the Etruscans on the other side of the Tiber. There was once, however, a people called the Rutuli, who occupied a small portion of the Latin territory adjoining the sea-coast, and are described as a separate people under their own king,—a tradition familiar to all modern readers from its having been adopted by Virgil. But the name of the Rutuli, as that of an independent people, disappears from history at a very early period, and their capital city of Ardea was certainly one of the thirty cities that in historical times constituted the Latin league. The list of these cities given us by Dionysius of Halicarnassus, which has every appearance of

being derived from an authentic document (see Niebuhr's *Roman History*, vol. ii. p. 25), enumerates them as follows:—Aides, Aricia, Bovillae, Bubentum, Corniculum, Carventum, Cereii, Corioli, Corbio, Cora, Fontani (?), Gabii, Laurentum, Lavinium, Labicum, Lanuvium, Nomentum, Norba, Praeneste, Padum, Querquetulum, Satricum, Scaptia, Setia, Tellese, Tibur, Tussulum, Toleia, Tricrinum (?), Veitiae.

The list thus given by Dionysius is arranged in an order approximately alphabetical. Omitting the two names which are probably corrupt, and a few of which the site cannot be determined with any certainty, the others may be described according to their geographical arrangement. Laurentum and Lavinium, names so conspicuous in the legendary history of Aeneas, were situated in the sandy strip near the sea-coast, the former only 8 miles east of Ostia, which was from the first merely the port of Rome, and never figured as an independent city. Tibur extended again by Ardea, the ancient capital of the Rutuli, and some distance beyond that Antium, situated on the sea-coast, which, though not in the list of Dionysius, was certainly a Latin city. On the southern underfalls of the Alban mountains, commanding the plain at the foot, stood Lanuvium and Veitiae; Ardea rose on a neighbouring hill, and Corioli was probably situated in the plain beneath. The more important city of Tuscolum occupied one of the northern summits of the same group; while opposite to it, in a commanding situation on a lofty outlier of the Apennines, rose Praeneste, now Palestrina. Bola and Padum were in the same neighbourhood, Labicum on the slope of the Alban hills below Tuscolum, and Corbano on a rocky summit east of the same city. Tiber (Tyrol) occupied a height commanding the outlet of the river Anio. Corniculum, farther west, stood on the summit of one of three conical hills that rose abruptly out of the plain at the distance of a few miles from Monte Genaro, the nearest of the Apennines, and which were then known as the Montes Corniculani. Nomentum was a few miles farther north, between the Apennines and the Tiber, and close to the Sabias frontier. The boundary between the two nations was indeed in this part very fluctuating. Nearly in the centre of the plain of the Campagna stood Gaius; Bovillae was also in the plain, but close to the Arpin Way, where it begins to ascend the Alban hills. Several other cities—Tellese, Scaptia, and Querquetulum—mentioned in the list of Dionysius were probably situated in the Campagna, but their site cannot be determined. Satricum, on the other hand, was south of the Alban hills, apparently between Veitiae and Antium; while Cora, Norba, and Setia (all of which retain their ancient names with little modification) crowded the rocky heights which form advanced posts from the Volcanic mountains towards the Pontine Marshes.

It must be borne in mind that the list given by Dionysius belonged to a date about 490 B.C., and a considerable number of the Latin cities had before that time either been utterly destroyed or reduced to subjection by Rome, and had thus lost their independent existence. Such were Antenne and Cennina, both of them situated within a few miles of Rome, and the conquest of which was ascribed to Romulus; Fidene, about 5 miles north of the city, and close to the Tiber; and Ostium Tiberis, in the hilly tract farther north towards the Sabine frontier. Pometia also, on the borders of the Pontine Marshes, to which it was said to have given name, was a city of importance, the destruction of which was ascribed to Targuinius Superbus. But by far the most important of these extinct cities was Alba, on the lake to which it gave its name, which was, according to the tradition universally received, the parent of Rome, as well as of numerous other cities within the limits of Latium, including Gabii, Fidene, Collatia, Nomentum, and other well-known towns. Whether or not this tradition deserves to rank as historical, it appears certain that at an early period there existed a confederacy of thirty towns, of which Alba was the supreme head. A list of these is given us by Pliny (iii. 5, 968) under the name of "populi Albenses," which includes only six of those found in the list of Dionysius; and these for the most part among the more obscure and least known of the names there given; while the more powerful cities of Aricia, Lanuvium, and Tuscolum, though situated immediately on the Alban hills, are not included, and appear to have maintained a wholly independent position. This earlier

league was doubtless broken up by the fall of Alba; it was probably the increasing power of the Volsci and Aequi that led to the formation of the later league, including all the more powerful cities of Latium, as well as to the alliance concluded by them with the Romans in the consulship of Sp. Cessius (493 A.C.).

The cities of the Latin league continued to hold general meetings or assemblies from time to time at the Grove of Ferentina, a sanctuary at the foot of the Alban hills in a valley below Marino, while they had also a common place of worship on the summit of the Alban Mount (the Monte Cavo), where stood the celebrated temple of Jupiter Latiaris. The participation in the annual sacrifices at this sanctuary was regarded as typical of a Latin city, and they continued to be celebrated long after the Latins had lost their independence and been incorporated in the Roman state. This change took place in 338 B.C. During the centuries that followed down to the end of the Roman republic many of the Latin towns sank into a very decayed condition. Cicero speaks of Gabii, Labicum, and Bovillae as places that had fallen into abject poverty, while Horace refers to Gabii and Fidene as mere "deserted villages." Many of the smaller places mentioned in the list of Dionysius, or the early wars of the Romans, had altogether ceased to exist, but the statement of Pliny that fifty-three communities (*populi*) had thus perished within the boundaries of Old Latium is certainly exaggerated, and his list of the "illustrations cities" (*clara oppida*) that had thus disappeared is very confused and unintelligible. Still more erroneous is his statement that there were once twenty-four cities on the site occupied in his time by the Pontine Marshes,—an assertion not confirmed by any other authority, and utterly at variance with the physical conditions of the tract in question.

II. LATIUM NOVUM, or ADJECTIVUM, as it is termed by Pliny, comprised the territories occupied in earlier times by the Volscians, Hernicans, and Auruncans. It was for the most part a rugged and mountainous country, extending at the back of Latium proper, from the frontier of the Sabines to the sea-coast between Terracina and Sinuessa. But it was not separated from the adjacent territories by any natural feature or physical boundary, and is only by the enumeration of the towns in Pliny according to the division of Italy by Augustus that we can determine its limits. It included the upper valley of the Anio, with the towns of Sublaqueum and Trebe, the Hernican cities of Anagnin, Ferentinum, Alatrium, and Verulanum—a group of mountain strongholds on the north side of the valley of the Trebia or Sacco; together with the Volcanic cities on the south of the same valley, and in that of the Liris, the whole of which, with the exception of its extreme upper end, was included in the Volcanic territory. Here were situated Signa, Praeneste, Fabiara, Regillae, Sorae, Arpinum, Atina, Aquinum, Cassinum, and Interamnia; Arxur, or Terracina, was the only seaport that properly belonged to the Volscians, the coast from thence to the mouth of the Liris being included in the territory of the Auruncans, or Ausonians as they were termed by Greek writers, who possessed the maritime towns of Fundi, Formiae, Cereia, and Minturnae, together with Suessa in the interior, which had replaced their more ancient capital of Arundina. Sinuessa, on the sea-coast between the Liris (Gerigliano) and the Volturnus, was the last town in Latium according to the official use of the term.

Though the Apennines comprised within the boundaries of Latium do not rise to a height approaching that of the loftiest summits of the central range, they attain to a considerable altitude, and form steep and rugged mountain masses from 4000 to 6000 feet high. They are traversed by three principal valleys:—(1) that of the Anio, now called Teverone, which descends from above Sublaqueum to Tivoli, where it enters the plain of the Campagna; (2) that of the Trebia or Sacco, which has its source below Palestrina (Praeneste), and flows through a comparatively broad valley that separates the main mass of the Apennines from the Volcanic mountains or Monti Lepini, till it joins the Liris below Capranza; (3) that of the Liris or Gerigliano, which enters the confines of New Latium about 20 miles from its source, flows under the walls of Sorae, and has a very tortuous course from thence to the sea at Minturnae; its lower valley is for the most part of considerable width, and forms a fertile tract of considerable extent, bordered on both sides by hills covered with vines, olives, and fruit trees, and thickly studded with towns and villages.

It may be observed that, long after the Latins had ceased to exist

as a separate people, we meet in Roman writers with the phrase of "nomen Latinum," used not in an etymological but a purely political sense, to designate the inhabitants of all those cities on which the Romans had conferred "Latin rights" (*ius Latium*),—an inferior form of the Roman franchise, which had been granted in the first instance to certain cities of the Latium, when they became subjects of Rome, and was afterwards bestowed upon many other cities of Italy, especially the so-called Latin colonies. At a later period the same privileges were extended to places in other countries also,—as for instance to most of the cities in Sicily and Spain. All persons enjoying these rights were termed in legal phraseology "Latini" or "Latini conditionis."

For the topography of Latium, and the local history of its more important cities, the reader may consult Sir W. Gell's *Topography of Rome and its Vicinity*, 2 vols 8vo, Lond., 1834, 2d ed., 1 vol., 1846, with a valuable map; Nibby, *Anales Storico-Topografico-Antiquarie della Città del Dominio di Roma*, 3 vols 8vo, 1837, 2d ed. 1843; Westphal, *Die Römische Campagna*, 4to, Berlin, 1829; Bormann, *Alt-Latrische Choronographie und Städte-Geschichte*, 8vo, Halle, 1852; Burn's *Rome and the Campagna*, 4to, Lond., 1871; Hare's *Walks around Rome*, 2 vols 8vo, Lond., 1873. An elaborate antiquarian map of Old Latium has been long in preparation by the Cavaliere De Rosa, but has not yet made its appearance.

(H. B.)

LATONA is the Latin name of the Greek Leto, mother of Apollo and Artemis. In Greece she belongs rather to the sphere of mythology than of religion; she forms part of the surroundings of these two great deities, but is not usually a goddess to whom worship is paid or temples built. Different forms of the Latona legend are found in the various seats of Apolline religion, and the tradition which has obtained the widest literary currency is a union of the legends of these two places, formed doubtless under the unifying influence of the Delphic oracle. Latona, pregnant by Zeus, long seeks in vain for a place of refuge to be delivered. She wanders from Crete over Athens, the coasts of Thraee and Asia Minor, and the islands; at last the barren desolate isle of Delos offers itself. Pindar and later poets tell that Delos was a wandering rock borne about by the waves, till it was fixed to the bottom of the sea to serve for the birth of Apollo. Hence arose the belief that Delos could not be shaken by earthquakes,—a belief that was disproved by several shocks in historical times (Herod., vi. 98, Plin., iv. 66). In the oldest forms of the legend Hera is not mentioned, but afterwards the wanderings of Leto are ascribed to the jealousy of Hera, enraged at her amour with Zeus. In the legend the foundation of Delphi follows immediately on the birth of the god, and on the sacred way between Tempe and Delphi the giant Tityos offers violence to Leto, and is immediately slain by the arrows of Apollo and Artemis. Such are the main facts of the Leto legend in its common literary form, which is due especially to the two Homeric hymns to Apollo. We must turn from mythology to actual religion in order to discover the true character of the myth. Then we shall find that Leto is a real goddess, and not a mere mythological figure. The honour paid to her in Delphi and Delos might be explained as part of the cultus of her son Apollo, but temples to her existed in Argos, in Mantinea, and in Xanthos of Iydia, her sacred grove was on the coast of Crete. In Iydia graves are frequently placed under her protection (see *Corpus Inscr. Græc.* No. 4259, 4300, 4303, &c.), and she is also known as a goddess of fertility and as *καυροπόδος*. In these attributes we recognise the earth-goddess. Now, although in the common legends Apollo and Artemis are called the twin children of Leto, yet she appears far more conspicuously in the Apolline myths than in those which grew round the great centres of Artemis worship; moreover, in the older forms of the Apolline myths Artemis is hardly mentioned except as an after-thought, and the Homeric hymn makes them both in different places (*ἥνυ μὲν δ' Ὀρρεγὼν, τὸν δὲ κρηναὶ ἐν Δελφῇ*). Facts such as these will be readily explained

if one recognizes that the idea of Apollo and Artemis as twins is one of later growth on Greek soil, and that the two religions come from different origins in Asia Minor. Again Iydia, one of the chief homes of the Apolline religion, is precisely the country where most frequent traces are found of the worship of Leto as the great goddess. Etymological considerations point in the same direction. The Greeks always connected the word Leto with the root seen in *λαθῆναι*, *λῆθη*, &c.; but it is more probable that the resemblance is delusive, and that the origin is to be found in words which are not so distinctively Greek. Leto and Leda are both probably forms of the Lycian word *Ladu*, which means woman or lady, and the island of Lade or Late (Plin., v. 35), the town Leto, the rivers Ladon and Lethæus, were all named from the goddess.

It is clear then that Latona or Leto was the great goddess of a religion which found its way into Greece, where its mythology was harmonized to a certain extent with that of the other religious systems of the country. Everything points to Iydia as the earlier home of this religion. Zeus, by whatever name he was called, and Leto are heaven and earth, their offspring is Apollo, the ever young god of light and of the sun, born afresh every spring. The myth is the same that occurs over and over again with different names in every district of Greece and Asia Minor. But in Greece Hera was recognized as the supreme consort of Zeus, and Latona could only rank with many other goddesses of antique religions as his concubine; though even in Greece the oldest forms of the tradition recognise her as the goddess-consort, *καθ' ἡμετέρας*, of Zeus. Sappho calls her and Niobe "loving companions." The father of Leto, Coeus, must be a god in the almost forgotten religion to which she belongs.

In Greek art Leto appears usually in company with her children; in vase paintings especially she is often represented with Apollo and Artemis. The statue of Leto in the Letoon at Argos was the work of Praxiteles.

See *Atlas*, *tab. 240*, 183; Hesiod., *Theog.* 184; Coeus, *Erasm. vof den Græck. Inschr.* p. 91.

LATREILLE, PIERRE-ANDRÉ (1762-1835), French naturalist, was born in humble circumstances at Brives-la-Gaillarde, now in the department of Corrèze, France, on November 29, 1762. His abilities attracted the attention of the Baron d'Espagnac, who in 1778 placed him at the Collège Lemoine at Paris, where the Abbé Hahy was at that time a teacher. Having chosen the ecclesiastical career, he was admitted to priestly orders in 1786, and in the same year retired to Brives, devoting all the leisure which the discharge of his professional duties allowed to the study of entomology. In 1788 he returned to Paris and found means of making himself known to the leading naturalists there,—Fabricius, Olivier, Bosc, Lamarck; his first important contribution to his special sciences, a "Mémoire sur les Mutilles découvertes en France," contributed to the *Proceedings of the Society of Natural History in Paris*, procured for him the honour of admission to that body, and of being made a corresponding member of the Linnean Society of London. At the Revolution he was compelled to quit Paris, and as a priest of conservative sympathies suffered considerable hardship, he lay for some time in prison at Bordeaux, and gained his liberty at last only through the intervention of the naturalist Bory de Saint-Vincent and Dargelas. His *Précis des Caractères génériques des insectes, disposés dans un ordre naturel*, appeared at Brives in 1796. In 1798 he became a corresponding member of the Institute, and at the same time was entrusted with the task of arranging the entomological collection at the recently organized "Muséum d'Histoire Naturelle" (Jardin des Plantes); in 1814 he succeeded Olivier as member of the Académie des Sciences, and in

1831 he was made a chevalier of the Legion of Honour. For some time he acted as professor of zoology in the veterinary school at Alfort near Paris, and in 1830, when the chair of zoology of invertebrates at the Muséum was divided after the death of Lamarck, Latreille was appointed professor of zoology of crustaceans, arachnids, and insects, that of molluscs, worms, and zoophytes being assigned to De Blainville. "On me donne du pain quand je n'ai plus de dents," said Latreille, who was then in his sixty-eighth year. He died on February 6, 1833.

In addition to the works already mentioned, the numerous works of Latreille include—*Histoire naturelle générale et particulière des Crustacés et Insectes* (14 vols., 1802-5), forming part of Bonaparte's edition of Buffon; *Genera Crustaceorum et Insectorum, secundum ordinem naturalem in familias disposita*, 4 vols., 1808-7; *Considerations générales sur l'ordre et la nature des animaux composant les classes des Crustacés, des Arachnides, et des Insectes*, 1810; *Familles naturelles du règne animal, exposées méthodiquement et dans un ordre analytique*, 1825; *Cours d'Entomologie* (of which only the first volume appeared, 1831), the whole of the section "Crustacés, Arachnides, Insectes," in Cuvier's *Régne Animal*, besides many papers in the *Annales du Muséum*, the *Encyclopédie Méthodique*, the *Dictionnaire Classique d'Histoire Naturelle*, and elsewhere.

LAUBAN, chief town of a circle of the same name in the government of Lëgnitz and province of Prussian Silesia, is situated in a picturesque valley, at the junction of the lines of railway from Goritz and Sorau, 39 miles west-south-west from Liegnitz, in 51° 7' N. lat., 16° 17' E. long. Lauban is the seat of a chamber of commerce, and has a Roman Catholic and three Lutheran churches, a conventual house of the order of St. Magdalene, dating from the 14th century, a municipal library and museum, two hospitals, an orphanage, a gymnasium, and a collegiate institute for girls. The industrial establishments comprise tobacco, yarn, thread, and linen and woollen cloth manufactories, bleaching, calendering, and dyeing works, a bell-foundry, tile kilns, breweries, and oil and flour mills. In 1880 the population was 10,779.

Lauban was founded in the 10th and fortified in the 13th century. In 1487 and 1488 it was devastated by the Hussites, and in 1640 by the Swedes. In 1761 it was the headquarters of Frederick the Great. In 1816 it was the last Saxon town that made its submission to Prussia.

LAUD, WILLIAM (1573-1644), archbishop of Canterbury, was born at Reading on October 7, 1573. In 1590 he became a scholar of St John's, Oxford, and a fellow in 1593. In 1601 he entered the ministry of the church. In 1605 he married the earl of Devonshire to the divorced Lady Rich, an act which he never ceased to regret. In 1611 he became president of St John's. His career at Oxford brought him into collision with the authorities of the university. He was one of those who were revolted by the Calvinistic Puritanism which prevailed, and he upheld in a sharp irritating way the doctrines on the divine right of Episcopacy, and of the permanent existence of the church during the Middle Ages, which was regarded as rank heresy by the Puritans. In 1616 he was appointed to the deanery of Gloucester, and, with the king's approbation, removed the communion table in the cathedral to the east end. In 1621 James made him bishop of St David's, though, if a commonly received story is to be believed, he entertained grave doubts whether Laud would exercise the episcopal authority with wisdom. In 1622 the new bishop took part in a controversy with Fisher the Jesuit, on the claims of the Papal Church. His argument, which was afterwards published, was not only a serious contribution to controversial literature, but marks a distinct advance in the direction which was afterwards taken by Chillingworth.

The controversy with Fisher had been entered on in order to save Buckingham's mother from conversion to the Church of Rome. It failed in this object, but it gained for Laud considerable influence over Buckingham himself,

and through Buckingham over Prince Charles, who when he became king in 1625 was attracted to an ecclesiastical adviser whose opinions so closely resembled his own, and whose firmness of character supplied a contrast to the irresoluteness of which he could scarcely be unconscious. During the first years of the reign Laud was frequently consulted in matters relating to the church. He is found favouring the promotion of anti-Puritan divines, approving Montague's *Appello Cæsarem*, and generally throwing his weight into the scale against the assumption of the House of Commons to lay down the law in politics and religion.

In 1628 Laud was made bishop of London, and when the ecclesiastical controversy came to a head in the session of 1629, his biography became identified, till the meeting of the Long Parliament, with the history of the Church of England.

Intellectually Laud's position was that of a man opposed to the dogmatism of the Calvinists. "The wisdom of the church," he wrote, "hath been in all ages, or the most, to require consent to articles in general as much as may be, because that is the way of unity, and the church in high points requiring assent to particulars hath been rent." Laud's love of peace unhappily led him to shrink from the free exuberance of spiritual life. Perhaps it could hardly be expected, in an age when each ecclesiastical party was longing to persecute all others, that any man placed in authority should think it possible to allow the struggling parties to grow up side by side, in what must have seemed the vain hope that liberty would bring a larger harmony. Laud, at least, had no conception of the kind. He was by nature a lover of order and discipline, devoid of the higher spiritual enthusiasm or breadth of judgment which characterizes the highest order of intellect. He spoke of Aristotle, the philosopher who lays such stress on the formation of habits, as his great master in *humana*. All Laud's work in life was to attempt to form habits, to make men learn to be decent by acting decently, and to be religious by acting religiously. "Since I came to this place," he said of himself, "I laboured nothing more than that the external public worship of God—too much alighted in most parts of this kingdom—might be preserved, and that with as much decency and uniformity as might be, being still of opinion that unity cannot long continue in the church when uniformity is shut out at the church doors. And I evidently saw that the public neglect of God's service in the outward face of it, and the nasty lying of many places dedicated to that service, had almost cast a damp upon the true and inward worship of God,—which, while we live in the body, needs external helps, and all little enough to keep it in any vigour."

Upon these principles he acted, more especially after his promotion in 1633 to the archbishopric of Canterbury. His metropolitanical visitation of the province enforced his system of uniformity in every parish contained in it. He had no sympathy with the special doctrines of the Papal Church, still less with its ceremonial; but he held that conformity to the prayer book was to be the universal rule. He gave great offence to the Puritans by insisting upon the removal of the communion table to the east end of the church, while the communicants were to receive the sacrament on their knees. For this and for the enforcement of other observances he was stigmatized as an innovator, but he repelled the charge in the speech which he delivered at the trial in the Star Chamber of Prynne, Bastwick, and Burton in 1637, declaring that the Puritan usages were themselves innovations on the practice inculcated at the Reformation.

Nor did Laud confine himself to imposing ceremonies upon the clergy. The church courts undertook in those days to reform the morals of the laity, and Laud excited

much ill-feeling by insisting that the powerful and the wealthy should submit to punishment as well as the poor. As a privy councillor he took part in affairs of state, and upon the death of Portland in 1685 he became a commissioner of the treasury till he procured for Bishop Juxon the appointment of lord treasurer in 1687. The advice which he gave to the king with respect to the introduction of a new prayer book into Scotland proved ultimately fatal to him. Of this prayer book, in the amendment of which he had had a considerable share, he was not unnaturally regarded as the author; and, when in 1640 the Scots triumphantly occupied the northern counties, and sent commissioners to London to negotiate a peace, they called for the punishment of the archbishop as the great incendiary. One of the first acts of the Commons after the meeting of the Long Parliament was to impeach him. For some time he remained in prison, apparently overlooked. But in 1643 there was fresh need of conciliating the Scots, and his impeachment was proceeded with. He made an able and in many respects a satisfactory defence, but his condemnation was a foregone conclusion, and he was executed on January 10, 1644, at the age of seventy-two.

The best source of the biography of Laud is to be found in his own *Works*, edited by Dr Bliss, in the Anglo-Catholic Library. The adverse view of his character will be found in Prynne's *Cantuarv's Doom*. (S. R. G.)

LAUDANUM. See OPIUM.

LAUDER, SIR THOMAS DICK, BART. (1784-1848), was the only son of Sir Andrew Lauder, the sixth baronet, and was born at Edinburgh in 1784. He succeeded to the baronetcy in 1830. In early life he published two romances, *Lothian and the Wolf of Badenoch*; and such were the merits of his style that his first contribution to *Blackwood's Magazine* in 1817, entitled "Simon Roy, Gardener at Dunphail," was by some ascribed to the author of *Waverley*. He was afterwards a frequent contributor to *Blackwood* and also to *Tait's Magazine*, and in 1830 he published the book by which his name is now best known, *An Account of the Great Floods of August 1829 in the Province of Moray and adjoining Districts*. Subsequent works were *Highland Rambles, with Long Tales to shorten the Way* (2 vols. 8vo, 1837), *Legendary Tales of the Highlands* (3 vols. 12mo, 1841), *Tour Round the Coasts of Scotland, and Memorial of the Royal Progress in Scotland* (1843). Lauder's paper on "The Parallel Roads of Glenroy," printed in vol. ix. of the *Transactions of the Royal Society of Edinburgh*, first drew attention to the phenomenon in question. Vol. i. of a *Miscellany of Natural History*, published in 1833, was also partly prepared by Lauder. He died on May 29, 1848. An unfinished series of papers, written for *Tait's Magazine* shortly before his death, was published under the title *Scottish Rivers*, with a preface by John Brown, M.D., in 1874.

LAUBENBURG, formerly a duchy belonging with Holstein to Denmark, but from 1865 to Prussia, was in July 1875 incorporated as a circle in the Prussian province of Schleswig-Holstein. It lies on the right bank of the Elbe, between 53° 21' and 53° 48' N. lat., 10° 13' and 11° 3' E. long., is bounded by the territories of Hamburg, Lubeck, and Mecklenburg, the province of Hanover, and the circle of Oldesloe, and comprises an area of 463 square miles. The surface of the country is a slightly undulating plain. The soil, chiefly alluvial, though in some places arenaceous, is generally fertile and well cultivated, but a great portion is covered with forests, and interspersed with lakes. By means of the Stecknitz Canal, the Elbe, the principal river, is connected with the Trave. The chief agricultural products of the circle are timber, fruit, grain, hemp, flax, and vegetables. Cattle breeding affords

employment for many of the inhabitants. The railroad from Hamburg to Berlin traverses the country. The judicial administration is divided among five courts of law, over which is a superior court for the whole circle, the supreme court of appeal being at Berlin. The capital is Ratzeburg, and there are two other towns, Molin and Lauenburg. In 1880 the population amounted to 49,186, Low Saxons by descent, and with few exceptions Lutherans by confession.

The earlier inhabitants of Lauenburg were a Slavic tribe known by the name of Polabes (i. e., dwellers on the Elbe, Slavic, *Leba*). They were gradually replaced by colonists from Lower Saxony, and about the middle of the 12th century the country was conquered by Henry the Lion, and thus came under the yoke of the dukes of Saxony. Lauenburg subsequently passed into the hands of Valdemar II. of Denmark, but, having in 1227 reverted to the Saxons, it remained in their possession for over four hundred years,—from 1260, however, in the separate line of Saxe-Lauenburg. After the death of Duke Julius Francis in 1589, the line of succession having become extinct, the emperor ordered the sequestration of the duchy, but Duke George William of Brunswick-Lüneburg-Celle forcibly occupied it, paid a money indemnity to Saxony, and was recognized by the inhabitants (1614, September 1702). Upon his death in 1705, Lauenburg fell to his nephew, George I., elector of Hanover, and afterwards king of England, whose claim was eventually recognized in 1728 by imperial decree. In 1806 Lauenburg was occupied by the French, and in 1810 it was incorporated with the department of Bouches de l'Elbe. After the battle of Leipzig in 1813 it reverted to Hanover, and on the 29th May 1815 was ceded to Prussia, which on the 4th June transferred it to Denmark. After the death of Frederick VII. of Denmark (1863) there were various claimants to the duchy, but at the peace of Vienna (20th October 1864) it was ceded by Christian IX. of Denmark to Austria and Prussia. By the convention of Gastein (14th August 1865) Austria surrendered her claims to Prussia upon the payment of 2,500,000 Danish thalers (about £280,000). On the 15th September William I. of Prussia took formal possession of the duchy, but it still retained its constitution and special privileges, and was not completely and incorporated with the kingdom of Prussia until the 1st of July 1878.

LAUNCESTON, a municipal and parliamentary borough and market-town of England, in the eastern division of the county of Cornwall, is situated on a branch railway line from Plymouth, on an eminence near the Kinsey, an affluent of the Tamar, 213 miles west-south-west from London. The streets are narrow and irregular, but of late years have been considerably improved. The parish church, dedicated to St Mary Magdalene, and built of curiously carved blocks of granite, was erected in the beginning of the 16th century, but possesses a detached tower of the date 1830. There are important remains of the old castle, which was the ancient seat of the earls of Cornwall, and was frequently besieged during the wars of Charles I. For the grammar school originally established in the reign of Edward VI. a new building was erected in 1862. The trade of the town is chiefly in agricultural produce. The population of the municipal borough (area 1604 acres) increased between 1871 and 1881 from 2936 to 3217, and that of the parliamentary borough (area 14,707 acres) from 5468 to 6675.

The ancient name of Launceston was *Dunchechael*, the swelling hill. The name Launceston, originally *Launeston*, derived from an old monastery dedicated to St Stephen. From the time of the Conqueror the place has belonged to the earls of Cornwall. It was made a free borough in the reign of Henry III., and received a charter of incorporation from Queen Mary in 1566. From 1294 it returned two members to parliament until 1832, when it was deprived of one of its members, and the disfranchised borough of Newport, comprising the parish of St Stephens, was included in its boundaries. The assizes of the county were transferred to Bodmin in 1838.

LAUNCESTON, the second town of Tasmania, is situated in the north of the island, at the point where the North and South Esk unite to form the river Tamar. It is the northern terminus of the railway from Hobart Town (120 miles distant), and has regular communication by steamer with Melbourne. Among the places of note are

the Government buildings, the town-hall, a theatre, two hospitals, a public library, and a convent of the Presentation Order. The population was 10,100 in 1847, 10,668 in 1870, and 12,753 in 1881. Launceston began to be an important settlement not long after the first colonization of Tasmania. St John's Church (Episcopal) dates from 1824. The town was incorporated in 1858.

LAUREATE. See ROYAL HOUSEHOLD.

LAUREL. There are at least four shrubs or small trees which are called by this name in Great Britain, viz., the common or cherry laurel (*Cerasus Laurocerasus*, Lois.), the Portugal laurel (*C. lusitanica*, Loia.), the bay or sweet laurel (*Laurus nobilis*, L.), and the spurge laurel (*Daphne Laureola*, L.). The first two belong to the rose family (*Rosaceae*), and are regarded by Bentham and Hooker as a subgenus of *Prunus*, L. (*Genera Plantarum*, i. p. 610), to which genus Linnaeus referred them.

The common laurel is a native of the woody and sub-alpine regions of the Caucasus, of the mountains of northern Persia, of north-western Asia Minor, and of the Crimea. It was received into Europe in 1576 (De Candolle, *Prod.*, ii. p. 540), and flowered for the first time in 1583. Ray in 1688 relates that it was first brought from Trebizonde to Constantinople, thence to Italy, France, Germany, and England. Parkinson in his *Paradysus* records it as growing in a garden at Highgate in 1629; and in Johnson's edition of Gerard's *Herbal*, published in 1833, it is recorded that the plant "is now got into many of our choice English gardens, where it is well respected for the beauty of the leaves and their lasting or continual greenness" (see Loudon's *Arboretum*, ii. p. 717). The leaves of this plant are rather large, broadly lance-shaped, and of a leathery consistence, the margin being somewhat serrated. They are remarkable for their poisonous properties, giving off the odour of bitter almonds when bruised, the vapour thus issuing is sufficient to kill small insects. Cherry laurel water is a solution of the volatile oil. The leaves when cut up finely and distilled yield the oil of bitter almonds and hydrocyanic (prussic) acid. Sweetmeats, custards, cream, &c., are often flavoured with laurel-leaf water, as it imparts the same flavour as bitter almonds, but it should be used sparingly, as it is a dangerous poison, having several times proved fatal. The first case occurred in 1731, which induced a careful investigation to be made of its nature, which was discovered by Schrader in 1802 to be hydrocyanic acid. The effects of the distilled laurel-leaf water on living vegetables is to destroy them like ordinary prussic acid; while a few drops act on animals as a powerful poison. It was introduced into the British pharmacopoeia in 1839, but is more generally superseded by the use of hydrocyanic acid. The following varieties of the common laurel are in cultivation:—the Caucasian (*Prunus Laurocerasus caucasica*), which is hardier and bears very rich dark-green glossy foliage; the Versailles laurel (*P. L. latifolia*), which has larger leaves; the Colchican (*P. L. colchica*), which is a dwarf-spreading bush with narrow sharply serrated pale green leaves. There is also the variety *rotundifolia* with short broad leaves, the Grecian with narrow leaves, and the Alexandrian with very small leaves. See Hemsley's *Handbook of Hardy Trees*, &c., p. 141.

The Portugal laurel is believed to be a native of Portugal and Madeira. This tree, together with a variety called *Huxa*, Ser., which bears larger leaves and has the flowers more loosely disposed, were found growing together in 1837 on the Serra de Geres in Portugal, the former being 20 feet high while the latter attained to 70 feet. It was introduced into England about the year 1648, when it was cultivated in the Oxford Botanic Gardens. During the first half of the 18th century this plant, the common

laurel, and the holly were almost the only hardy evergreen shrubs procurable in British nurseries. They are all three tender about Paris, and consequently much less seen in the neighbourhood of that city than in England, where they stand the ordinary winters but not very severe ones. There is a variety (*myrtilifolia*) of compact habit with smaller narrow leaves, a variegated variety, and one of recent introduction (*azorica*), probably not so hardy as the Continental form. See *Handbook of Hardy Trees*, &c., p. 141.

The evergreen glossy foliage of the common and Portugal laurels render them well adapted for shrubberies, while the racemes of white flowers are not devoid of beauty. The former often ripens its insipid drupes, but the Portugal rarely does so. It appears to be less able to accommodate itself to the English climate, as the wood does not usually "ripen" so satisfactorily. Hence it is rather more liable to be cut by the frost. According to Prof. A. Gray neither the common nor the Portugal laurel stands either the summer or the winter climate of the United States.

The bay or sweet laurel (*Laurus nobilis*, L.), belongs to the family *Lauraceae*, which contains *assafras*, *benzoin*, *camphor*, and other trees remarkable for their aromatic properties. It is a large evergreen shrub, sometimes reaching the height of 60 feet, but rarely assuming a truly tree-like character. The leaves are smaller than those of the preceding laurels, possessing an aromatic and slightly bitter flavour, and are quite devoid of the poisonous properties of the cherry laurel. The small yellowish-green flowers are produced in axillary clusters, and consist of a calyx only, which encloses nine stamens in the male, the anthers of which dehisce by valves which lift upwards as in the common barberry, and carry glandular processes at the base of the filament. The fruit consists of a succulent berry surrounded by the persistent base of the calyx. The bay laurel is a native of Italy, Greece, and North Africa, and is abundantly grown in the British Isles as an evergreen shrub, as it stands most winters. The date of its introduction is unknown, but must have been previous to 1562, as it is mentioned in Turner's *Herbal* published in that year. A full description also occurs in Gerard's *Herbal*, 1597, p. 1222. It was used for strewing the floors of houses of distinguished persons in the reign of Elizabeth. Several varieties have been cultivated, differing in the character of their foliage, as the *undulata* or wave-leaved, *salsifolia* or willow-leaved, the variegated, the broad-leaved, and the curled, there is also the double-flowered variety. The bay laurel was carried to North America by the early colonists, but, like the others, apparently does not thrive there.

This laurel is generally held to be the *Daphne* of the ancients, though at least Dr Lindley, following Gerard (*Herbal*, 1768, p. 761), asserts that the Greek *Daphne* was *Zunera racemosa*. Among the Greeks the laurel was sacred to Apollo, especially in connexion with Tempe, in whose laurel grove the god himself obtained purification from the blood of the Pythian. This legend was dramatically represented at the Pythian festival once in eight years, a boy fleeing from Delphi to Tempe, and after a time being led back with song, crowned and adorned with laurel. Similar *Daphnephoria* were known elsewhere in Greece. Apollo, himself purified, was the author of purification and atonement to other penitents, and the laurel was the symbol of this power, which came to be generally associated with his person and sanctuaries. The relation of Apollo to the laurel was expressed in the legend of DAPHNE (*q.v.*). The victors in the Pythian games were crowned with the laurels of Apollo, and thus the laurel became the symbol of triumph in Rome as well as in Greece. As Apollo was the god of poets, the *Laurus Apolloarum* naturally belonged to poetic merit, and so we still have a poet laureate. The various prerogatives of the laurel among the ancients are collected by Phleg (*Hist. Nat.*, xv. 80). It was a sign of truth, like the olive branch; letters announcing victory and the arms of the victorious soldiery were garished with it; it was thought that lightning could not strike it, and the

emperor Tiberius always wore a laurel wreath during thunderstorms.¹ From its association with the divine power of purification and protection, it was often set before the door of Greek houses, and among the Romans it was the guardian of the gates of the Caesars (Ovid, *Met.*, i. 582 sq.). The laurel worn by Augustus and his successors had a miraculous history: the laurel grove at the imperial villa by the ninth milestone on the Flaminian way sprang from a shoot sent from heaven to Livus Dencilis (Sueton., *Julius*, ii.). Like the olive, the laurel was forbidden to profane use. It was employed in divination; the cracking of its leaves in the sacred flame was a good omen (Tibull., ii. 5, 81), and their silence unlucky (Propert., ii. 21), and the leaves when chewed excited a prophetic afflatus (*Ecceprædix*, comp. Tibull., *id. supra*, line 65). There is a poem enumerating the ancient virtues of the laurel by J. Passeratius, 1594.

The last of the plants mentioned above under the name of laurel is the so-called spurge laurel (*Daphne Laureola*, L.). This and one other species (*D. mezereum*, L.), the mezeuron, are the sole representatives of the family *Thymelæaceæ* in Great Britain. The spurge laurel is a small evergreen shrub, with alternate somewhat lanceolate leaves with entire margins. The green flowers are produced in early spring, and form drooping clusters at the base of the leaves. The calyx is four-cleft, and carries eight stamens in two circles of four each within the tube. The pistil forms a berry, green at first, but finally black. De Candolle says they are poisonous to all animals except singing birds. The mezeuron differs from it in blossoming before the leaves are produced, while the flowers are lilac instead of green. The bark furnishes the drug *Cortex Meseret*, for which that of the spurge laurel is often substituted. Both are powerfully astringent, but the latter is less so than the bark of mezeuron. It is now only used as an ingredient of the compound decoction of sarsaparilla (*Pharmacographia*, p. 487). Of other species in cultivation there are *D. Portuensis* from China, which has lilac flowers; *D. pontica*, a native of Asia Minor; *D. alpina*, from the Italian alps; *D. collina*, South European; and *D. Oncorubra*, the garland flower or trailing daphne, the handsomest of the hardy species. See Hemslay's *Handbook of Hardy Trees*, &c., p. 394; Loudon's *Arboretum*, iii. p. 1307 sq. (H. N.)

LAURENS, HENRY (1724-1789), American statesman, was born at Charleston, South Carolina, in 1724, of Huguenot ancestry. After receiving a good education, he entered a counting-house in London by way of preparation for commercial pursuits, in which he engaged, after his return to Charleston, with such success as to amass rapidly a large fortune. He accepted ardently the advanced views of individual rights then prevalent in the colony, and was several times engaged in stubborn contests with the crown judges, in which he resisted their alleged arbitrary and oppressive rulings, not only by all legal means at his command, but in occasional pamphlets, the vigour and legal acumen of which attracted much attention. He retired from active business in 1771, and spent the next three years in Europe in travel, and in superintending the education of his sons in England. In 1774 he united with thirty-seven other Americans in a petition to parliament against the passing of the Boston Port Bill, in the hope of averting war. Becoming convinced that a peaceful settlement was impracticable, he returned to Charleston at the close of 1774, to take part with his fellow colonists in the impending struggle. He was soon made president of the South Carolina council of safety, and in 1776 a delegate from that colony to the general continental congress at Philadelphia, of which body he was president during 1777-78. Throughout these years he was a steadfast and influential promoter of the colonial cause, and a trusted friend of Washington. In 1778 he undertook a mission as minister plenipotentiary to Holland, in furtherance of

secret negotiations for a commercial treaty which had been some time in progress, but, while on the way, he was captured by a British frigate, and taken to London. On the evidence of his papers, which he had vainly attempted to destroy, war was declared upon Holland by Great Britain, and Laurens was closely imprisoned in the Tower. During his imprisonment of nearly fifteen months, his health became greatly enfeebled, yet he steadily refused opportunities for procuring release by abandoning his patriotic principles. Having been set free late in 1781, he was appointed by congress one of the commissioners for negotiating the peace; and, proceeding to Paris with Franklin and Jay, he signed with them, on November 30, 1783, the preliminaries of the treaty. Failing health obliged him to return to Charleston, South Carolina, where he passed his remaining years in retirement, much respected and beloved by his countrymen. He died in December 1792, and, in accordance with the directions of his will, his body was burned, and the bones and ashes were carefully collected and buried. The most valuable of his papers and pamphlets have been published by the South Carolina Historical Society.

LAURENS, JOHN (1756-1782), an American revolutionary officer of distinguished bravery, son of Henry Laurens noticed above, was born at Charleston, South Carolina, in 1756. He was educated in England, and on his return to America in 1777, in the height of the revolutionary struggle, he joined Washington's staff. He soon gained his commander's confidence, which he reciprocated with the most devoted attachment, and was entrusted with the delicate duties of a confidential secretary, which he performed with much tact and skill. He was present in all Washington's battles, from that of the Brandywine to Yorktown, and his gallantry on every occasion has gained him the title of "the Bayard of the Revolution." Laurens displayed bravery even to rashness in the storming of the Chew mansion at Germantown; at Monmouth, where he saved Washington's life by rushing between him and danger, and was himself severely wounded; and at Coosahatchie, where, with a handful of men, he defeated a pass against a large English force under General Prevost, and where he was again wounded. In command of a body of light infantry at the storming of Savannah, he was among the first to penetrate the English lines, and again distinguished himself at the siege of Charleston in 1780. After the capture of Charleston by the English, he rejoined Washington, and was selected by him as a special envoy to appeal to the king of France for supplies for the relief of the American armies, which had been brought by prolonged service and scanty pay to the verge of dissolution. The more active co-operation of the French fleets with the land forces in Virginia, which was one result of his mission, brought about the unexpected overwhelming of Cornwallis at Yorktown. Laurens lost no time in rejoining the army, and at Yorktown was at the head of the American storming party which captured the first redoubt, and received the sword of Colonel Campbell, its commander. Laurens was designated with Count de Noailles to arrange the terms of a surrender, which occurred October 19, 1781, and virtually ended the war, although desultory skirmishing, especially in the south, attended the months of delay before peace was formally concluded. In one of these trifling affairs in July 1782, on the Combahee Ferry, Laurens exposed himself needlessly and was killed. Washington lamented deeply the death of Laurens, then in his twenty-seventh year, saying of him, "He had not a fault that I could discover, unless it were intrepidity bordering upon rashness."

LAURIA, or LOMIA, a city of Italy in the province of Potenza, 13 miles south of Lagonegro, consisting of a walled town on the steep side of a hill and another portion in the

¹ A similar superstition still exists among the peasants of the Pyrenees.

old feudal city, with its ancient castle, and its irregularly built houses whose slate roofs and pointed gables peep from the groves of trees which clothe the hill. On the left bank the regularly built new town extends far into the plain. The river, here 80 yards broad, is crossed by the handsome railway viaduct, a beautiful stone bridge called "Pont Neuf," and the Mayenne bridge of three pointed arches, built in the 16th century. There is communication by steamer as far as to Angers. Laval may justly claim to be one of the loveliest of French towns. Its most curious and interesting monument is the sombre-looking old castle of the counts, now transformed into a prison. The new castle, dating from the Renaissance, is now the court house. Laval possesses several churches of different periods, in that of the Trinity, which serves as the cathedral, the transept is of the 12th century while the choir is of the 16th, the chapel of the Carmelites is an imitation of the Sainte Chapelle at Paris, Notre Dame des Cordeliers, which dates from the end of the 14th century or beginning of the 15th, has some fine marble altars. Half a mile below the Mayenne bridge is the beautiful 12th century church of Avenières, with an ornamental spire of 1534 and a handsome modern pulpit. The finest remaining relic of the ancient fortifications is the Becheresse gate near the cathedral. There is a scientific museum, and a library containing 25,000 volumes. The town is embellished by fine promenades, at the entrance of one of which, facing the mairie, stands the statue of the celebrated surgeon Ambrose Paré. On the Place de Cheverus is a statue to the cardinal of that name, archbishop of Bordeaux. The principal industry of the town is the linen manufacture, introduced from Flanders in the 14th century. A large cloth hall (Halle-aux-toiles), built in last century is used now for industrial, artistic, and agricultural exhibitions. At present tickings are chiefly made. This industry occupies ten thousand workmen, who are not gathered together in great factories, but scattered all over the town. Cotton spinning is also carried on, and there are tanneries, flour-mills, foundries, paper-works, and dye-works. Here also the marbles of the neighbourhood are sawn, the greater part being converted into lime. Laval is the seat of a bishop, and has a lyceum. Population 27,000.

The history of Laval goes back only to the beginning of the 11th century, but from an early date in the feudal period the barons of Laval were distinguished by their valour and power, and by their alliances. One of them followed William the Conqueror into England. After having assumed the cross they allied themselves with the Montmorencys and Montforts, and their barony passed on later to the Colignys and the La Trémouilles. Laval was taken by Talbot in 1428. It changed hands several times during the wars of the League and the war of La Vendée in 1798.

LAVATER, JOHANN KASPAR (1741-1801), is a remarkable instance of a man who has obtained celebrity by following a bypath apart from the proper work of his life. As a preacher, theological writer, and spiritual director he occupied during his lifetime a position not very dissimilar to that held by Kable in our own day, but he survives for posterity chiefly as the author of a work on physiognomy. He was born at Zurich, November 16, 1741. Consistent with himself from the first, he manifested little application to study, but great depth of feeling, especially on religious themes, and a remarkable fluency of fervent and persuasive discourse. When barely one and twenty he greatly distinguished himself by denouncing, in conjunction with his friend the painter Fuseli, an iniquitous magistrate, who was compelled to make restitution of his ill-gotten gains. In 1769 Lavater took orders, and officiated till his death as deacon or pastor in various churches in his native city. The advantages of his manner and address, as well as his oratorical fervour and genuine

depth of conviction, gave him great personal influence, especially with women, he was extensively consulted as a casuist, and was welcomed with demonstrative enthusiasm in his numerous journeys through Germany. His mystical writings were also widely popular. Scarcely a trace however, of this influence has remained, and Lavater's name would be forgotten but for his work on physiognomy, *Physiognomische Fragmente zur Beförderung der Menschenkenntnis und Menschenliebe*, Leipzig, 1775-78, republished in French with extensive additions by the author. The fame even of this universally known book rests to a great extent upon the handsome style of publication and the accompanying illustrations. It is not to be compared with the subsequent labours of Cuvier for scientific value, and leaves the study of physiognomy as desultory and unsystematic as it found it. The author's remarks, nevertheless, frequently display remarkable acuteness and insight into character, and the illustrations render it very valuable to artists. Next to his physiognomy, Lavater is perhaps chiefly remembered for his acquaintance with Goethe, and the lively portrait of him in *Wahrheit und Dichtung*. The impression he produced upon one so dissimilar to himself shows that the man was greater than his works. At a later period Goethe became estranged from him, somewhat abruptly accusing him of superstition and hypocrisy. Of the former charge he cannot be acquitted, seeing that he had manifested a tendency to run after Cagliostro; but he seems to have been no more open to the latter than every man whose ideal of creed and conduct is too exalted to be maintained with unvarying consistency. A more cogent reason for Lavater's discredit with Goethe was his intellectual intolerance. No man was more bigoted upon paper, while in truth his heart was open to all. He was continually propounding the alternative of his own form of Christianity or atheism; and it is indeed true that, if passages in his own writings are to be taken literally, he was himself incapable of conceiving a Deity apart from the person of the Redeemer. Much that he has written might be expressed in the language of Feuerbach with but slight alteration. He had a mystic's indifference to historical Christianity, and, although esteemed by himself and others a champion of orthodoxy, was in fact only an antagonist of rationalism. During the latter years of his life his influence waned, and he incurred ridicule by some exhibitions of vanity, pardonable in the recipient of so much incense. He redeemed himself by his patriotic conduct during the troubles occasioned by the French occupation of Switzerland, which brought about his tragical death. On the taking of Zurich by the French in 1799, Lavater, while endeavouring to appease the soldiery, was shot through the body by an infuriated grenadier, and died after long sufferings borne with great fortitude, on January 2, 1801. His life was written in the following year by his son-in-law Georg Gessner, with natural partiality and unavoidable reticences, but faithfully in the main. There are more recent biographies by Hegner and Bodemann, the latter entirely from the religious point of view.

LAVAUUR, chief town of an arrondissement in the department of Tarn, France, 26 miles E.N.E. of Toulouse, stands at a height of 460 feet on the left bank of the Agout (a tributary of the Tarn), which is here crossed by a bold bridge of a single arch of 160 feet span. The most interesting monument of Lavaur is its cathedral, which dates from the 14th and 15th centuries. In front of it is an octagonal bell-tower, without a spire, 131 feet high; a second smaller square tower contains a *jaquemart* (a metal statue which strikes the hours with a hammer) of the 16th century. In the bishop's garden is the statue of Las Cases. The chief industry of Lavaur is sericulture, but wool-spinning and tanning occupy some of the people.

The town has 7500 inhabitants. It was taken by Simon de Montfort during the war of the Albigenes, and several times during the religious wars of the 16th century.

LA VENDER, botanically *Lavandula*, a genus of *Labiate* distinguished by an ovate tubular calyx, a two-lipped corolla, of which the upper lip has two and the lower three lobes, and four stamens bent downwards.

The plant to which the name of lavender is commonly applied, *Lavandula vera*, D.C., is a native of the mountainous districts of the countries bordering on the western half of the Mediterranean, extending from the eastern coast of Spain to Calabria and northern Africa, growing in some places at a height of 4500 feet above the sea-level, and preferring stony declivities in open sunny situations. It is cultivated in the open air as far north as Norway and Livonia. Lavender forms an evergreen undershrub about 2 feet high, with greyish green hoary linear leaves, rolled under at the edges when young; the branches are erect, and give a bushy appearance to the plant. The flowers are borne on a terminal spike at the summit of a long naked stalk, the spike being composed of 6-10 verticillasters or dense cymes in the axils of small, brownish, rhomboidal, tapering, opposite bracts, the verticillasters being more widely separated towards the base of the spike. The calyx is tubular, contracted towards the mouth, marked with 13 ribs and 5-toothed, the posterior tooth being the largest. The corolla is of a pale violet colour, but darker on its inner surface, tubular, two-lipped, the upper lip with two and the lower with three lobes. Both corolla and calyx are covered with stellate hairs, amongst which are imbedded shining oil glands to which the fragrance of the plant is due. The leaves and flowers of lavender are said to have been used by the ancients to perfume their baths; hence the name *Lavandula* is supposed to have been derived from *lavare*, to wash. But, although *S. Stoechas* was well known to the ancients, no allusion unquestionably referring to *L. vera* has been found in the writings of classical authors, the earliest mention of the latter plant being in the 12th century by the abbess Hildegard, who lived near Bingen on the Rhine. Under the name of *lilafant* or *lilafant* it was known to the Welsh physicians as a medicine in the 13th century. In England lavender is cultivated chiefly for the distillation of its essential oil, of which it yields on an average $\frac{1}{4}$ per cent. when freed from the stalks, but in the south of Europe the flowers form an object of trade, being exported to the Barbary states, Turkey, and America.

In Great Britain lavender is grown in the parishes of Mitham, Carshalton, and Beddington in Surrey, where about 300 acres are under cultivation, and in Hertfordshire, in the parish of Hitchin, to the extent of 50 acres. The most suitable soil seems to be a sandy loam with a calcareous substratum, and the most favourable position a sunny slope in localities elevated above the level of fog, where the plant is not in danger of early frost and is freely exposed to air and light. At Hitchin lavender is said to have been grown as early as 1668, but as a commercial speculation its cultivation dates back only to 1828. The plants at present in cultivation do not produce seed, and the propagation is always made by slips or by dividing the roots. The latter plant has only been followed since 1860, when a large number of lavender plants were killed by a severe frost. Since that date the plants have been subject to the attack of a fungus, in consequence of which the price of the oil has been considerably enhanced, and the disease is likely, if it continues, to affect seriously the cultivation of the herb. At Market Deeping in Lincolnshire, where lavender was formerly grown, its cultivation has been discontinued on this account.

The flowers are collected in the beginning of August, and taken direct to the still. The yield of oil depends in great measure upon the weather. After a wet and dull June and July the yield is sometimes only half as much as when the weather has been bright and sunshiny. From 12 to 80 lb of oil per acre is the average amount obtained. The oil contained in the stem has a more rank odour and is less volatile than that of the flowers; consequently the portion that distils over after the first hour and a half is collected separately.

The finest oil is obtained by the distillation of the flowers with out the stalks, but the labour spent upon this adds about 10s. per lb to the expense of the oil, and the same end is practically attained by the fractional distillation. The oil mellow by keeping three years, after which it deteriorates unless mixed with alcohol, it is also improved by redistillation. Oil of lavender is distilled from the wild plants in Piedmont and the South of France, especially in the village about Mont Ventoux near Avignon, and in those some leagues west of Montpellier. The best French oil realizes scarcely one-sixth of the price of the English oil. Cheaper varieties are made by distilling the entire plant.

Oil of lavender is a mobile liquid having a specific gravity from 0.78 to 0.86 (Zeller). It appears to be a simple true in variable proportion of oxygenated oils and a stearoptene, the latter being identical, according to Dumas, with common camphor. Its adulteration with alcohol may be detected by chloride of calcium dissolving in it and forming a separate layer of liquid at the bottom of the vessel. Glycerin sets in the same way. If it contain turpentine it will not dissolve in three volumes of alcohol, in which quantity the pure oil is perfectly soluble.

Lavender flowers were formerly considered good for "all disorders of the head and nerves"; a spirit prepared with them was known under the name of palmy drops. At the present day a compound spirit in the form of a lavender oil, the latter being sometimes given in conjunction with other stimulants to nervous and hysterical persons suffering from depression of spirits, or is used to give a colour and flavour to medicines.

Lavender water consists of a solution of the volatile oil in spirit of wine with the addition of the essences of musk, rose, bergamot, and ambergris, but is very rarely prepared by distillation of the flowers with spirit.

In the climate of New York lavender is scarcely hardy, but in the vicinity of Philadelphia considerable quantities are grown for the market, the dried flowers being used for sachets or scent bags and for perfuming linens, &c. In American gardens sweet basil (*Ocimum basilicum*) is frequently called lavender.

Lavandula Spica (D.C.), a species which differs from *L. vera* chiefly in its smaller size, more crowded leaves, and linear bracts, is also used for the distillation of an essential oil, which is known in England as oil of spike and in France under the name of essence d'aspic. It is used in painting on porcelain and in veterinary medicine. The oil as met with in commerce is less fragrant than that of *L. vera*,—probably because the whole plant is distilled, for the flowers of the two species are scarcely distinguishable in fragrance. *L. Spica* does not extend so far north as *L. vera*; beyond the mountains beyond 2000 feet. It cannot be cultivated in Britain except in sheltered situations. A nearly allied species, *L. lanata* (Boiss.), a native of Spain, with broader leaves, is also very fragrant, but does not appear to be distilled for oil.

Lavandula Stoechas (L.), a species extending from the Canaries to Anna Minor, is distinguished from the above plants by its blackish purple flowers, and shortly-stalked spikes crowned by conspicuous purplish sterile bracts. The flowers were official in the London pharmacopoeia as late as 1746. They are still used by the Arabs as an expectorant and antispasmodic. The Stoehades (now called the Isles of Hyères near Toulon) owe their name to the abundance of the plant growing there.

Several other species of lavender (twenty in all) are known, some of which extend as far east as to India. A few which differ from the above in having divided leaves, as *L. dentata*, *L. abrotanoides*, *L. multifida*, *L. pinnatifida*, and *L. verticillata*, have been cultivated in greenhouses, &c., in England.

Sea lavender is a name applied in England to several species of *Statice*, a genus of littoral Plumbaginaceae plants. Lavender cotton is a species of the genus *Santolina*, small, yellow-flowered, evergreen undershrub of the Composite order.

See *Pharmacopoeia*, p. 474; the *Compendium*, p. 145; *Pharm. Journal*, (1) xi p. 376, (2) vii p. 376; (3) xii p. 366; (4) p. 381; (5) p. 382; (6) viii p. 361, (7) p. 362; *Gaussen, Histoire des Laves*, 1828, (2) p. 12.

LAVOISIER, ANTOINE LAURENT (1743-1794), one of the founders of modern chemistry, was born in Paris, August 26, 1743. His father, a wealthy tradesman, gave him an excellent education at the Collège Mazarin, and encouraged his desire to adopt the career of science. On quitting college, he devoted himself to study with extraordinary ardour: he followed the astronomical and mathematical courses of Lacaille, worked in the laboratory of Rouelle, and took lessons in botany from Jussieu; he renounced all frivolous society, and even restricted himself to a diet of milk in order to repair the damage to his constitution caused by excessive application. His first public distinction was gained on the occasion of a prize offered by the Academy of Sciences for an essay on the best mode of

lighting the streets of Paris. To increase the sensitiveness of his eyes, he immersed himself for six weeks in a room hung with black, from which all light was excluded except that of the lamps experimented upon. His zeal was a pledge of success, and was rewarded with the gold medal, April 9, 1766. A multitude of subjects now engaged his attention. He presented to the Academy a masterly analysis of gypsum, travelled through France with Guettard, who was occupied in constructing the first geological map of the country, and composed a work, of which a fragment entitled *Mémoire sur les couches des montagnes* found a place in the Academy collection for 1789; refuted the prevalent error as to the conversion of water into silica by repeated distillation, and studied the phenomena of thunder and aurora, of crystallization and congelation. He became an associate of the Academy in 1768, and in 1769 obtained the lucrative post of farmer-general of the revenue, with a view to increase the resources at his command for the advancement of science.

It was about the year 1770 that the vast possibilities of the new field opened to the researches of chemists by the pneumatic discoveries of Black, Cavendish, and Priestley were recognized by Lavoisier, and the perception gave to his genius the definitive impulse hitherto wanting to it. He repeated and verified experiments which became, in his hands, the means of invalidating their authors' conclusions, and prepared to import the clear-cut precision of his own ideas into a science as yet illogical in form and incoherent in expression. His wealth and position, as well as his enthusiasm, eminently qualified him to lead a successful reform. He lived in the midst of the most stimulating society of his time. Between him and such men as Laplace, Monge, Berthollet, and Fourcroy the constant interchange of ideas established a community of opinion in physical matters so close that the separate intellectual property of each was all but completely merged in the general stock.¹ On one day in each week Lavoisier threw open his laboratory to a select few of his friends, communicated the results of his labours, and invited their criticism and advice. By this consultative system his work gained in solidity, and lost nothing in originality. On the 1st of November 1772 Lavoisier, eager to secure the credit of priority, deposited at the Academy a sealed packet containing the record of his earliest conclusions on the crucial point of metallic oxidation. The discovery by Priestley in 1774 of "dephlogisticated air" materially assisted the development of the innovating doctrine, which took the form of a fully fledged theory when Lavoisier in 1778 assigned to the new substance, with the name of "oxygen," the important functions of the universal "acidifying principle." His analysis of water in 1784, and synthesis of "fixed air" (called by him "carbonic acid," *Academy Memoirs*, 1781), opened the way for an extended view of the composition of organic as well as inorganic substances, and the anti-phlogistic chemistry was completed by the publication, in 1787, of the *Méthode de nomenclature chimique*. The reform of language effected by Lavoisier in conjunction with Guyton de Morveau, Berthollet, and Fourcroy was an indispensable prelude to the reform of thought. With the current alchemical jargon science, properly so-called, could have no fellowship. The new terminology prevailed without change for fifty years, and has been fitted, by trifling modifications, to meet the exigencies of recent progress. The acceptance of the "oxygen theory" was enormously facilitated by the defined and logical form given to it in Lavoisier's *Traité Élémentaire de chimie* (Paris, 1789). Indeed, the history of science scarcely presents a second instance of a change

so fundamental accomplished with such ease. The partitions of phlogiston did not, it is true, abandon the field without a struggle. In Berlin they met Lavoisier's demonstrations by burning him in effigy, and in Paris Lavoisier conducted, in the *Journal de Physique*, a fierce polemic against the party of innovation. The controversy was, however, brief, and its issue visibly certain. Before the end of the century the reformed chemistry was everywhere in a position of uncontested triumph.

The enlightened activity of Lavoisier was no less conspicuous in his administrative than in his scientific capacity. A prominent member of the body of farmers-general during twenty-ous years, he obtained the abolition of certain taxes equally onerous and unproductive, and earned the gratitude of the Jews of Metz by relieving them from an oppressive impost. Appointed director of the powder-works by Turgot in 1776, he not only suppressed the vexatious searches for saltpetre in the cellars of private houses, but succeeded in quadrupling the produce of the commodity. He, moreover, improved the manufacture of gunpowder so as to add one-third to its explosive force, thereby reversing the previous superiority of English over French ordnance. His philanthropic zeal was displayed in the provincial assembly of the Orléanais in 1787. In the year following he was attached to the Caisse d'escompte, and presented a report of its operations, November 21, 1788, to the Constituent Assembly. In 1790 he sat on the commission of weights and measures. In 1791 he became commissary to the treasury, where he established a system of accounts of unexampled punctuality. Requested by the National Assembly to set forth a new scheme of taxation, he composed a *tratté De la richesse territoriale de la France*, of which an extract, printed at the public expense, shows him to have been possessed of sound and liberal views on political economy. In short, to quote the words of Lalande, "Lavoisier was to be found everywhere." But those were times when to be conspicuous was to be in peril. On the 2d of May 1794, Dupin, a member of the Convention, presented a frivolous accusation against the whole of the ex-farmers-general, whose wealth constituted in itself an inexplicable crime. Lavoisier found a hiding-place for a day or two in the deserted apartments of the Academy, but, hearing that his absence was likely to prejudice the cause of his colleagues, he voluntarily gave himself up. He thought it impossible that his life could be taken, but expected the confiscation of his property, when, as he told Lalande, he proposed to earn his bread as an apothecary. Half measures, however, were not in favour with the revolutionary tribunal. On the 6th of May, he, with twenty-seven others of the same profession, was condemned to the guillotine, and two days later, the sentence was carried into execution. "Il ne leur a fallu," Lagrange remarked, "qu'un moment pour faire tomber cette tête, et cent années peut-être ne suffiront pas pour en reproduire une semblable." It is said that a petition presented in his favour met with the brutal reply: "The republic has no need of *savants*." He was propped on the scaffold by M. Paulze, whose gifted daughter he had married in 1771. He left no posterity.

To the gift of a transcendent intellect Lavoisier joined the charms of a noble person and winning manners. He was faithful to his friends, charitable to the poor, a model husband, and a patriotic public servant. His fame as the reformer of chemistry rests on no single discovery, but is involved in the first principles of the science (see CHEMISTRY, p. 463). It was his great merit to have made the balance the *ultima ratio* of the laboratory. Quantitative analysis thus became for the first time possible, and a chemical reaction took in his hands the rigid form of an algebraical equation.² His latest studies were of a physiological character, and M. Dumas³ found among his papers a piece showing that he had arrived at a remarkable anticipation of modern views concerning the relations

¹ *Œuvres de Lavoisier*, tom. i. p. 18.

² *Œuvres*, tom. i. p. 108.

³ *Leçons de Chimie*, 1861.

of organs to inorganic nature. He was probably the first to devote systematic attention to agricultural chemistry, and obtained the practical success of doubling the produce of a large farm owned by him near Blois. A striking proof of his disinterested humanity is afforded by a long and painful investigation of putrefying substances carried out solely with a view to averting accidents in sewers. Not the least notable of his achievements is that of having first formed a clear idea as to the nature of gases, and of matter generally in its relation to heat. He held that bodies exist in the solid, liquid, or gaseous states according as the attractive force of their particles is superior, equal, or inferior to the repulsive action of an universally diffused, imponderable fluid which he called "caloric." Differences of specific heat he attributed to differences of inter-molecular space. The theory, put forward by him with due reserve, formed a useful if not indispensable preliminary to further progress. He was the inventor of the gasometer, and, jointly with Laplace, his coadjutor in a series of experiments on specific heat, of the calorimeter.

A complete edition of the writings of Lavoisier was issued in four vols. 4to by the Government of Napoleon III., under the title *Œuvres de Lavoisier publiées par les soins de son Excellence le Ministre de l'Instruction publique*, Paris, 1864-68. This publication comprises, besides the works already mentioned, *Omniscience physique et chimique* (1774), a large number of memoirs from the Academy volumes (during the twenty years 1770-90 he contributed no less than fifty-eight), and numerous letters, notes, and reports relating to the various affairs in which he was engaged. At the time of his death he was preparing an edition of his collected works, and the portions ready for the press were published by his widow in 1805, in two 8vo vols. entitled *Mémoires de Chimie*. The plates in the *Traité élémentaire* were drawn and engraved by Malane Lavoisier. Biographical notices of Lavoisier are given in Fourcroy's *Notion*, and by Lalonde in Scherer's *Néologie*, Jena, 1798. For an account of his discoveries see Dumas, *Leçons sur la Philosophie Chimique*, and Béchamp, *Leçons Historiques sur la Chimie*. (A. M. C.)

L A W

THE present article will be limited to the consideration of the phenomena presented for study by positive laws. The objects which laws ought to subserve, the principles of legislation, the sphere of law, the province of government, and other topics of a similar nature which are generally to be found in writings professing to treat of law in the abstract have been discussed under the heading GOVERNMENT and elsewhere. It will be convenient, and it will be following the lines of a very remarkable development of English thought, to take actual laws as positive facts, without reference to their goodness or badness, and examine, so far as it can be done within the limits at our command, the character which they present when looked at from different points of view. This conception of the science of law, which is closely related to the scientific ideas of the time, has been developed by the efforts of the modern school of English jurists. In former times the science of law meant anything but science as we have been taught to conceive it by physical philosophers. It meant if anything a philosophy of legal principles not necessarily related to any system of actual law. A philosophy of laws actually existing on fact is what we in England at least should now consider the science of law to be. By universal consent the somewhat shifting term jurisprudence has been limited to this meaning. Jurisprudence is the science of positive laws. The present article will attempt to present simply the leading principles and conclusions of jurisprudence.

The human race may be conceived as parcelled out into a number of distinct groups or societies, differing greatly in size and circumstances, in physical and moral characteristics of all kinds. But they all resemble each other in this that they reveal on examination certain rules of conduct in accordance with which the relations of the members *inter se* are governed. Such rules we may for the present, without anticipating a somewhat difficult discussion, term laws. Each society has its own system of laws, and all the systems, so far as they are known, constitute the appropriate subject matter of jurisprudence. The jurist may deal with it in the following ways. He may first of all examine the leading conceptions common to all the systems, or in other words define the leading terms common to them all. Such are the terms *law* itself, *right*, *duty*, *property*, *crime*, and so forth, which, or their equivalents, may, notwithstanding delicate differences of connotation, be regarded as common terms in all systems. That kind of inquiry is what is known in England as analytical jurisprudence. It regards the conceptions with which it deals as fixed or stationary, and aims at expressing them distinctly and exhibiting their logical relations with each other. What is really meant by a right and by a duty, and what is the true connexion between a right and a duty, are

types of the questions proper to this inquiry. Shifting our point of view, but still regarding systems of law in the mass, we may consider them, not as stationary, but as changeable and changing, we may ask what general features are exhibited by the record of the change. Thus, somewhat crudely put, may serve to indicate the field of historical jurisprudence. In its ideal condition it would require an accurate record of the history of all legal systems as its material. As yet the record is exceedingly incomplete, and the results are proportionately limited. But whether the material be abundant or scanty, the method is the same. It seeks the explanation of institutions and legal principles in the facts of history. Its aim is to show how a given rule came to be what it is. The legislative source—the emanation of the rule from a sovereign authority—is of no importance here; what is important is the moral source—the connexion of the rule with the ideas prevalent during contemporary periods. This method, it is evident, involves, not only a comparison of successive stages in the history of the same system, but a comparison of different systems, of the Roman with the English, of the Hindu with the Irish, and so on. The historical method as applied to law may be regarded as a special example of the method of comparison. The comparative method is really employed in all generalizations about law; for, although the analysis of legal terms might be conducted with exclusive reference to one system, the advantage of testing the result by reference to other systems is obvious. But, besides the use of comparison for purposes of analysis and in tracing the phenomena of the growth of laws, it is evident that for the purposes of practical legislation the comparison of different systems may yield important results. Laws are contrivances for bringing about certain definite ends, the larger of which are identical in all systems. The comparison of these contrivances not only serves to bring their real object, often obscured as it is in details, into clearer view, but enables legislators to see where the contrivances are deficient, and how they may be improved.

The "science of law," as the expression is generally used, means the examination of laws in general in one or other of the ways just indicated. It means an investigation of laws which exist or have existed in some given society in fact—in other words, positive laws; and it means an examination not limited to the exposition of particular systems. Analytical jurisprudence is in England associated chiefly with the name of JOHN AUSTIN (q.v.), whose *Province of Jurisprudence Determined* systematized and completed the work begun in England by Hobbes, and continued at a later date and from a different point of view by Bentham. The best view of the subject will be obtained by taking Austin's principal positions in outline, and con-

sidering the criticisms which later jurists have bestowed upon them.

Austin's first position is to distinguish between laws properly so called and laws improperly so called. In any of the older writers on law, we find the various senses in which the word is used grouped together as variations of one common meaning. Thus Blackstone advances to his proper subject, municipal laws, through (1) the laws of inanimate matter, (2) the laws of animal nutrition, digestion, &c., (3) the laws of nature, which are rules imposed by God on men and discoverable by reason alone, and (4) the revealed or Divine law, which is part of the law of nature directly expounded by God. All of these are connected by this common element that they are "rules of action dictated by some superior being." And some such generalization as this is to be found at the basis of most treatises on jurisprudence which have not been composed under the influence of the analytical school. Austin disposes of it by the distinction that some of those laws are commands, while others are not commands. The so-called laws of nature are not commands, they are uniformities which resemble commands only in so far as they may be supposed to have been ordered by some intelligent being. But they are not commands in the only proper sense of that word,—they are not addressed to reasonable beings, who may or may not will obedience to them. Laws of nature are not addressed to anybody, and there is no possible question of obedience or disobedience to them. Austin accordingly pronounces them laws improperly so called, and confines his attention to laws properly so called, which are commands addressed by a human superior to a human inferior.

This distinction seems so simple and obvious that the energy and even bitterness with which Austin insists upon it now seems superfluous. But the indiscriminate identification of everything to which common speech gives the name of a law was, and still is, a fruitful source of confusion. Blackstone's statement that when God "put matter into motion He established certain laws of motion, to which all movable matter must conform," and that in those creatures that have neither the power to think nor to will such laws must be invariably obeyed, so long as the creature itself subsists, for its existence depends on that obedience, imputes to the law of gravitation in respect of both its origin and its execution the qualities of an Act of Parliament. On the other hand the qualities of the law of gravitation are imputed to certain legal principles which, under the name of the law of nature, are asserted to be binding all over the globe, so that "no human laws are of any validity if contrary to this." Nonsense like this so exasperated Austin that he never fails to stigmatize the use of "natural laws" in the sense of scientific facts as improper, or as metaphorical. A later writer has pointed out that law in the scientific sense has acquired a position of its own, from which it is impossible to dislodge it, and which involves none of the ambiguities and confusions against which Austin protested. It would be as reasonable for the man of science as for the jurist to set up his own conception of law as the only legitimate one. There is perhaps only one field of inquiry where the two opposed conceptions of law are still to be found entangled. The "laws of political economy" still hover in the minds of many between the jurist and the scientific conception. Certain economical principles appear to have acquired a double character,—that of scientific generalizations, and that of rules which may be disobeyed. Measures are pronounced to be a violation of the laws of political economy, with a vague implication that these being laws of nature any violation of them must be particularly heinous.

Having eliminated metaphorical or figurative laws, we

restrict ourselves to those laws which are commands. This word is the key to the analysis of law, and accordingly a large portion of Austin's work is occupied with the determination of its meaning. A command is an order issued by a superior to an inferior. It is a signification of desire distinguished by this peculiarity that "the party to whom it is directed is liable to evil from the other, in case he comply not with the desire." "If you are able and willing to harm me in case I comply not with your wish, the expression of your wish amounts to a command." Being liable to evil in case I comply not with the wish which you signify, I am *bound* or obliged by it, or I lie under a *duty* to obey it. The evil is called a *sanction*, and the command or duty is said to be *sanctioned* by the chance of incurring the evil. The three terms *command*, *duty*, and *sanction* are thus inseparably connected. As Austin expresses it in the language of formal logic, "each of the three terms signifies the same notion, but each denotes a different part of that notion, and connotes the residue."

All commands, however, are not laws. That term is reserved for those commands which oblige generally to the performance of acts of a class. A command to your servant to rise at such an hour on such a morning is a particular command, but not a law or rule; a command to rise always at that hour is a law or rule. Of this distinction it is sufficient to say in the meantime that it involves, when we come to deal with positive laws, the rejection of particular enactments to which by invertebrate usage the term law would certainly be applied. On the other hand it is not, according to Austin, necessary that a true law should bind persons as a class. Obligations imposed on the grantees of an office specially created by parliament would imply a law; a general order to go into mourning addressed to the whole nation for a particular occasion would not be a law.

So far we have arrived at a definition of laws properly so called. Austin holds superiority and inferiority to be necessarily implied in command, and such statements as that "laws emanate from superiors" to be the merest tautology and trifling. Elsewhere he sums up the characteristics of true laws as ascertained by the analysis thus:—(1) laws, being commands, emanate from a determinate source; (2) every sanction is an evil annexed to a command; and (3) every duty implies a command, and chiefly means obnoxiousness to the evils annexed to commands.

Of true laws, those only are the subject of jurisprudence which are laws strictly so called, or positive laws. Austin accordingly proceeds to distinguish positive from other true laws, which are either laws set by God to men or laws set by men to men, not, however, as political superiors nor in pursuance of a legal right. The discussion of the first of these true but not positive laws leads Austin to his celebrated discussion of the Utilitarian theory. The laws set by God are either revealed or unrevealed, i.e., either expressed in direct command, or made known to men in one or other of the ways denoted by such phrases as the "light of nature," "natural reason," "dictates of nature," and so forth. Austin maintains that the principle of general utility, based ultimately on the assumed benevolence of God, is the true index to such of His commands as He has not chosen to reveal. His exposition of the meaning of the principle is a most valuable contribution to moral science, though he rests its claims ultimately on a basis which many of its supporters would disavow. And the whole discussion is now generally condemned as lying outside the proper scope of the treatise, although the reason for so condemning it is not always correctly stated. It is found in such assumptions of fact as that there is a God, that He has issued commands to men in what Austin calls the "truths of revelation," that He designs the happiness of all His creatures, that there is a predominance of good in

the order of the world—which do not now command universal assent. It is impossible to place these propositions on the same scientific footing as the assumptions of fact with reference to human society on which jurisprudence rests. If the "Divine laws" were facts like Acts of Parliament, it is conceived that the discussion of their characteristics would not be out of place in a scheme of jurisprudence.

The second set of laws properly so called, which are not positive laws, consists of three classes.—(1) those which are set by man living in a state of nature; (2) those which are set by sovereigns but not as political superiors, *e.g.*, when one sovereign commands another to act according to a principle of international law, and (3) those set by subjects but not in pursuance of legal rights. This group, to which Austin gives the name of positive morality, helps to explain his conception of positive law. Men are living in a state of nature, or a state of anarchy, when they are not living in a state of government or as members of a political society. "Political society" thus becomes the central fact of the theory, and some of the objections that have been urged against it arise from its being applied to conditions of life in which Austin would not have admitted the existence of a political society. Again, the third set in the group is intimately connected with positive laws on the one hand and rules of positive morality which are not even laws properly so called on the other. Thus laws set by subjects in consequence of a legal right are clothed with legal sanctions, and are laws positive. A law set by guardian to ward, in pursuance of a right which the guardian is bound to exercise, is a positive law pure and simple, a law set by master to slave, in pursuance of a legal right which he is not bound to exercise, is, in Austin's phraseology, to be regarded both as a positive moral rule and as a positive law.¹ On the other hand the rules set by a club or society, and enforced upon its members by exclusion from the society, but not in pursuance of any legal right, are laws, but not positive laws. They are imperative and proceed from a determinate source, but they have no legal or political sanction. Closely connected with this positive morality, consisting of true but not positive laws, is the positive morality whose rules are not laws properly so called at all, though they are generally denominated laws. Such are the laws of honour, the laws of fashion, and, most important of all, international law.

Nowhere does Austin's phraseology come more bluntly into conflict with common usage than in pronouncing the law of nations (which in substance is a compact body of well-defined rules resembling nothing so much as the ordinary rules of law) to be not laws at all, even in the wider sense of the term. That the rules of a private club should be law properly so called, while the whole mass of international jurisprudence is mere opinion, shocks our sense of the proprieties of expression. Yet no man was more careful than Austin to observe these proprieties. He recognizes fully the futility of definitions which involve a painful struggle with the current of ordinary speech. But in the present instance the apparent paradox cannot be avoided if we accept the limitation of laws properly so called to commands proceeding from a determinate source. And that limitation is so generally present in our conception of law that to ignore it would be a worse anomaly than this. No one finds fault with the statement that the so-called code of honour or the dictates of fashion are not, properly speaking, laws. We repeat the same statement applied to the law of nature, because it resembles in so many of its most

striking features—in the certainty of a large portion of it, in its terminology, in its substantial principles—the most universal elements of actual systems of law, and because, moreover, the assumption that brought it into existence was nothing else than this, that it consisted of those abiding portions of legal systems which prevail everywhere by their own authority. But, though "positive morality" may not be the best phrase to describe such a code of rules, the distinction insisted on by Austin is unimpeachable.

The elimination of those laws properly and improperly so called which are not positive laws brings us to the definition of positive law, which is the keystone of the system. Every positive law is "set by a sovereign person, or sovereign body of persons, to a member or members of the independent political society wherein that person or body is sovereign or superior." Though possibly sprung directly from another source, it is a positive law, by the institution of that present sovereign in the character of a political superior. The question is not as to the historical origin of the principle, but as to its present authority. "The legislator is he, not by whose authority the law was first made, but by whose authority it continues to be law." This definition involves the analysis of the connected expressions *sovereignty*, *subjection*, and *independent political society*, and of *determinate body*,—which last analysis Austin performs in connexion with that of commands. These are all excellent examples of the logical method of which he was so great a master. The broad results alone need be noticed here.

In order that a given society may form a society political and independent, the *generality* or *bulk* of its members must be in a *habit* of obedience to a certain and common superior; whilst that certain person or body of persons must not be *habitually* obedient to a certain person or body. All the italicized words point to circumstances under which it might be difficult to say whether a given society is political and independent or not. Several of these Austin has discussed,—*e.g.*, the state of things in which a political society yields obedience which may or may not be called habitual to some external power, and the state of things in which a political society is divided between contending claimants for sovereign power, and it is uncertain which shall prevail, and over how much of the society. So long as that uncertainty remains we have a state of *anarchy*. Further, an independent society to be political must not fall below a number which can only be called considerable. Neither then in a state of anarchy, nor in inconsiderable communities, nor among men living in a state of nature, have we the proper phenomena of a political society. The last limitation goes some way to meet the most serious criticism to which Austin's system has been exposed, and it ought to be stated in his own words. He supposes a society which may be styled independent, which is considerable in numbers, and which is in a savage or extremely barbarous condition. In such a society, "the bulk of its members is not in the habit of obedience to one and the same superior. For the purpose of attacking an external enemy, or for the purpose of repelling an attack, the bulk of its members who are capable of bearing arms submit to one leader or one body of leaders. But as soon as that emergency passes the transient submission ceases, and the society reverts to the state which may be deemed its ordinary state. The bulk of each of the families which compose the given society renders habitual obedience to its own peculiar chief, but those domestic societies are themselves independent societies, or are not united and compacted into one political society by habitual and general obedience to one common superior, and there is no law (simply or strictly so called) which can be called the law of that society. The so-called laws which are common to the bulk of the community are purely and properly

¹ This appears to be an unnecessary complication. The sovereign has authorized the master to set the law, although not compelling him to do so, and enforces the law when set. There seems no good reason why the law should be called a rule of positive morality at all.

customary laws—that is to say, laws which are set or imposed by the general opinion of the community, but are not enforced by legal or political sanctions." Such, he says, are the savage societies of hunters and fishers in North America, and such were the Germans as described by Tacitus. He takes no account of societies in an intermediate stage between this and the condition which constitutes political society.

We need not follow the analysis in detail. Much ingenuity is displayed in grouping the various kinds of government, in detecting the sovereign authority under the disguises which it wears in the complicated State system of the United States or under the fictions of English law, in elucidating the precise meaning of abstract political terms. Incidentally the source of many celebrated fallacies in political thought is laid bare. That the question who is sovereign in a given state is a question of fact and not of law or morals or religion, that the sovereign is incapable of legal limitation, that law is such by the sovereign's command, that no real or assumed compact can limit his action—are positions which Austin has been accused of enforcing with needless iteration. He has cleared them, however, from the air of paradox with which they had been previously encumbered, and his influence was in no direction more widely felt than in making them the commonplaces of educated opinion in this generation.

Passing from these, we may now consider what has been said against the theory, which may be summed up in the following terms. Laws, no matter in what form they are expressed, are in the last resort reducible to commands set by the person or body of persons who are in fact sovereigns in any independent political society. The sovereign is the person or persons whose commands are habitually obeyed by the great bulk of the community; and by an independent society we mean that such sovereign head is not himself habitually obedient to any other determinate body of persons. The society must be sufficiently numerous to be considerable before we can speak of it as a political society. From command, with its inseparable incident of sanction, come the duties and rights in terms of which laws are for the most part expressed. Duty means that the person of whom it is predicated is liable to the sanction in case he fails to obey the command. Right means that the person of whom it is predicated may set the sanction in operation in case the command be disobeyed.

Before noticing the considerable body of hostile criticism with which in the main we are unable to agree, we may here interpolate a doubt whether the condition of independences on the part of the head of a community is essential to the legal analysis. It seems to us that we have all the elements of a true law present when we point to a community habitually obedient to the authority of a person or determinate body of persons, no matter what the relations of that superior may be to any external or superior power. Provided that in fact the commands of the lawgiver are those beyond which the community never looks, it seems unnecessary to inquire whether this lawyer in turn takes his orders from somebody else or is habitually obedient to such orders when given. One may imagine a community governed by a dependent legislative body or person, while the supreme sovereign whose representative and nominee such body or person may be never directly addresses the community at all. We do not see that in such a case anything is gained in clearness by representing the law of the community as set by the sovereign, rather than the dependent legislator. Nor is the ascertainment of the ultimate seat of power necessary to define political societies. That we get when we suppose a community to be in the habit of obedience to a single person or to a determinate combination of persons.

The use of the word "command" is not unlikely to lead to a misconception of Austin's meaning. When we say that a law is a command of the sovereign, we are apt to think of the sovereign as enunciating the rule in question for the first time. Many laws are not traceable to the sovereign at all in this sense. Some are based upon immemorial practices, some can be traced to the influence of private citizens, whether practicing lawyers or writers on law, and in most countries a vast body of law owes its existence as such to the fact that it has been observed as law in some other society. The

great bulk of modern law owes its existence and its shape ultimately to the labours of the Roman lawyers of the empire. Austin's definition has nothing to do with this, the historical origin of laws. Most books dealing with law in the abstract generalize the modes in which laws may be originated under the name of the "sources" of law, and one of these is legislation, or the direct command of the sovereign body. The commonness of laws with each other as principles is properly the subject-matter of historical jurisprudence, the ideal perfection of which would be the establishment of the general laws governing the evolution of law in the technical sense. Austin's definition looks, not to the authorship of the law as a principle, not to its inventor or originator, but to the person or persons who in the last resort cause it to be obeyed. If a given rule is enforced by the sovereign it is a law.

It may be convenient to notice here what is usually said about the sources of law, as the expression sometimes proves a stumbling-block to the appreciation of Austin's system. In the *corpus juris* of any given country only a portion of the laws is traceable to the direct expression of his commands by the sovereign. Legislation is one, but only one, of the sources of law. Other portions of the law may be traceable to other sources, which may vary in effect in different systems. The list given in the *Institutes* of Justinian of the ways in which law may be made—*lex, plebiscitum, decretum, placita, edicta magistratuum*, and so on—is a list of sources. Among the sources of law other than legislation which are most commonly exemplified are the laws made by judges in the course of judicial decisions, and law originating as custom. The source of the law in the one case is the judicial decision, in the other the custom. In consequence of the dominion and in consequence of the custom the rule has prevailed. English law is largely made up of principles derived in each of those ways, while it is deficient in principles derived from the writings of independent teachers, such as have in other systems exercised a powerful influence on the development of law. The *responso prudentium*, the opinions of learned men, published as such, did undoubtedly originate an immense portion of Roman law. No such influence has affected English law to any appreciable extent—a result owing to the activity of the courts of the legislature. This difference has profoundly affected the form of English law as compared with the systems which have been developed by the play of free discussion. These are the most definite of the influences to which the beginning of laws may be traced. The law once established, no matter how, is nevertheless law in the sense of Austin's definition. It is enforced by the sovereign authority. It was originated by something very different. But when we speak of it as a command we refer to the way in which it is to-day presented to the subject. The newest order of an Act of Parliament is not more positively presented to the people as a command to be obeyed than are the elementary rules of the common law for which no legislative origin can be traced. It is not even necessary to resort to the figure of speech by which alone, according to Sir Henry Maine (*Early History of Institutions*, p. 814), the common law can be regarded as the commands of the Government. "The common law," he says, "consists of their commands because they can repeal or alter or restate it at pleasure."

"They command because, being by the assumption possessed of uncontrollable force, they could enforce without limit at any moment." On the contrary, it may be said that they command because they do as a matter of fact enforce the rules laid down in the common law. It is not because they could innovate if they pleased in the common law that they are said to command it, but because it is known that they will enforce it as it stands.

The criticism of Austin's analysis resolved itself into two different sets of objections. One relates to the theory of sovereignty which underlies it; the other to its alleged failure to include rules which in common parlance are laws, and which it is felt ought to be included in any satisfactory definition of law. As the latter is to some extent anticipated and admitted by Austin himself, we may deal with it first.

A recent writer¹ has been at great pains to collect a number of laws or rules of law which do not square with the Austinian definition of law as a command creating rights and duties. Take the rule that "every will must be in writing." It is a very circuitous way of looking at duties, according to Mr Harrison, to say that such a rule creates a specific right in any determinate person of a definite description. So, again, the rule that "a legacy to the witness of a will is void." Such a rule is not "designed to give any one any rights, but simply to protect the public against wills made under undue influence." Again, the

¹ Mr Frederic Harrison in the *Fortnightly Review* (vol. xxx., xxxi.)

technical rule in Shelley's case that a gift to A for life, followed by a gift to the heirs of A, is a gift to A in fee simple, is pronounced to be inconsistent with the definition. It is an idle waste of ingenuity to force any of these rules into a form in which they might be said to create rights.

This would be a perfectly correct description of any attempt to take any of these rules separately and analyse it into a complete command creating specific rights and duties. But there is no occasion for doing anything of the kind. It is not contended that every grammatically complete sentence in a text-book or a statute is *per se* a command creating rights and duties. A law, like any other command, must be expressed in words, and will require the use of the usual aids to expression. The gist of it may be expressed in a sentence which, standing by itself, is not intelligible, other sentences locally separate from the principal one may contain the exceptions and the modifications and the interpretations to which that is subject. In no one of these taken by itself, but in the substance of them all taken together, is the true law, in Austin's sense, to be found. Thus the rule that every will must be in writing is a mere fragment—only the limb of a law. It belongs to the rule which fixes the rights of devisees or legatees under a will. That rule in whatever form it may be expressed is, without any straining of language, a command of the legislator. That "every person named by a testator in his last will and testament shall be entitled to the property thereby given him" is surely a command creating rights and duties. After testament add "expressed in writing"; it is still a command. Add further, "provided he be not one of the witnesses to the will," and the command, with its product of rights and duties, is still there. Each of the additions limits the operation of the command stated imperatively in the first sentence. So with the rule in Shelley's case. It is resolvable into the rule that every person to whom an estate is given by a conveyance expressed in such and such a way shall take such and such rights. To take another example from recent legislation. A statute passed in 1861 enacts nothing more than this, that an Act of a previous session shall be construed as if "that" meant "this." It would be futile indeed to force this into conformity with Austin's definition by treating it as a command addressed to the judges, and as indirectly creating rights to have such a construction respected. As it happens, the section of the previous Act referred to (the Burials Act, 1860) is an undeniable command, addressed to the clergy, and imposing upon them a specific duty. The true command—the law—is to be found in the two sections taken together.

All this confusion arises from the fact that laws are not habitually expressed in imperative terms. Even in a mature system like that of England the great bulk of legal rules is hidden under forms which disguise their imperative quality. They appear as principles, maxims, propositions of fact, generalizations, points of pleading and procedure, and so forth. Even in the statutes the imperative form is not uniformly observed. It might be said that the more mature a legal system is the less do its individual rules take the form of commands. The greater portion of Roman law is expressed in terms which would not become scientific or speculative treatises. The institutional works abound in propositions which have no legal significance at all, but which are not distinguished from the true law in which they are embedded by any difference in the forms of expression. Assertions about matters of history, dubious speculations in philology, and reflexions on human conduct are mixed up in the same narrative with genuine rules of law. Words of description are used, not words of command, and rules of law assimilate themselves in

form to the extraneous matter with which they are mixed up.

It has been said that Austin himself admitted to some extent the force of these objections. He includes among laws which are not imperative the following—"declaratory laws, or laws explaining the import of existing positive law, and laws abrogating or repealing existing positive law." He thus associates them with rules of positive morality and with laws which are only metaphorically so called. This collocation is unfortunate and out of keeping with Austin's method. Declaratory and repealing laws are as completely unlike positive morality and metaphorical laws as are the laws which he describes as properly so called. And if we avoid the error of treating each separate proposition enunciated by the lawgiver as a law, the cases in question need give us no trouble. Read the declaratory and the repealing statutes along with the principal laws which they affect, and the result is perfectly consistent with the proposition that all law is to be resolved into a species of command. In the one case we have in the principal taken together with the interpretative statute a law, and whether it differs or not from the law as it existed before the interpretative statute was passed makes no difference to the true character of the latter. It contributes along with the former to the expression of a command which is a true law. In the same way repealing statutes are to be taken together with the laws which they repeal—the result being that there is no law, no command, at all. It is wholly unnecessary to class them as laws which are not truly imperative, or as exceptions to the rule that laws are a species of commands. The combination of the two sentences in which the lawgiver has expressed himself, yields the result of silence—absence of law—which is in no way incompatible with the assertion that a law, when it exists, is a kind of command. Austin's theory does not logically require us to treat every Act of Parliament as being a complete law in itself, and therefore to set aside a certain number of Acts of Parliament as being exceptions to the great generalization which is the basis of the whole system.

Rules of procedure again have been alleged to constitute another exception. They cannot, it is said, be regarded as commands involving punishment if they be disobeyed. Nor is anything gained by considering them as commands addressed to the judge and other ministers of the law. There may be no doubt in the law of procedure a great deal that is resolvable into law in this sense, but the great bulk of it is to be regarded like the rules of interpretation as entering into the substantive commands which are laws. They are descriptions of the sanction and its mode of working. The bare prohibition of murder without any penalty to enforce it would not be a law. To prohibit it under penalty of death implies a reference to the whole machinery of criminal justice by which the penalty is enforced. Taken by themselves, the rules of procedure are not, any more than canons of interpretation, complete laws in Austin's sense of the term. But they form part of the complete expression of true laws. They imply a command, and they describe the sanction and the mode in which it operates.

A more formidable criticism of Austin's position is that which attacks the definition of sovereignty. There are countries, it is said, where the sovereign authority cannot by any stretch of language be said to command the laws, and yet where law manifestly exists. The ablest and the most moderate statement of this view is given by Sir Henry Maine in *Early History of Institutions*, p. 880:—

"It is from no special love of modern examples that I take one from India, but because it happens to be the most modern precedent in point. My instance is the Indian province called the Punjab, the country of the Five Rivers, in the state in which it was for about

a quarter of a century before its annexation to the British Indian empire. After passing through every conceivable phase of anarchy and dormant anarchy, it fell under the tolerably consolidated dominion of a half military half religious oligarchy known as the Sikhs. The Sikhs themselves were afterwards reduced to subjection by a single chieftain belonging to their order, Runjeet Singh. At first sight there could be no more perfect embodiment than Runjeet Singh of sovereignty as conceived by Austin. He was absolutely despotic. Except occasionally on his wild frontier he kept the most perfect order. He could have commanded anything; the smallest disobedience to his commands would have been followed by death or mutilation; and this was perfectly well known to the enormous majority of his subjects. Yet I doubt whether once in all his life he issued a command which Austin would call a law. He took as his revenue a prodigious share of the produce of the soil. He harried villages which reallocated at his exactions, and he executed great numbers of men. He levied great armies, he had all material of power, and he exercised it in various ways. But he never made a law. The rules which regulated the lives of his subjects were derived from their immemorial usages, and those rules were administered by domestic tribunals in families or village communities—that is, in groups no larger or little larger than those to which the application of Austin's principles cannot be effected on his own admission without absurdity."

So far as the mere size of the community is concerned, there is no difficulty in applying the Austinian theory. In postulating a considerably numerous community Austin was thinking evidently of small isolated groups which could not without provoking a sense of the ridiculous be termed nations. Two or three families, let us suppose, occupying a small island, totally disconnected with any great power, would not claim to be and would not be treated as an independent political community. But it does not follow that Austin would have regarded the village communities spoken of by Maine in the same light. Here we have a great community, consisting of a vast number of small communities, each independent of the other, and disconnected with all the others, so far as the administration of anything like law is concerned. Suppose in each case that the headman or council takes his orders from Runjeet Singh, and enforces them, each in his own sphere, relying as the last resort on the force at the disposal of the sultan. The mere size of the separate communities would make no sort of difference to Austin's theory. He would probably regard the empire of Runjeet Singh as divided into small districts,—an assumption which invests no doubt the true historical order, the smaller group being generally more ancient than the larger. But provided that the other conditions prevail, the mere fact that the law is administered by local tribunals for minute areas should make no difference to the theory. The case described by Sir Henry Maine is that of the undoubted possession of supreme power by a sovereign, coupled with the total absence of any attempt on his part to originate a law. That no doubt is, as we are told by the same authority, "the type of all Oriental communities in their native state during their rare intervals of peace and order." The empire was in the main in each case a tax-gathering empire. The unalterable law of the Modes and Persians was not a law at all but an occasional command. So again Maine puts his position clearly in the following sentences:—"The Athenian assembly made true laws for residents on Attic territory, but the dominion of Athens over her subject cities and islands was clearly a tax-taking as distinguished from a legislating empire." Sir Henry Maine, it will be observed, does not say that the sovereign assembly did not command the laws in the subject islands—only that it did not legislate.

In the same category may be placed without much substantial difference all the societies that have ever existed on the face of the earth previous to the point at which legislation becomes active. Sir Henry Maine is undoubtedly right in connecting the theories of Bentham and Austin with the overwhelming activity of legislation in modern times. And formal legislation, as he has elsewhere

shown, comes late in the history of most legal systems. Law is generated in other ways, which seem irreconcilable with anything like legislation. Not only the tax-gathering emperors of the East, indifferent to the condition of their subjects, but even actively benevolent Governments have up to a certain point left the law to grow by other means than formal enactments. What is *ex facie* more opposed to the idea of a sovereign's commands than the conception of schools of law? Does it not "sting us with a sense of the ridiculous" to hear principles which are the outcome of long debates between Froulans and Sabinians described as commands of the emperor? How is sectarianism in law possible if the sovereign's command is really all that is meant by a law? No mental attitude is more common than that which regards law as a natural product—discoverable by a diligent investigator, much in the same way as the facts of science or the principles of mathematics. The introductory portions of Justinian's *Institutes* are certainly written from this point of view, which may also be described without much unfairness as the point of view of German jurisprudence. And yet the English jurist who accepts Austin's postulate as true for the English system of our own day would have no difficulty in applying it to German or Roman law generated under the influence of such ideas as these.

Again, referring to the instance of Runjeet Singh, Sir H. Maine says no doubt rightly that "he never did or could have dreamed of changing the civil rules under which his subjects lived. Probably he was as strong a believer in the independent obligatory force of such rules as the elders themselves who applied them." That too might be said with truth of states to which the application of Austin's system would be far from difficult. The sovereign body or person enforcing the rules by all the ordinary methods of justice might conceivably believe that the rules which he enforced had an obligatory authority of their own, just as most lawyers at one time, and possibly some lawyers now, believe in the natural obligatoriness, independently of courts or parliaments, of portions of the law of England. But nevertheless, whatever ideas the sovereign or his delegates might entertain as to "the independent obligatory force" of the rules which they enforce, the fact that they do enforce them distinguishes them from all other rules. Austin seizes upon this peculiarity and fixes it as the determining characteristic of positive law. When the rule is enforced by a sovereign authority as he defines it, it is his command, even if he should never so regard it himself, or should suppose himself to be unable to alter it in a single particular.

It may be instructive to add to these examples of dubious cases one taken from what is called ecclesiastical law. In so far as this has not been adopted and enforced by the state, it would, on Austin's theory, be not positive law, but either positive morality or possibly a portion of the Divine law. No jurist would deny that there is an essential difference between so much of ecclesiastical law as is adopted by the state and all the rest of it, and that for scientific purposes this distinction ought to be recognized. How near this kind of law approaches to the positive or political law may be seen from the sanctions on which it depended. "The theory of penitential discipline was this, that the church was an organized body with an outward and visible form of government; that all who were outside her boundaries were outside the means of divine grace; that she had a command laid upon her, and authority given to her, to gather men into her fellowship by the ceremony of baptism, but, as some of those who were admitted proved unworthy of their calling, she also had the right by the power of the keys to deprive them temporarily or absolutely of the privilege of communion with her, and on their amendment to restore them once more to church membership. On this power of excommunication and restoration was founded the system of ecclesiastical discipline. It was a purely spiritual jurisdiction. It extended its hold over the minds of men from the belief, universal in the catholic church of the early ages, that he who was expelled from her pale was expelled also from the way of salvation, and that the sentence which was pronounced by God's church on earth was ratified by Him in heaven" (Smith's *Dictionary of Christian Antiquities*, art. "Penance," p. 1667).

These laws are not the laws of the jurists, though they resemble them closely in many points—indeed in all points except that of the sanction by which they are enforced. It is a spiritual not a political sanction. The force which lies behind them is not that of the sovereign or the state. When physical force is used to compel obedience to the laws of the church they become positive laws. But so long as the belief in future punishments or the fear of the purely spiritual punishments of the church is sufficient to procure obedience to them, they are to be regarded as commands, not by the state, but by the church. That difference Austin makes essential. In rejecting spiritual laws from the field of positive law, his example would be followed by jurists who would nevertheless include other laws, not ecclesiastical in purpose, but enforced by very similar methods.

Compare the following account of "the mode in which justice was administered in the neighbourhood of Benares towards the end of the last century," extracted from a very valuable work on the scientific study of Hindu law by Mr. J. H. Nelson. "The recognized mode of compelling a debtor to pay up appears to have been, by sending a Brahman to do *dharma* before his house with a dagger or a bowl of poison to be used by the Brahman on his own body if the debtor proved obstinate. When the tax collector gave too much trouble, a ryot would sometimes erect a *kar* or pile of wood and burn an old woman on it by way of language as to the head of the tormentor. The *tes talous* obtained in the following shape. Persons who considered themselves aggrieved by acts of their enemies would kill their own wives and children, in order, as we may suppose, to compel their enemies to do a similar act to their own hurt. Thus two Brahmins cut off their mother's head to ruin a foe." The same author states that he is "firmly persuaded that the normal condition of India has ever been to be without what Europeans understand by laws and law courts."

So far as the question is one of the propriety of language, the burden in this case is decidedly against those who would extend the phraseology of law to such rules as these. Can we with any advantage speak of one person having a right against another, when his remedy consists in starving himself in order to bring sin upon the head of his opponent or compel him to do likewise? If *dharma* or anything like it suffices to keep a community to its customary practices, is it possible to express such customs in terms applicable to the laws of European societies? Or is any harm done by saying that the difference between the two is so great that the former cannot be regarded as positive laws at all?

The true criterion in all these cases is, neglecting the shape and circumstances in which the rules in question may have appeared, to ask by which means compliance with them is enforced. Austin's theory in the end comes to this, that true laws are in all cases obeyed in consequence of the application of regulated physical force by some portion of the community. That is a fair paraphrase of the position that laws are the commands of the sovereign, and is perhaps less objectionable inasmuch as it does not imply or suggest anything about the forms in which laws are enunciated. All rules, customs, practices, and laws—or by whatever name these uniformities of human conduct may be called—have either this kind of force at their back or they have not. Is it worth while to make this difference the basis of a scientific system or not? Apparently it is. If it were a question of distinguishing between the law of the law courts and the laws of fashion no one would hesitate. Why should laws or rules having no support from any political authority be termed laws positive merely because there are no other rules in the society having such support?

The question may perhaps be summed up as follows. Austin's definitions are in strict accordance with the facts of government in civilized states; and, as it is put by Sir H. Maine, certain assumptions or postulates having been made, the great majority of Austin's positions follow as of course or by ordinary logical process. But at the other extreme end of the scale of civilization are societies to which Austin himself refuses to apply his system, and where, it would be conceded on all sides, there is neither political community nor sovereign nor law,—none of the facts which jurisprudence assumes to exist. There is an interme-

diate stage of society in which, while the rules of conduct might and generally would be spoken of as laws, it is difficult to trace the connexion between them and the sovereign authority whose existence is necessary to Austin's system. Are such societies to be thrown out of account in analytical jurisprudence, or is Austin's system to be regarded as only a partial explanation of the field of true law, and his definitions good only for the laws of a portion of the world? The true answer to this question appears to be that when the rules in any given case are habitually enforced by physical penalties, administered by a determinate person or portion of the community, they should be regarded as positive laws and the appropriate subject matter of jurisprudence. Rules which are not so enforced, but are enforced in any other way, whether by what is called public opinion, or spiritual apprehensions, or natural instinct, are rightly excluded from that subject matter. In all stages of society, savage or civilized, a large body of rules of conduct, habitually obeyed, are nevertheless not enforced by any state sanction of any kind. Austin's method assimilates such rules in primitive society, where they subserv the same purpose as positive laws in an advanced society, not to the positive laws which they resemble in purpose but to the moral or other rules which they resemble in operation. If we refuse to accept this position we must abandon the attempt to frame a general definition of law and its dependent terms, or we must content ourselves with saying that law is one thing in one state of society and another thing in another. On the ground of clearness and convenience Austin's method is, we believe, substantially right, but none the less should the student of jurisprudence be on his guard against such assumptions as that legislation is a universal phenomenon, or that the relation of sovereign and subject is discernible in all states of human society. And a careful examination of Sir Henry Maine's criticism will show that it is devoted not so much to a rectification of Austin's position as to correction of the misconceptions into which some of his disciples may have fallen. It is a misconception of the analysis to suppose that it involves a difference in juridical character between custom not yet recognized by any judicial decision and custom after such recognition. There is no such difference except in the case of what is properly called "judicial legislation"—wherein an absolutely new rule is added for the first time to the law. The recognition of a custom or law is not necessarily the beginning of the custom or law. Where a custom possesses the marks by which its legality is determined according to well understood principles, the courts pronounce it to have been law at the time of the happening of the facts as to which their jurisdiction is invoked. The fact that no previous instance of its recognition by a court of justice can be produced is not material. A lawyer before any such decision was given would nevertheless pronounce the custom to be law,—with more or less hesitation according as the marks of a legal custom were obvious or not. The character of the custom is not changed when it is for the first time enforced by a court of justice, and hence the language used by Sir Henry Maine must be understood in a very limited sense. "Until customs are enforced by courts of justice"—so he puts the position of Austin—they are merely "positive morality," rules enforced by opinion; but as soon as courts of justice enforce them they become commands of the sovereign, conveyed through the judges who are his delegates or deputies. This proposition, on Austin's theory, would only be true of customs as to which these marks were absent. It is of course true that when a rule enforced only by opinion becomes for the first time enforceable by a court of justice—which is the same thing as the first time of its being actually enforced—

its juridical character is changed. It was positive morality; it is now law. So it is when that which was before the opinion of the judge only becomes by his decision a rule enforceable by courts of justice. It was not even positive morality but the opinion of an individual; it is now law.

The most difficult of the common terms of law to define is *right*; and, as right rather than duty is the basis of classification, it is a point of some importance. Assuming the truth of the analysis above discussed, we may go on to say that in the notion of law is involved an obligation on the part of some one, or on the part of every one, to do or forbear from doing. That obligation is duty; what is right? Dropping the negative of forbearance, and taking duty to mean an obligation to do something, with the alternative of punishment in default, we find that duties are of two kinds. The thing to be done may have exclusive reference to a determinate person or class of persons, on whose motion or complaint the sovereign power will execute the punishment or sanction on delinquents; or it may have no such reference, the thing being commanded, and the punishment following on disobedience, without reference to the wish or complaint of individuals. The last are absolute duties, and the omission to do, or forbear from doing, the thing specified in the command is in general what is meant by a crime. The others are relative duties, each of them implying and relating to a right in some one else. A person has a right who may in this way set in operation the sanction provided by the state. In common thought and speech, however, right appears as something good deal more positive and definite than this,—as a power or faculty residing in individuals, and suggesting not so much the relative obligation as the advantage or enjoyment secured thereby to the person having the right. Mr J. S. Mill, in a valuable criticism of Austin, suggests that the definition should be so modified as to introduce the element of "advantage to the person exercising the right." But it is exceedingly difficult to frame a positive definition of right which shall not introduce some term at least as ambiguous as the word to be defined. Professor Holland defines right in general as a man's "capacity of influencing the acts of another by means, not of his own strength, but of some authority or power external to himself." Direct influence exercised by virtue of one's own strength, physical or otherwise, over another's acts, is "might" as distinguished from right. When the indirect influence is the opinion of society, we have a "moral right." When it is the force exercised by the sovereign, we have a legal right. It would be more easy, no doubt, to pick holes in this definition than to frame a better one.¹

The distinction between rights available against determinate persons and rights available against all the world, *jura in personam* and *jura in rem*, is of fundamental importance. The phrases are borrowed from the classical jurists, who used them originally to distinguish actions according as they were brought to enforce a personal obligation or to vindicate rights of property. The owner of property has a right to the exclusive enjoyment thereof, which avails against all and sundry, but not against one person more than another. The parties to a contract have rights available against each other, and against no other persons. The

jus in rem is the badge of property, the *jus in personam* is a mere personal claim.

That distinction in rights which appears in the division of law into the law of persons and the law of things is thus stated by Austin. There are certain rights and duties, with certain capacities and incapacities, by which persons are determined to various classes. The rights, duties, &c., are the condition or status of the person; and one person may be invested with many status or conditions. The law of persons consists of the rights, duties, &c., constituting conditions or status, the rest of the law is the law of things. The separation is a mere matter of convenience, but of convenience so great that the distinction is universal. Thus any given right may be exercised by persons belonging to innumerable classes. The person who has the right may be under twenty-one years of age, may have been born in a foreign state, may have been convicted of crime, may be a native of a particular county, or a member of a particular profession or trade, &c.; and it might very well happen, with reference to any given right, that, while persons in general, under the circumstances of the case, would enjoy it in the same way, a person belonging to any one of these classes would not. If belonging to any one of those classes makes a difference not to one right merely but to many, the class may conveniently be abstracted, and the variations in rights and duties dependent thereon may be separately treated under the law of persons. The personality recognised in the law of persons is such as modifies indefinitely the legal relations into which the individual clothed with the personality may enter. See Holland's *Elements of Jurisprudence*, p. 90.

The author last cited disapproves of the prominence given by Austin to this distinction, instead of that between public and private law. This, according to Professor Holland, is based on the public or private character of the persons with whom the right is connected, public persons being the state or its delegates. Austin, holding that the state cannot be said to have legal rights or duties, recognises no such distinction. The term "public law" he confines strictly to that portion of the law which is concerned with political conditions, and which ought not to be opposed to the rest of the law, but "ought to be inserted in the law of persons as one of the limbs or members of that supplemental department."

Lastly, following Austin, the main division of the law of things is into (1) primary rights with primary relative duties, (2) sanctioning rights with sanctioning duties (relative or absolute). The former exist, as it has been put, for their own sake, the latter for the sake of the former. Rights and duties arise from facts and events; and facts or events which are violations of rights and duties are *delicts* or *injuries*. Rights and duties which arise from delicts are remedial or sanctioning, their object being to prevent the violation of rights which do not arise from delicts.

We are inclined to agree with the view expressed by Mr F. Harrison (*Fortnightly Review*, vol. xxi), that the rearrangement of English law on the basis of a scientific classification, whether Austin's or any other, would not result in advantages at all compensating for its difficulties. If anything like a real code were to be attempted, the scientific classification would be the best; but in the absence of that, and indeed in the absence of any habit on the part of English lawyers of studying the system as a whole, the arrangement of facts does not vary much matter. It is essential, however, to the abstract study of the principles of law. Scientific arrangement might also be observed with advantage in treatises affecting to give a view of the whole law, especially those which are meant for educational rather than professional uses. The only

¹ In English speech another ambiguity is happily wanting which in many languages besets the phrase expressing "a right." The Latin "*ius*," the German "*Recht*," the Italian "*diritto*," and the French "*droit*" express, not only a right, but also law in the abstract. To indicate the distinction between "*law*" and "*a right*" the Germans are therefore obliged to resort to such phrases as "*objectives*" and "*subjectives Recht*," meaning by the former law in the abstract, and by the latter a concrete right. And Blackstone, perpetrating the distinction drawn by Roman law between the "*jus quod ad rem*" and the "*jus quod ad personam attinet*," devotes the first two volumes of his *Commentaries* to the "*Rights of Persons*" and the *Rights of Things*." See Holland's *Elements of Jurisprudence*, p. 57.

book worth naming of that kind is Blackstone's *Commentaries*, which, in the hands of successive annotators, retains all its original defects of arrangement. It has simply been brought down to date, and its last condition is, from every point of view but that, worse than its first. As an example of the practical application of a scientific system of classification to a complete body of law, we may point to Professor W. A. Hunter's elaborate *Exposition of Roman Law* (London, 1876).

It is impossible to present the conclusions of historical jurisprudence in anything like the same shape as those which we have been discussing. As yet historical jurisprudence is little more than a method, and its results are generalizations of more or less plausibility or probability. The inquiry is in that stage which is indicated in one way by describing it as a philosophy. The philosophy of the history of law is all that it can yet claim to be. It resembles, and is indeed only part of, the study which is described as the philosophy of history. Its chief interest hitherto has been in the light which it has thrown upon rules of law and legal institutions which had been and are generally contemplated as positive facts merely, without reference to their history, or have been associated historically with principles and institutions not really connected with them.

The historical treatment of law displaces some very remarkable misconceptions. Peculiarities and anomalies abound in every legal system, and, as soon as laws become the special study of a professional class, some mode of explaining or reconciling them will be resorted to. One of the prehistorical ways of philosophizing about law was to account for what wanted explanation by some theory about the origin of technical words. This implies some previous study of words and their history, and is an instance of the deep-seated and persistent tendency of the human mind to identify names with the things they represent. The *Institutes* of Justinian abound in explanations, founded on a supposed derivation of some leading term. *Testamentum*, we are told, *ex eo appellatur quod testatio mentis est*. A testament was no doubt, in effect, a declaration of intention on the part of the testator when this was written. But the *mentum* is a mere termination, and has nothing to do with *mens* at all. The history of testaments, which, it may be noticed incidentally, has been developed with conspicuous success, gives a totally different meaning to the institution from that which was expressed by this fanciful derivation. So the perplexing subject of *possession* was supposed in some way to be explained by the derivation from *pono* and *sedeo*,—*quasi sedibus positio*. *Posthumus* was supposed to be a compound of *post* and *humus*. These examples belong to the class of rationalizing derivations with which students of philosophy are familiar. Their characteristic is that they are suggested by some prominent feature of the thing as it then appeared to observers,—which feature thereupon becomes identified with the essence of the thing at all times and places.

Another prehistorical mode of explaining law may be described as metaphysical. It conceives of a rule or principle of law as existing by virtue of some more general rule or principle in the nature of things. Thus, in the English law of inheritance, until the passing of the recent Inheritance Act, an estate belonging to a deceased intestate would pass to his uncle or aunt, to the exclusion of his father or other lineal ancestor. This anomaly from an early time excited the curiosity of lawyers, and the explanation accepted in the time of Bracton was that it was an example of the general law of nature:—"Descendit itaque jus quasi pondusmodum quid cadens deorsum recta linea vel transversal, et nunquam resascendit ea via qua descendit." The author of an excellent summary of the history of the

law of real property (Mr Digby) supposes that the "rule really results from the associations involved in the word descent." It seems more likely, however, that these associations explained rather than that they suggested the rule,—that the omission of the lineal ancestor existed in custom before it was discovered to be in harmony with the law of nature. It would imply more influence than the reasoning of lawyers is likely to have exercised over the development of law at that time to believe that a purely artificial inference of this kind should have established so very remarkable a rule. However that may be, the explanation is typical of a way of looking at law which was common enough before the dawn of the historical method. Minds capable of reasoning in this way were, if possible, farther removed from the conceptions implied in the reasoning of the analytical jurists than they were from the historical method itself. In this connexion it may be noticed that the great work of Blackstone marks an era in the development of legal ideas in England. It was not merely the first, as it still remains the only, adquate attempt to expound the leading principles of the whole body of law, but it was distinctly inspired by a rationalizing method. Blackstone tried not merely to express but to illustrate legal rules, and he had a keen sense of the value of historical illustrations. He worked of course with the materials at his command. His manner and his work are obnoxious alike to the modern jurist and to the modern historian. He is accused by the one of perverting history, and by the other of confusing the law. But his scheme is a great advance on anything that had been attempted before; and, if his work has been prolific in popular fallacies, at all events it enriched English literature by a conspectus of the law, in which the logical connexion of its principles *inter se*, and its relation to historical facts, were distinctly if erroneously recognized.

While the historical method has superseded the verbal and metaphysical explanation of legal principles, it has apparently, in some cases, come into conflict with the conclusions of the analytical school. The difference between the two systems comes out most conspicuously in relation to customs. There is an unavoidable break in the analytical method between societies in which rules are backed by regulated physical force and those in which no such force exists. At what point in its development a given society passes into the condition of "an independent political society" it may not be easy to determine, for the evidence is obscure and conflicting. To the historical jurist there is no such breach. The rule which in one stage of society is a law, in another merely a rule of "positive morality," is the same thing to him throughout. By a recent Act of Parliament the Ulster custom of tenant right and other analogous customs were legalized. For the purposes of analytical jurisprudence there is no need to go beyond the Act of Parliament. The laws known as the Ulster custom are laws solely in virtue of the sovereign government. Between the law as it now is and the custom as it existed before the Act there is all the difference in the world. To the historical jurist no such separation is possible. His account of the law would not only be incomplete without embracing the precedent custom, but the Act which made the custom law is only one of the facts, and by no means the most significant or important, in the history of its development. An exactly parallel case is the legalization in England of that customary tenant right known as *coppold*. It is to the historical jurist exactly the same thing as the legalization of the Ulster tenant right. In the one case a practice was made law by formal legislation, and in the other without formal legislation. And there can be very little doubt that in an earlier stage of society, when formal legislation had not become

the rule, the custom would have been legalized relatively much sooner than it actually was.

Customs then are the same thing as laws to the historical jurist, and his business is to trace the influences under which they have grown up, flourished, and decayed, their dependence on the intellectual and moral conditions of society at different times, and their reaction upon them. The recognized science—and such it may now be considered to be—with which historical jurisprudence has most analogy is the science of language. Laws and customs are to the one what words are to the other, and each separate municipal system has its analogue in a language. Legal systems are related together like languages and dialects, and the investigation in both cases brings us back at last to the meagre and obscure records of savage custom and speech. A great master of the science of language (Max Müller) has indeed distinguished it from jurisprudence, as belonging to a totally different class of sciences. "It is perfectly true," he says, "that if language be the work of man in the same sense in which a statue, or a temple, or a poem, or a law are properly called the works of man, the science of language would have to be classed as an historical science. We should have a history of language as we have a history of art, of poetry, and of jurisprudence; but we could not claim for it a place side by side with the various branches of natural history." Whatever be the proper position of either philology or jurisprudence in relation to the natural sciences, it would not be difficult to show that laws and customs on the whole are equally independent of the efforts of individual human wills,—which appears to be what is meant by language not being the work of man. The most complete acceptance of Austin's theory that law everywhere and always is the command of the sovereign does not involve any withdrawal of laws from the domain of natural science, does not in the least interfere with the scientific study of their affinities and relationships. Max Müller elsewhere illustrates his conception of the different relation of words and laws to the individual will by the story of the emperor Tiberius, who was reproved for a grammatical mistake by Marcellus, whereupon Capito, another grammarian, observed that, if what the emperor said was not good Latin, it would soon be so. "Capito," said Marcellus, "is a liar; for, Caesar, thou canst give the Roman citizenship to men, but not to words." The mere impulse of a single mind, even that of a Roman emperor, however, probably counts for little more in law than it does in language. Even in language one powerful intellect or one influential academy may, by its own decree, give a bent to modes of speech which they would not otherwise have taken. But whether law or language be conventional or natural is really an obsolete question, and the difference between historical and natural sciences in the last result is one of names.

The application of the historical method to law has not resulted in anything like the discoveries which have made comparative philology a science. There is no Grimm's law for jurisprudence; but something has been done in that direction by the discovery of the analogous processes and principles which underlie legal systems having no external resemblance to each other. It happens, however, that the historical study of law has, for the most part, been confined to a single system—the Roman law. The Roman law presents itself to the historical student in two different aspects. It is, regarded as the law of the Roman republic and empire, a system whose history can be traced throughout a great part of its duration with certainty, and in parts with great detail. It is, moreover, a body of rationalized legal principles which may be considered apart from the state system in which they were developed, and which

have, in fact, entered into the jurisprudence of the whole of modern Europe on the strength of their own abstract authority,—so much so that the continued existence of the civil law, after the fall of the empire, is entitled to be considered one of the first discoveries of the historical method. Alike, therefore, in its original history, as the law of the Roman state, and as the source from which the fundamental principles of modern laws have been taken, the Roman law presented the most obvious and attractive subject of historical study. An immense impulse was given to the history of Roman law by the discovery of the *Institutes* of Gaius in 1816. A complete view of Roman law, as it existed three centuries and a half before Justinian, was then obtained, and as the later *Institutes* were, in point of form, a recension of those of Gaius,¹ the comparison of the two stages in legal history was at once easy and fruitful. Moreover, Gaius dealt with antiquities of the law which had become obsolete in the time of Justinian, and were passed over by him without notice. Roman law has accordingly been the main subject of historical study, and the conclusions of jurisprudence are to a great extent generalizations suggested by the history of Roman law.

Nowhere did Roman law in its modern aspect give a stronger impulse to the study of legal history than in Germany. The historical school of German jurists led the reaction of national sentiment against the proposals for a general code made by Thibaut. They were accused by their opponents of setting up the law of past times as intrinsically entitled to be observed, and they were no doubt strongly inspired by reverence for customs and traditions. Through the examination of their own customary laws, and through the elimination and separate study of the Roman element therein, they were led to form general views of the history of legal principles. In the hands of Savigny, the greatest master of the school, the historical theory was developed into a universal philosophy of law, covering the ground which we should assign separately to jurisprudence, analytical and historical, and to theories of legislation. There is not in Savigny's system the faintest approach to the Austinian analysis. The range of it is not the analysis of law as a command, but that of a *Rechtsverhältnis* or legal relation. Far from regarding law as the creation of the will of individuals, he maintains it to be the natural outcome of the consciousness of the people, like their social habits or their language. And he assimilates changes in law to changes in language. "As in the life of individual men no moment of complete stillness is experienced, but a constant organic development, such also is the case in the life of nations, and in every individual element in which this collective life consists; so we find in language a constant formation and development, and in the same way in law."² German jurisprudence is darkened by metaphysical thought, and weakened, as we believe, by defective analysis of positive law. But its conception of laws is exceedingly favourable to the growth of an historical philosophy, the results of which have a value of their own, apart altogether from the character of the first principles. Such, for instance, is Savigny's famous examination of the law of possession.

There is only one other system of law which is worthy of being placed by the side of Roman law, and that is the law of England. No other European system can be compared with that which is the origin and substratum of them all; but England, as it happens, is isolated

¹ A very useful edition of the *Institutes* of Justinian, printed as a recension of the text of Gaius, has been published by Professor T. B. Holland, Oxford, Clarendon Press, 1885, 2d ed.

² See *Introduction to the History of Jurisprudence*, by Dr. O. Guhlfield Eisen, LL.D., London, 1880.

in jurisprudence. She has solved her legal problems for herself. Whatever element of Roman law may exist in the English system has come in, whether by conscious adaptation or otherwise, *ab extra*; it is not of the essence of the system, nor does it form a large portion of the system. And, while English law is thus historically independent of Roman law, it is in all respects worthy of being associated with it on its own merits. Its originality, or, if the phrase be preferred, its peculiarity, is not more remarkable than the intellectual qualities which have gone to its formation—the ingenuity, the rigid logic, the reasonableness, of the generations of lawyers and judges who have built it up. This may seem extravagant praise for a legal system, the faults of which are and always have been matter of daily complaint, but it would be endorsed by all unprejudiced students. What men complain of is the practical hardship and inconvenience of some rule or process of law. They know, for example, that the law of real property is exceedingly complicated, and that, among other things, it makes the conveyance of land expensive. But the technical law of real property, which rests to this day on ideas that have been buried for centuries, has nevertheless the qualities we have named. So too with the law of procedure as it existed under the "science" of special pleading. The greatest practical law reformer, and the severest critic of existing systems that has ever appeared in any age or country, Jeremy Bentham, has admitted this:—"Confused, indeterminate, inadequate, ill-adapted, and inconsistent as to a vast extent the provision or no provision would be found to be that has been made by it for the various cases that have happened to present themselves for decision, yet in the character of a repository of such cases it affords, for the manufactory of real law, a stock of materials which is beyond all price. Traverse the whole continent of Europe, ransack all the libraries belonging to all the jurisprudential systems of the several political states, add the contents together, you would not be able to compose a collection of cases equal in variety, in amplitude, in clearness of statement—in a word, all points taken together, in constructiveness—to that which may be seen to be afforded by the collection of English reports of adjudged cases" (Bentham's *Works*, vol. 17 p. 460). On the other hand, the fortunes of English jurisprudence are not unworthy of comparison even with the catholic position of Roman law. In the United States of America, in India, and in the vast colonial empire, the common law of England constitutes most of the legal system in actual use, or is gradually being superimposed upon it. It would hardly be too much to say that English law of indigenous growth, and Roman law, between them govern the legal relations of the whole civilized world. Nor has the influence of the former on the intellectual habits and the ideas of men been much if at all inferior. Those who set any store by the analytical jurisprudence of the school of Austin will be glad to acknowledge that it is pure outcome of English law. Sir Henry Maine has associated its rise with the activity of modern legislatures, which is of course a characteristic of the societies in which English laws prevail. And it would not be difficult to show that the germs of Austin's principles are to be found in legal writers who never dreamed of analyzing a law. It is certainly remarkable, at all events, that the acceptance of Austin's system is as yet confined strictly to the domain of English law. Sir H. Maine has found no trace of its being even known to the jurists of the Continent, and it would appear that it has been equally without influence in Scotland, which, like the Continent, is essentially Roman in the fundamental elements of its jurisprudence.

While, however, Roman law has had many historians, and while it has been, in Germany at least, the subject of

a good deal of historical philosophy, English law can hardly yet be said to have had its historian, much less its philosopher. What is wanted here, in the first place, is the setting forth of the materials in a condition fit for examination. This has been rightly described as perhaps the most important intellectual want of the present time. But in the meantime the revival of the study of Roman law in England has made the comparison of Roman and English law a matter of course in legal education, and has undoubtedly led, in accordance, no doubt, with the bent of contemporary thought, to the formation in England of what may not improperly be called a great school of historical jurists.

By far the most considerable contribution made by England to historical jurisprudence is the writings of Sir Henry Maine. The first of these (*Ancient Law*), published in 1861, has probably had a more profound influence on contemporary thought than any other book of this generation. *The Early History of Institutions and Village Communities in the East and West* have since followed. In *Ancient Law* Sir Henry Maine proposes to trace the connexion of the subject with the early history of society and its relation to modern ideas. Taking the Roman law as a typical system, he revealed for the first time to English readers the connexion between the principles of forgotten laws and, not merely the legal ideas, but the moral common-places of our own time. The book undermined what had been accepted as first principles by showing that they had a history. It gratified the intellectual sense by the brilliant identification of legal ideas, obscured by difference of time and place and circumstance. It is not surprising that its influence has been even more extensive among educated laymen than among professional lawyers, for the latter are condemned by custom to disregard everything in their science but its relation to the business of the day. But *Ancient Law* set the attitude of regarding a legal rule not as an isolated fact but as the last link in an historical series. In the better sort of legal text-books which have recently appeared the attitude is discernible, and on the whole to the advantage of the exposition, even for the purposes of practice.

At the present moment conclusions based on an examination of the history of legal systems stand subject to correction by the results of the investigation, which is being conducted with so much diligence and success, into the condition of savage races. If it be a right inference that the phenomena of barbarism, as it exists at the present day, represent a condition through which civilized societies have passed, it is obvious that the origin which recorded history suggests for legal ideas and practices must not be taken as absolute. It so happens that prehistoric society has hitherto engaged a much larger share of attention than the history of laws. Conspicuous among the writers who have made important contributions to the literature of this subject are Mr R. B. Tylor, Sir J. Lubbock, Mr Lewis Morgan, and especially Mr J. F. M'Lennan. Many of the conclusions to which these inquirers have been led do not affect any position taken up by historical jurists, but others tend to show that social forms which, seen from the side of legal history, appeared to be the absolute beginning of modern institutions, may themselves have been the result of a long evolution. The most conspicuous example, not of antagonism, but of what may be called disconnection, between juridical and naturalistic theories of the origin of society, is to be found in the FAMILY (*q.v.*). Here it need only be said that the part played by the family in the development of legal ideas has been fully elaborated by historical jurists, sometimes with the inference, implied rather than expressed, that it marks the beginning of the history, or at least is to be found in the earliest period of the race of which we have

trustworthy evidence. Substantially the conclusions of the jurists as to the influence of the conception of the family on historic law remain unimpaired. It is true that a great part of the "legal ideas of civilized races may be traced to this conception, and that the history of their development is the history of its slow unwinding."¹ But that there is no anterior condition to that in which the patriarchal family—"a group of men, women, and slaves, of animate and inanimate property, all connected together by subjection to the paternal power of the chief of the household"—is the unit of society, is not, so far as we are aware, affirmed by any historical jurist. The evidences on that question will be found in the article FAMILY above mentioned.

Another natural group whose place in legal history has recently been the subject of careful investigation is the village community. In one of its forms—the township—"it is an organized self-acting group of Teutonic families, exercising a common proprietorship over a definite tract of land, its mark, cultivating its domain on a common system, and sustaining itself by the produce. It is described by Tacitus in the *Germania* as the *vicius*; it is well known to have been the proprietary and even the political unit of the earliest English society, it is allowed to have existed among the Scandinavian races, and it survived to so late a date in the Orkney and Shetland islands as to have attracted the attention of Sir Walter Scott" (Maine, *Village Communities*, p. 10). Founding on the researches of G. L. von Maurer, of Nasse, and others on the Teutonic mark, and comparing them with the observed phenomena of the village community in India, Sir H. Maine has shown, in the work just cited, how this widely diffused institution illustrates legal history, more particularly with reference to property in land, and to the conservation of customary law.

The lateness of the intervention of the state or sovereign as a direct legislator has been adverted to in the previous discussion. Formal law-making by the state is everywhere posterior to its intervention as the enforcer of law. Not that law-making was consciously separated from judging, or that the assembly or officer who represented the state was conceived as exclusively judicial. But the state, whether represented by a public assembly or by an officer, undertook to decide disputes between man and man long before it presumed to say on what principle such disputes should be decided. The judge everywhere comes before the legislator, if indeed terms so purely modern can be applied without danger to early law. That the pronouncements of the judge were themselves a source of law,—that he created the law which he professed to declare,—is true in a sense which, however, requires us to obliterate the most conspicuous of all the duties of a judge conceived in relation to mature law. That the law existed before the judgment, that the judgment should simply declare pre-existing law, that *ex post facto* laws are unjust—are the inveterate beliefs and prejudices of a civilized society, the strength of which is manifested by the fictions elsewhere noticed as concealing the manufacture of new law. No such conception is to be imported into the notions of early society as to the right and wrong of civil justice. The office of the judge was to settle disputes, to do right where wrong had been done; and whether his decision was founded on law, or custom, or religion, or on personal wisdom or inspiration, was a question which we cannot conceive as being asked, when these things were not distinguished in thought.

A conclusion suggested by the earliest forms of procedure in Roman law is that the intervention of the judge is originally that of a private arbitrator. The *legis actio sacramenti* retained down to a very late period certain

symbolical proceedings, in which the features of a private quarrel were simulated. It was a petrified legal drama, like that played by the vouchers in the English action of assumpsit. The parties wrangle over the disputed property, the magistrate interposes, and they agree to abide by his decision, each staking a deposit on the justice of his case. Maine felicitously compares these formalities with the trial scene depicted on the shield of Achilles in the *Iliad*, in which the *sacramentum* is represented by two talents of gold to go to the judge who shall best decide the points in dispute in the opinion of the spectators. The reward given to the private arbitrator has become in legal symbolism the fee payable to the court on the hearing of the cause. "In confirmation of this view," says Maine, "it may be added that many observers of the oldest judicial usages of modern Europe have remarked that the fines inflicted by courts on offenders were originally *sacramenta*" (*Ancient Law*, p. 376). The symbolism of another *legis actio* is susceptible of a similar interpretation. The *condictio* was a personal action taking its name from the notification to the defendant to appear before the judge on a day named, and it simulated a quarrel settled, not by the interposition of the arbitrator, but by agreement of the parties in the form of a wager, to be decided by the arbitrator at a future time. It is consistent with this view of the first manifestations of judicial functions that early as compared with mature law should assign so large a place to mere procedure. The adjective law, as it is now called, was the first portion of the law to take definite shape, and long maintained its place in the foreground of the system. When a special class in society, whether an aristocratic or priestly caste or a profession, became, as was almost universally the case, the exclusive custodians of the law, the formalities of procedure were their most important secrets. It is represented as a revolution in Roman society when the clerk of one of the aristocratic lawfirms divulged to the public his master's notes for the conduct of legal proceedings. And at all times, it may be said, the law of procedure or practice is in a special sense the law of the professional lawyer, his knowledge of which makes him a skilled craftsman.

The more definite the judiciary power the more do we approach the state of things in which the postulates of analytical jurisprudence are true. Another mark of maturing law is its expression in writing, which, while it destroys the secret monopoly of a class, tends to develop the separate profession of free practising lawyers, who in all progressive societies count as the most powerful instrument for moulding the shape of the law. The influence of lawyers upon law is one of the topics on which the comparison of English and Roman law throws a flood of light, but its illustration would carry us beyond our present limits. Nor can we do more than allude to the importance tentatively assigned by Maine to the question whether a written law comes relatively early or late in the history of a nation. He appears to hold that the relatively early code of the Romans saved them from that degeneration of custom which takes place when it is transmitted by oral tradition from one generation to another.

We have discussed elsewhere, under the headings *Equity* and *FRONTS*, two of the modes by which legal changes have been brought about indirectly. Direct law-making by the sovereign power, there is reason to believe, is not only everywhere later than these agencies, but its activity is progressive, and constantly tends to displace them. A glance at the English statute-book will show that the legislature at the present day undertakes the deliberate alteration of the law to a much greater extent than it has ever done before. A rough illustration is the fact that the chronological table of the statutes from 1235 to 1877

¹ Maine's *Village Communities*, p. 16.

covers over three hundred pages, of which fully two-thirds are occupied with the legislation of the last hundred years. This activity varies of course at different times, and the variations even in recent times have been remarkable. And, large as are the contributions of modern parliaments to the law, it is notorious that but for defects in the legislative machinery they would be much larger. Nor is this activity to be accounted for by the theory that the domain of law is more intrusive than in earlier times. There has undoubtedly been within the last generation a steady increase in the control asserted by the state over the habits of its citizens, for some account of which reference may be made to the article GOVERNMENT. But on the whole the range of action with which the English law declines to interfere is probably as great now as it ever has been in civilized societies. The true explanation is that parliament has effectively secured for itself exclusive authority as the source of legal changes. The violent assault of Bentham on judiciary law was but the echo of the lesson taught by the English judges as to omnipotence of parliament, and thoroughly understood and accepted by popular opinion. To that is due the caution, not to say timidity, which now characterizes the judicial interpretation of statutes. The courts adhere to the literal meaning of the enactment unless compelled to open it by its too frequent absurdity or self-contradiction. If there is any way out of a difficulty which will not involve the slightest addition to the enacted law, that will be the way followed by judicial decision. This attitude is a complete reversal of that which once prevailed in the courts, when the law embodied in decided cases, pure drawn from the fountains of justice, was deemed superior in dignity to the enactments of an unlearned parliament. The tribunals, in so far as they now make law, operate much more freely on the cases than on the statutes.

The consequence of this relation of the judiciary and the legislature is that, while great reforms are no doubt accelerated, small reforms have to wait. Parliament does in a single session that which would have taken ages to accomplish under the natural agencies of equity and fiction, and much which would never have been brought about by these agencies at all. But the capacity of parliament is limited, and so is its foresight. The work of legislation is left incomplete, and the judiciary carefully avoids completing it, leaving the legislature to take it up again when it may. An instance in point is the late history of the law of evidence. This portion of the law grew to maturity in the courts, whose creation it was. It has been wholly transformed by direct legislative enactment (under the influence of Benthamite principles), Act after Act being passed as occasion pointed out defects in what had already been accomplished. One of the latest Acts on the subject simply enables parties and their husbands or wives to give evidence in a certain class of indictments. The substitution of an affirmation for an oath has been carried out in the same piecemeal fashion, the courts refraining from developing the principle of the amendments, as they would have done if the movement had originated with themselves and in an earlier stage of their history. The most portentous example of the intervention of the legislature to complete the exact details of its enactments is the Act previously noticed, which orders the word "this" to be interpreted as "that." The defects of existing legislative methods in England result in some defects in the form of the law, which the tribunals are free to criticize but not to correct. An Act of Parliament bears upon its face the marks of the tumultuous discussion of a large popular assembly, and of the compromise which reconciles the opposing views of the two Houses. Very few Acts, no matter what care may be employed in framing them, are

promulgated in the form best suited for actual exercise,—in the form which would be given to them by an intelligent legislator, charged with the expression of the principle which parliament is supposed to have sanctioned.

In what has been said regarding the relations of the legislature and the judiciary it is not implied that the manufacture of case-law by the latter has ceased. On the contrary, it goes on with yearly increasing volume, and the immense accumulation of decided cases is one of the evils of the present state of the law. The hand of precedent never lay heavier on the conscience of the judge than it does now. The necessary literature of the law is increased by a dozen large volumes every year. The law becomes more voluminous without becoming more elastic or more systematic. The stereotyped judicial habit is to follow absolutely the precedents set by every tribunal of higher rank, and almost absolutely those set by tribunals of co-ordinate rank. A careful semi-official record has taken the place of the private reports published by lawyers privileged by the courts to take notes of their proceedings. Every case of any importance is recorded and becomes a precedent which the practising lawyer in future must know, and which the judge must follow. The minute detail into which legal literature is thus made to descend is becoming an intolerable load; and it is a question whether some revolution in respect to precedents is not becoming necessary.

Legislation by judges has its counterpart in the use of legislative forms for judicial purposes. Long after legislative and judicial functions have been separated, we find legislative acts serving the purpose of judicial decisions. The history of English law is full of examples, the best known of which is that of divorce. The practice of passing private bills of divorce, at a time when the technical law did not allow of that remedy, hardened into a purely judicial practice. The Act which established the Divorce Court did not in effect do more than create a new and better tribunal. So with the General Enclosure Act, which took over from the legislature the purely judicial work of sanctioning enclosures in proper cases.

Comparative jurisprudence, in the sense in which it is distinguishable from historical jurisprudence, can scarcely be said as yet to have a separate existence. Since Leibnitz projected his youthful scheme for tabulating the laws of all the countries of the world, and exhibiting their correspondence and differences by parallel columns, little or nothing has been done for the comparison of laws except in connexion with history. One special line of study does indeed use what may be called a comparative method. The "conflict of laws" involves at least a contrast of a vast number of important points in which the laws of different nations disagree. The object of the study of this conflict is of the practical kind which comparative jurisprudence as here conceived is meant to subserve. It is to develop some *rationale* of decisions where two or more discordant rules claim exclusive application to the case. There are circumstances which seem to show that the mere comparison of laws with no other object but that of discovering in how many ways the same thing can be done, and which way is the best, will enter more and more into the higher legal studies. For one thing, the vast increase which has taken place in the means of communication between nations has made a knowledge of each other's laws a matter of imperative necessity, and has broken down, at least as between the most advanced nations, that barrier of insularity which formerly shut out all suggestions of improvement from abroad. We have already emphasized the marked extent to which this exclusiveness has characterized English law, and we cannot but regard it as typical of a new temper that in preparing for the solution of important problems of

legislation, the British Government not unfrequently collects from its agents abroad information as to the solution of the same problems in other countries. An important influence always tending in this direction, and greatly strengthened by the changes to which we have alluded, is that of commerce, and particularly of British commerce. England's business relations are coextensive with the world; it is a necessity of her business that she

should know what view is taken of contracts and the relations arising out of them by the laws of different states. And it is becoming a necessity of the commercial class in all countries that, on fundamental points at least, the principles of law should be everywhere the same. Strenuous efforts, for instance, are now being made for the establishment of a uniform law of negotiable instruments in all countries, and with some prospect of success. (E. A.)

LAW, JOHN (1671-1729), best known as the originator of what is usually called the Mississippi scheme, was born at Edinburgh in April 1671. His father, a goldsmith and what we should now describe as banker, bought shortly before his death, which took place in his son's youth, the lands of Lauriston near Edinburgh. John lived at home till he was twenty, and then went to London. He had already studied mathematics, and the theory of commerce and political economy, with much interest, but he was known rather as a fop than as a scholar. In London he gambled, drank, and flirted till in April 1694 a love intrigue resulted in a duel. He killed his antagonist, and was arrested, tried, found guilty, and condemned to death. His life was spared, but he was detained in prison. He found means to escape, and fled to Holland, then the greatest commercial country in Europe. Here he observed with close attention the practical working of banking and financial business, and conceived the first ideas of his celebrated "system." After a few years spent in foreign travel, he returned to Scotland, then exhausted and enraged by the failure of the Darien expedition (1695-1701). He propounded plans for the relief of his country in a work¹ entitled *Money and Trade Considered, with a Proposal for Supplying the Nation with Money* (1705). This attracted some notice, but had no practical effect, and Law again betook himself to wandering over the Continent. He visited Brussels, Paris, Vienna, Genoa, Rome, making large sums by gambling and speculation, and spending them in a lavish and reckless manner. He was in Paris in 1703, and made some proposals to the Government as to their financial difficulties, but Louis XIV. declined to treat with a "Huguenot," and D'Argenson, chief of the police, had him expelled the city as a suspicious character. He had, however, become intimately acquainted with the duke of Orleans, and, when in 1716 the king died, and that prince became regent, Law at once returned to the French capital. The extravagant expenditure of the late monarch had plunged the kingdom into apparently inextricable financial confusion. The debt was 3 milliard livres, the estimated annual expenditure, exclusive of interest payments, 148 million livres, and the income about the same.

The advisability of declaring a national bankruptcy was seriously discussed, and though this plan was rejected measures hardly less violent were resorted to. By a vote, or examination of the state liabilities by a committee with

full powers of quashing claims, the debt was reduced nearly a half, the coin in circulation was ordered to be called in and reissued at the rate of 120 for 100,—a measure by which foreign coiners profited greatly; and a chamber of justice was established to punish speculators, to whom the difficulties of the state were ascribed. These measures had so little success that the *billets d'état* which were issued as part security for the new debt at once sank 75 per cent. below their nominal value. At this crisis Law came forward and unfolded a vast scheme to the perplexed regent. A royal bank was to be founded. It was to manage the trade and currency of the kingdom, to collect the taxes, and free the country from debt. The council of finance then under the duke of Noailles, opposed the plan, but the regent allowed Law to go on with part of it in a tentative way. By an edict of 2d May 1716, a private institution called *La Banque Générale*, and managed by Law, was founded. The capital was 6 million livres, divided into 1200 shares of 5000 livres, payable in four instalments, one-fourth in cash, three-fourths in *billets d'état*. It was to perform the ordinary functions of a bank, and had power to issue notes payable at sight in the weight and value of the money mentioned at day of issue. The bank was a great and immediate success. By providing for the absorption of part of the state paper it raised to some extent the credit of the Government. The notes were a most desirable medium of exchange, for they had the element of fixity of value, which, owing to the arbitrary mint decrees of the Government, wanting in the coin of the realm. They were also found the most convenient instruments of remittance between the capital and the provinces, and they thus developed and increased the industries of the latter. The rate of interest, previously enormous and uncertain, fell first to 6 and then to 4 per cent.; and when another decree (10th April 1717) ordered collectors of taxes to receive notes as payment, and to change them for coin at request, the bank so rose in favour that it had soon a note issue of 60 million livres. Law now gained the full confidence of the regent, and was allowed to proceed with the development of the "system."

The trade of the large and fertile region in North America about the Mississippi had been granted to a speculator named Crozat. He found the undertaking too large, and was glad to give it up. By a decree of August 1717 Law was allowed to establish the *Compagnie des Indes-Occidentales*, and to endow it with privileges practically amounting to sovereignty over the most fertile region of North America. The capital was 100 millions, divided into 200,000 shares of 500 livres. The payments were to be one-fourth in coin and three-fourths in *billets d'état*. On these last the Government was to pay 3 millions livres interest yearly to the company. As the state paper was depreciated the shares fell much below par. The rapid rise of Law had made him many enemies, and they took advantage of this to attack the system. D'Argenson, the former chief of the police, and now, in succession to De Noailles, head of the council of finance, with the brothers Parie of Grenoble, famous tax farmers of the day, formed what was called the "anti-system." The farming of the

¹ A work entitled *Proposals and Reasons for constituting a Council of Trade in Scotland* was published anonymously at Edinburgh in 1701. It was republished at Glasgow in 1761 with Law's name attached; but several references in the state papers of the time mention William Paterson (1668-1719), founder of the Bank of England, as the author of the plan therein propounded. Even if Law had nothing to do with the composition of the work, he must have read it and been influenced by it. This may explain how it contains the germs of many of the developments of the "system." Certainly the suggestion contained in the pamphlet of a central board, to manage great commercial undertakings, to furnish occupation for the poor, to encourage mining, fishing, and manufactures, and to bring about a reduction in the rate of interest, is a plan which was to no inconsiderable extent actually realized in the Mississippi scheme. See Baillie's *Life of William Paterson* (ed. 1858), and *Writings of William Paterson* (2d ed., 3 vols., 1869).

taxes was let to them, under an assumed name, for 48½ million livres yearly. A company was formed the exact counterpart of the Mississippi company. The capital was the same, divided in the same manner, but the payments were to be entirely in money. The returns from the public revenue were sure; those from the Mississippi scheme were not. Hence the shares of the latter were for some time out of favour. Law proceeded unmoved with the development of his plans. On the 4th December 1718 the bank became a Government institution under the name of *La Banque Royale*. Law was director, and the king guaranteed the notes. The shareholders were repaid in coin, and, to widen the influence of the new institution, the transport of money between towns where it had branches was forbidden. The paper issue now reached 110 millions. Law had such confidence in the success of his plans that he agreed to take over shares in the Mississippi company at par at a near date. The shares began rapidly to rise. The next move was to unite the companies *Des Indes Orientales* and *De Chine*, founded in 1664 and 1713 respectively, but now dwindled away to a shadow, to his company. The united association was called *La Compagnie des Indes*; it had practically the monopoly of the foreign trade of France. These proceedings necessitated the creation of new capital to the nominal amount of 25 million livres. The payment was spread over 20 months. It required four of the old shares and a premium of 50 livres to obtain a new one. All these 500 livre shares rapidly rose to 750, or 50 per cent. above par. Law now turned his attention to the obtaining of additional powers within France itself. On the 25th July 1719 an edict was issued granting the company for nine years the management of the mint and the coin issue. For this privilege the company paid 5 million livres, and the money was raised by a new issue of shares of the nominal value of 500 livres, but with a premium of other 500. The list was only open for twenty days, and five of the former shares were required to obtain a new one. At the same time two dividends per annum of 6 per cent. each were promised. Again there was an attempt to ruin the bank by the commonplace expedient of making a run on it for coin, but the conspirators had to meet absolute power managed with fearlessness and skill. An edict appeared reducing, at a given date, the value of money, and those who had withdrawn coin from the bank hastened again to exchange it for the more stable notes. Public confidence in Law was increased, and he was enabled rapidly to proceed with the completion of the system. A decree of 27th August 1719 deprived the rival company of the farming of the revenue, and gave it to the *Compagnie des Indes* for nine years in return for an annual payment of 62 million livres. Thus at one blow the anti-system was crushed. One thing yet remained; Law proposed to take over the national debt, and manage it on terms advantageous to the state. The mode of transfer was this. The debt was over 1600 million livres. Notes were to be issued to that amount, and with these the state creditors were to be paid in a certain order. Shares were to be issued at intervals corresponding to the payments, and it was expected that the notes would be used in buying these. The Government was to pay 3 per cent. for the loan. It had formerly been bound to pay 80 millions, it would now pay under 50, a clear gain of over 30. As the shares of the company were almost the only medium for investment, the transfer would be surely effected. The creditors would now look to the Government payments and the commercial gains of the company for their annual returns. Indeed the creditors were often not able to procure the shares, for each succeeding issue was immediately seized upon. The third, on the 2d October, for 600 millions, divided into shares of

(with premium) 5000 livres each, was taken up as eagerly as its predecessors, and the shares immediately rose to 8000 livres in the Rue Quincampoix, then used as a bourse. They went on rapidly rising as new privileges were still granted to the company. Law had now more than regal power. The exiled Stuarts paid court to him, the proudest aristocracy in Europe humbled themselves before him; and his liberality made him the idol of the populace. After, as a necessary preliminary, becoming a Catholic, he was made controller-general of the finances in place of D'Argenson, who was removed to make way for him. Finally, in February 1720, the bank was in name as well as in reality united to the company.

The system was now complete; but it had already begun to decay. In December 1719 it was at its height. The shares then had mounted to 20,000 livres, forty times their nominal price. A sort of madness possessed the nation. Men sold their all, and hastened to Paris to speculate. The population of the capital was increased by an enormous influx of provincials and foreigners. Trade received a vast though unnatural impulse. Everybody seemed to be getting richer, no one poorer. Those who could still reflect saw that this prosperity was not real. The whole issue of shares at the extreme market price valued 12 milliard livres. It would require 500 million annual revenue to give a 6 per cent. dividend on this. Now, the whole income of the company as yet was hardly sufficient to pay 5 per cent. on the original capital of 1 milliard 677 million livres. The receipts from the taxes, &c., could be precisely calculated, and it would be many years before the commercial undertakings of the company—with which only some trifling beginning had been made—would yield any considerable return. People began to sell their shares, and to buy coin, houses, land,—anything that had a stable element of value in it. There was a rapid fall in the shares, a rapid rise in all kinds of property, and consequently a rapid depreciation of the paper money. Law met these new tendencies by a succession of the most violent edicts. The notes were to bear a premium over specie. Coin was only to be used in small payments, and only a small amount was to be kept in the possession of private parties. The use of diamonds, the fabrication of gold and silver plate, was forbidden. A dividend of 40 per cent. on the original capital was promised. By several ingenious but fallaciously reasoned pamphlets Law endeavoured to restore public confidence. The shares still fell. At last, on the 5th March, an edict appeared fixing the price of these at 9000 livres, and ordering the bank to buy and sell them at that price. The fall now was transferred to the notes, of which there were soon over 2½ milliard livres in circulation. A large proportion of the coined money was removed from the kingdom. Prices rose enormously. There was everywhere distress and complete financial confusion. Law became an object of popular hatred. He lost his court influence, and was obliged to consent to a decree (21st May 1720) by which the notes and consequently the shares were reduced to half their nominal value. This created such a commotion that its promoters were forced to recall it, but the mischief was done. What confidence could there be in the depreciated paper after such a measure? Law was removed from his office, and his enemies proceeded to demolish the system. A vast number of shares had been deposited in the bank. These were destroyed. The notes were reconverted into Government debt, but there was first a *vis* which reduced that debt to the same size as before it was taken over by the company. The rate of interest was lowered, and the Government now only pledged itself to pay 37 instead of 80 millions annually. Finally the bank was abolished, and the company reduced to a mere trading association. By November the system had disappeared. With these last

measures Law, it may well be believed, had nothing to do. He left France secretly in December 1720, resumed his wandering life, and died at Venice, poor and forgotten, 21st March 1729.

Of Law's writings the most important for the comprehension of the "system" is his *Money and Trade Considered*. In this work he says that national power and wealth consist in numbers of people, and magazines of home and foreign goods. These depend on trade, and that on money, of which a greater quantity employs more people; but credit, if the credit have a circulation, has all the beneficial effects of money. To create and increase instruments of credit is the function of a bank. Let such be created then, and let its notes be only given in return for land sold or pledged. Such a currency would supply the nation with abundance of money, and it would have many advantages, which Law points out in detail, over silver. The bank or commission was to be a Government institution, and its profits were to be spent in encouraging the export and manufacture of the nation. A very evident error lies at the root of the system. Money is not the result but the cause of wealth, he thought. To increase it then must be beneficial, and the best way is by a properly secured paper currency. This is the motive force, but it is to be applied in a particular way. Law had a profound belief in the omnipotence of Government. He saw the evils of minor monopolies, and of private farming of taxes. He proposed to centre foreign trade and internal finance in one huge monopoly managed by the state for the people, and carrying on business through a plentiful supply of paper money. He did not see that trade and commerce are best left to private enterprise, and that such a scheme would simply result in the profits of speculators and favourites. The system indeed was never so far developed as to exhibit its inherent faults. We have already seen how the madness of speculators ruined the plan when only its foundations were laid. One part indeed might have been saved. The bank was not necessarily bound to the company, and had its note issue been intended it might have become a mere bank of issue. As it thus came into the effect of 5th March 1720, which made the shares convertible into notes, ruined the bank without saving the company. The shares had risen to an unnatural height, and they should have been allowed to fall to their natural level. Perhaps Law felt this to be impossible. He had the errors of his time, but his writings show that he first perceived the errors as to the nature of currency and banking then unknown to his contemporaries. The marvellous skill which he displayed in adapting the theory of the system to the actual condition of things in France, and in carrying out the various financial transactions rendered necessary by its development, is absolutely without parallel. His profound self-confidence and belief in the truth of his own theories were the reasons alike of his success and his ruin. He never hesitated to employ the whole force of a despotic Government for the definite ends which he saw before him. He was not self-seeking. He left France poorer than he entered it, nor was he perceptibly changed by his sudden transference of fortune. Montesquieu visited him at Venice after his fall, and has left a description of him not without a certain touch of pathos. Law, he tells us, was still the same in character, perpetually planning and scheming, and, though in poverty, reviving vast projects to restore himself to power, and France to commercial prosperity.

The best account of the *Mississippi* scheme is that of Thiers, "Law et son système des Finances," first published in the *Biographie universelle*, Paris, 1820; there is an American edition, York, 1825. See also *Thiers, Histoire du Système, Munich, 1833*, & *Levasseur, Recherches historiques sur le système de Law, Paris, 1864*, and *Jobert, Un projet ou socialisme, et le système de Law et la chute des capitalistes*, Paris, 1864. Full bibliographical details are given in *Wood's Life of Law*, Edinburgh, 1884. All Law's later writings are to be found in *De la Collection des ouvrages posthumes de Law*, vol. 1, Paris, 1845. (G. W. A.)

LAW, WILLIAM (1656-1761). The events of the life of this remarkable man may be very briefly stated. He was born in 1656 at King's Cliffe; in 1705 he entered as a sizar at Emmanuel College, Cambridge; in 1711 he was elected fellow of his college and received holy orders, and in 1712 he took his M.A. degree. He resided at Cambridge, taking pupils and occasional duty until the accession of George I., when his conscience forbade him to take the oath of allegiance to the new Government and of abjuration of the Stuarts; his staunch Jacobitism had already been betrayed in a tripos speech which brought him into trouble; and he was now deprived of his fellowship, and became a non-juror. For the next few years he is said to have been a curate in London, but the point is doubtful. In 1727 we find him domiciled at Putney as tutor to Edward Gibbon,

father of the historian, and "the much honoured friend and spiritual director of the whole family" (Gibbon, *The Memoirs of my Life and Writings*). In the same year he accompanied his pupil to Cambridge, and resided with him as governor, in term time, for the next four years. His pupil then went abroad, but Law was left at Putney, where he remained in Mr Gibbon's house for more than ten years, acting as a religious guide not only to the family but to a number of pious men who used to make pilgrimages to consult the Putney sage. The most eminent of these were the two brothers John and Charles Wesley, Dr Byrom the poet, Dr Chaynes the famous physician, and Mr Archibald Hutcheson, M.P. for Hastings. In 1737 Mr Gibbon the elder died, and the household was, a short time afterwards, dispersed. Law therefore was parted from his friends, leaving behind him, the historian tells us, "in our family the reputation of a worthy and pious man, who believed all that he professed, and practised all that he enjoyed."

In 1740 Law retired to his native village, where he had inherited from his father a house and a small property. There he was presently joined by two ladies, Mrs Hutcheson, the rich widow of his old friend, who recommended her on his death-bed to place herself under Law's spiritual guidance, and Miss Hester Gibbon, sister to his late pupil. This curious trio lived for twenty-one years a life wholly given to devotion and charity, until the death of Law in 1761.

Such was the singularly uneventful life of this good man; but during the whole period from the time when he became a non-juror almost to the day of his death he was busily engaged in literary work which places him in the very first rank of 18th century divines. As a writer, it will be convenient to consider him under three heads.

1. As a singularly able controversialist. The first of his controversial works was *Three Letters to the Bishop of Bangor* (1717), which were considered both by friend and foe as one of the most powerful contributions to the Bangorian controversy on the High Church side. Dean (afterwards Bishop) Sherlock declared that "Mr Law was a writer so considerable that he knew but one good reason why his lordship did not answer him." Law's next controversial work was *Remarks on Montaigne's Fable of the Bees* (1728), in which he vindicated morality on the highest grounds; for pure style, sound wit, and lucid argument this is a perfect gem; it was enthusiastically praised by John Sterling, and has been republished by F. D. Maurice. Law's *Case of Reason* (1732), in answer to Tisdal's *Christianity as sold as the Creation* is to a great extent an anticipation of Bishop Butler's famous argument in the *Analogy*. In this work Law shows himself at least the equal of the ablest champion of Deism. His *Letters to a Lady* (written to enter the Church of Rome are excellent specimens of the attitude which a High-Churchman maintains against Romanism.

2. As a very effective writer on practical divinity. The *Serious Call to a Devout and Holy Life* (1726), together with its preface, *A Treatise of Christian Perfection* (1726), deeply influenced the chief actors in the great Evangelical revival. The Wesleys, Whitefield, Venn, Scott, and Adam all express their deep obligation to the author. The *Serious Call* affected others quite as deeply. Dr Johnson, Gibbon, Lord Lyttelton, and Bishop Horne all speak enthusiastically of its merits, and it has been, unfortunately, perhaps the only work by which its author was popularly known. In a tract entitled *The Absolute Unlawfulness of Stage Entertainments*, Law, unlike himself, was tempted by the unedifying corruptions of the stage of the period to use language which transcends the bounds of reason.

3. As one of the few English mystics. Though the least popular, by far the most interesting, original, and suggestive of all Law's works are those which he wrote in his later years, after he had become an enthusiastic admirer (not a disciple) of Jacob Boehme, the Teutonic theosopher. From his earliest years he had been deeply impressed with the piety, beauty, and thoughtfulness of the writings of the Christian mystic, but it was not till after his accident meeting with the works of Boehme, about 1734, that pronounced mysticism appears in his works. It would far transcend the limits of this article to describe, however briefly, the purport of Law's mystic writings. All are very beautiful; some are wild and fanciful, but not one of them is inconsistent with his position as a churchman, and even a very high churchman of the spiritual type. The titles of the works written by Law in his mystic stage are—

Demonstration of the Gross and Fundamental Errors of a late Book called a "Plain Account, &c., of the Lord's Supper," 1737; An Appeal to all that Doubt and Disbelieve the Truths of Revelation, 1739, The Grounds and Reason of Christian Regeneration, 1739, An Earnest and Serious Answer to Dr Pappi's Sermon on being Righteous Goeth, 1740, The Spirit of Prayer, 1749, 1752; The Way to Divine Knowledge, 1759, The Start of Love, 1752, 1754; A Short but Sufficient Confutation of Dr Warburton's Projected Defence (as he calls it) of Christianity in his Divine Legation of Moses, 1757, A Series of Letters, 1780, a Dialogue between a Methodist and a Churchman, 1760, and An Humble, Reasoned, and Affectionate Address to the Clergy, 1761.

Mr R Tipton wrote a short account of Law's life at the beginning of this century. Mr C Wallen printed for private circulation *Notes and Materials for a Complete Biography of W Law*, in 1850. Mr Leath Stephen in *The English Thought to the 16th Century*, p. 321. Locky in *The History of England to the 16th Century*, and Mr Abbey in *The English Church in the 16th Century*, all give sketches of Law's life, character, and works, and Mr Overton has devoted a volume to him, entitled *William Law, Non-juror and Mystic*, 1863.

LAWES, HENRY (1595-1662), a prominent member of the school of early English musicians, which culminated in Purcell, and was nipped in the bud by his early death, was born at Dinton in Wiltshire in December 1595, and received his musical education from John Cooper, better known under his Italian pseudonym Giovanni Operario, a famous composer of the day. In 1625 he was received as one of the gentlemen of the chapel royal, which place he held till the Commonwealth put a stop to church music. But even during that songless time Lawes continued his work as a composer, and the famous collection of his vocal pieces, *Lyres and Dialogues for One, Two, and Three Voices*, was published in 1653, being followed by two other books under the same title in 1655 and 1658 respectively. When in 1660 the king returned, Lawes once more entered the royal chapel, and composed an anthem for the coronation of Charles II. His death took place October 11, 1662. Lawes's name has become known beyond musical circles by his friendship with Milton, whose *Comus* he supplied with incidental music for the performance of the masque in 1634. The poet in return immortalized his friend in the famous sonnet beginning—

Henry, whose tuneful and well-measured song
First taught our English music how to span
Words with just note and accent, not to scan
With Mides' ears, committing short and long

In these lines, Milton, with a musical perception not common amongst poets, exactly indicates the great merit of Lawes, which distinguishes his compositions from those of many of his contemporaries and successors. His careful attention to the words of the poet, the manner in which his music seems to grow from those words, the perfect coincidence of the musical with the metrical accent, all put Lawes's songs on a level with those of Schumann or Lutz or any modern composer. At the same time he is by no means wanting in genuine melodic invention, and his concerted music shows the learned contrapuntist.

LAWN TENNIS. See TENNIS.

LAW OF NATIONS. See INTERNATIONAL LAW.

LAWRENCE, a city of Kansas, U.S., the capital of Douglas county, is situated on both sides of the Kansas river, about 40 miles above its junction with the Missouri. Founded in 1854 by the Massachusetts Emigrant Aid Society as a centre of the anti-slavery party, Lawrence was at first retarded in its development by the disturbed condition of the State, but its population has rapidly increased from 1645 in 1880 to 8511 in 1880, and it is now the fourth city in the State in population and wealth. It is a considerable railway junction, has a good trade, and numbers among its manufacturing establishments a pork-packing factory, planing-mills, foundries, carriage works, grist-mills, and breweries. A dam has been constructed across the Kansas. In 1862-63 the State university was settled at Lawrence, the buildings occupying a fine site on Mount Oread, a bluff in the south-west part of the city; in 1880 it had 14 teachers and 438 students. In 1866 Law-

rence was sacked and partially burned by a party of soldiers and Missourians claiming to act with the sanction of the U.S. Government, and in 1863, during the civil war, it was captured and burned by a Confederate guerrilla force.

LAWRENCE, a city of Massachusetts, U.S., one of the county seats of Essex county, 26 miles by rail north of Boston, on the Merrimack, about 35 miles from its mouth. The greater part lies on the north side of the river, to the west of the Spicket. Lawrence is emphatically a manufacturing town, and its rise and rapid development are mainly due to the abundant water-power supplied by the dam across the Merrimack and distributed by a canal a mile long and 14 feet deep. This is the property of the Essex Company, which was incorporated in 1845, and spent \$250,000 on the construction of the dam—a piece of granite masonry 1829 feet in length. The Bay State Woollen Mills (capital \$2,000,000) and the Atlantic Cotton Mills (capital \$1,500,000), both chartered in 1846, were the first great establishments to take advantage of the position. The Lawrence Duck Company and the Pacific Mills (capital \$300,000 and \$2,500,000) followed in 1853; the Washington Mills (\$1,650,000), taking the place of the Bay State, in 1858, the Everett (\$800,000) and the Pemberton Mills (\$450,000) in 1860, the Lawrence Woollen Company in 1863, the Arlington in 1865. There are now eight large "corporations," the largest of which, the Pacific Mills, alone employs 5800 operatives, and produces weekly 1,500,000 yards of cloth, printed or dyed. In 1880 the total number of looms in the cotton and woollen mills was 10,460, of spindles 345,988, and of operatives 13,124; and it is calculated that the average rate of production is 28,800,000 yards per week. The goods are of a varied description—broad cloth, fine flannels, shawls, pantaloons, felts, ticks, ginghams, &c. There are a number of large paper-mills in the town, as well as establishments for the manufacture of steam-engines, carriages, sewing machines, cordage, earthenware. Among the principal buildings and institutions may be mentioned the city hall (erected in 1847), the county court-house, the opera-house, the Oliver grammar school, and a public library (22,000 volumes). There are three public parks, one (17½ acres) in the heart of the city. Water works, deriving their supplies from the Merrimack, were opened in 1876 at a cost of \$1,700,000; the people had previously depended on wells and cisterns for drinking water. The population in 1850 was 8232; in 1860, 17,659; in 1870, 28,921, in 1880, 39,178. Lawrence, so-called in honour of the Lawrence family of Boston, was incorporated as a town in 1847, and attained the rank of a city in 1863.

LAWRENCE (LAURENTIUS, LORENZO), ST., according to Pope Leo the Great, whose account is that given also in the Roman Breviary, was a deacon, who in a time of persecution had been called on by the magistrate to give up the treasures committed to his keeping, and who thereupon had produced the church's poor, who were his special charge. Next, for his firmness in refusing to renounce Christ, he was subjected to scourging and laceration, and finally roasted to death on a gridiron. The later accounts of the martyrologists are much more circumstantial. According to these, Lawrence was a native of Huesca in Spain, but at a very early age had gone to Rome, where for his meekness and blamelessness he was chosen arch-deacon by Pope Sixtus II., and intrusted with the treasures of the church, consisting of vestments, plate, and a little money. Sixtus, having (in the reign of Valerian) been denounced as a Christian, was imprisoned and sentenced to death, whereupon Lawrence addressed to him the words which now form one of the antiphons in the office for St. Lawrence's day (August 10): "Whither goest thou, O

my father ! without thy son and servant ? " To this the pope replied with a prophecy that in three days Lawrence, the Levite should follow Sixtus the priest. At the same time Lawrence was directed to distribute the church treasures among the poor, and so prevent them from falling into the hands of the persecutor. When under the cruel punishment to which he was at last condemned for his steadfastness, he is said to have triumphed over the tyrant by the famous ironical speech—"Assatus est; jam versa et manduca." The fact of the martyrdom of St Lawrence seems to be well established, the most probable date being August 10, 258. The earliest extant mention of the event occurs in the writings of St Ambrose. Lawrence and his martyrdom have been favourite subjects for artistic treatment. Nuremberg, Genoa, and the Escorial are under his patronage.

LAWRENCE, JOHN LAIRD MAIR LAWRENCE, BARON (1811-1878), viceroy and governor-general of India, was born at Richmond, Yorkshire, 24th March 1811. His father, Colonel Alexander Lawrence, volunteered the forlorn hope at Seringapatam in presence of Baird and of Wellington, whose friend he became. His mother, Letitia Knox, was a collateral descendant of John Knox. To this couple were born twelve children, of whom three became famous in India, Sir George St Patrick, Sir Henry (noticed below), and Lord Lawrence. Irish Protestants, the boys were trained at Foyle College, Derry, and at Clifton, and received commissions from their mother's cousin, Mr Huddleston, who had been the friend of Schwartz in Tanjore. In 1829, when only seventeen, John Lawrence landed at Calcutta; he mastered the Persian language at the college of Fort William, and was sent to Delhi, on his own application, as assistant to the collector. The position was the most dangerous and difficult to which a Bengal civilian could be appointed at that time. The titular court of the pensioner who represented the Great Mogul was the centre of that disaffection and sensuality which found their opportunity in 1857. A Mussulman rabble filled the city. The district around, stretching from the desert of Rajpootana to the Jumna, was slowly recovering from the anarchy to which Lord Lake had given the first blow. When not administering justice in the city courts or under the village tree, John Lawrence was securing the country after the marauding Meos and Mohammedan freebooters. His keen insight and sleepless energy at once detected the murderer of his official superior, William Fraser, in 1835, in the person of the nabab of Lohari, whose father had been raised to the principality by Lake, and the assassin was executed. The first twenty years, from 1829 to 1849, during which John Lawrence acted as the magistrate and land revenue collector of the most turbulent and backward portion of the Indian empire as it then was, formed the period of the reforms of Lord William Bentinck. To what is now the lieutenant-governorship of the North-Western Provinces Lord Wellesley had promised the same permanent settlement of the land-tax which Lord Cornwallis had made with the large landholders or zemindars of Bengal. The court of directors, going to the opposite extreme, had sanctioned leases for only five years, so that agricultural progress was arrested. In 1833 Martins Bird and Thomason introduced the system of thirty years' leases based on a careful survey of every estate by trained civilians, and on the mapping of every village holding by native subordinates. These two revenue officers created a school of enthusiastic economists who rapidly registered and assessed an area as large as that of Great Britain, with a rural population of twenty-three millions. Of that school John Lawrence proved the most ardent and the most renowned. Intermittent his work at Delhi, he became land revenue settlement officer in the district of Etawah, and

there began, by buying out or getting rid of the talukdars, to realize the ideal which he did much to create throughout the rest of his career—a country "thickly cultivated by a fat contented yeomanry, each man riding his own horse, sitting under his own fig-tree, and enjoying his rude family comforts." Thus and a quiet persistent hostility to the oppression of the people by their chiefs formed the two features of his administrative policy throughout life.

It was fortunate for the British power that, when the first Sikh war broke out, John Lawrence was still collector of Delhi. The critical engagements at Ferozshah, following Mudki, and hardly redeemed by Aliwal, left the British army somewhat exhausted at the gate of the Punjab, in front of the Sikh entrenchments on the Sutlej. For the first seven weeks of 1845 there poured into camp, day by day, the supplies and munitions of war which this one man raised and pushed forward, with all the influence acquired during fifteen years of an iron yet sympathetic rule in the land between the Sutlej and the Jumna. The crowning victory of Sobraon was the result, and at thirty-five Lawrence became commissioner of the Jalandhar Doab, the fertile belt of hill and dale stretching from the Sutlej north to the Indus. The still youthful civilian did for the newly annexed territory what he had long before accomplished in and around Delhi. He restored it to order, without one regular soldier. By the fascination of his personal influence he organized levies of the Sikhs who had just been defeated, led them now against a chief in the upper hills and now to storm the fort of a raja in the lower, till he so welded the people into a loyal mass that he was ready to repeat the service of 1846 when, three years after, the second Sikh war ended in the conversion of the Punjab up to Peshawar into a British province.

The marquis of Dalhousie had to devise a government for a warlike population now numbering twenty-three millions, and covering an area little less than that of the United Kingdom. The first results were not hopeful (see next article), and it was not till John Lawrence became chief commissioner, and stood alone face to face with the chiefs and people and ring fence of still untamed border tribes, that there became possible the most successful experiment in the art of civilizing turbulent millions which history presents. The province was mapped out into districts, now numbering thirty-two, in addition to thirty-six tributary states, small and great. To each the thirty years' leases of the north-west settlement were applied, after a patient survey and assessment by skilled officials ever in the saddle or the tent. The revenue was raised on principles so fair to the peasantry that Ranjit Singh's exactions were reduced by a fourth, while agricultural improvements were encouraged. For the first time in its history since the earliest Aryan settlers had been overwhelmed by successive waves of invaders, the soil of the Punjab came to have a marketable value, which every year of British rule has increased. A stalwart police was organized; roads were cut through every district, and canals were constructed. Commerce followed on increasing cultivation and communications, courts brought justice to every man's door, and crime hid its head. The adventurous and warlike spirits, Sikh and Mohammedan, found a career in the new force of Irregulars directed by the chief commissioner himself under the governor-general, while Doet Mohammed kept within his own fastnesses, and the long extent of frontier at the foot of the passes was patrolled. In the brilliance of his later services to his country, this, the first, which alone rendered those possible, has not yet received justice.

Seven years of such work prepared the lately hostile and always anarchic Punjab under such a pilot as John Lawrence not only to weather the storm of 1857 but to

lead the older provinces into port. On the 12th May the news of the tragedies at Meerut and Delhi reached him at Rawal Pindi. The position was critical in the last degree, for of 50,000 native soldiers 38,000 were Hindustanis of the very class that had mutinied elsewhere, and the British troops were few and scattered. For five days the fate of the Punjab hung upon a thread, for the question was, Could the 12,000 Punjabis be trusted and the 38,000 Hindustanis be disarmed? Not an hour was lost in beginning the disarming at Lahore; and, as one by one the Hindustani corps succumbed to the epidemic of mutiny, the sepoys were deported or disappeared, or swelled the military rubble in and around the city of Delhi. The remembrance of the ten years' war which had closed only in 1849, a bountiful harvest, the old love of battle, the offer of good pay, but, above all, the personality of Lawrence and his officers, raised the Punjab force into a new army of 59,000 men, and induced the non-combatant classes to subscribe to a 6 per cent. loan. Delhi was invested, but for three months the rebel city did not fall. Under John Nicholson Lawrence sent out still more men to the siege, till every available European and faithful native soldier was there, while a movable column swept the country, and the border was kept by an improvised militia. At length, when even in the Punjab confidence became doubt, and doubt distrust, and that was passing into disaffection, John Lawrence was ready to consider whether we should not give up the Peshwar valley as a last resource, and send its garrison to recruit the force around Delhi. Another week and that must have been faced. But on the 30th September the city and palace were again in British hands, and the chief commissioner and his officers united in ascribing "to the Lord our God all the praise due for nerving the hearts of our statesmen and the arms of our soldiers." As Sir John Lawrence, Bart., G.C.B., with the thanks of parliament, the gratitude of his country, and a life pension of £2000 a year in addition to his ordinary pension of £1000, the "Saviour of India" returned home in 1859. While guarding the interests of India and its people as a member of the secretary of state's council, he was sent out again in 1864 as viceroy and governor-general on the resignation and death of Lord Elgin. At what appeared to be a critical time on the Punjab frontier Lord Palmerston recommended for the office the first civilian, not a peer, who has filled the governor-general's seat since Warren Hastings. If no great crisis enabled him to increase the lustre of his reputation, his five years' administration of the whole Indian empire was worthy of the ruler of the Punjab. His foreign policy has become a subject of imperial interest; his internal administration was remarkable for financial prudence, a jealous regard for the good of the masses of the people and of the British soldiers, and a generous interest in education, especially in its Christian aspects.

When in 1854 Dost Mohammed Khan, weakened by the antagonism of his brothers in Kandahar, and by the interference of Persia, sent his son to Peshawar to make a treaty, Sir John Lawrence was opposed to any entangling relation with the Afghans after the experience of 1838-42, but he obeyed Lord Dalhousie so far as to sign a treaty of perpetual peace and friendship. His ruling idea, the fruit of long and sad experience, was that *de facto* powers only should be recognized beyond the frontier. When in 1863 Dost Mohammed's death let loose the factions of Afghanistan he acted on this policy to such an extent that he recognized both the sons, Afzal Khan and Sher Ali, at different times, and the latter fully only when he had made himself master of all his father's kingdom. The steady advance of Russia from the north, notwithstanding the Gortschakoff circular of 1864, led to severe criticism of this cautious "buffer"

policy which he justified under the term of "masterly inactivity." But he was ready to receive Sher Ali in conference, and to aid him in consolidating his power after it had been established and maintained for a time, when his term of office came to an end and it fell to Lord Mayo, his successor, to hold the Amulka conference in 1869. When, nine years after, the second Afghan war was precipitated, the retired viceroy gave the last days of his life to an unsparring exposure, in the Houses of Lords and in the press, of a policy which he had striven to prevent in its inception, and which he did not cease to denounce in its course and consequences.

On his final return to England early in 1869, after forty years' service in and for India, "the great preceptor of our English Christian empire" was created Baron Lawrence of the Punjab, and of Grately, Hants. He assumed the same arms and crest as those of his brother Henry, with a Pathan and a Sikh trooper as supporters, and took as his motto "Be ready," his brother's being "Never give in." For ten years he gave himself to the work of the London school board, of which he was the first chairman, and of the Church Missionary Society. Latterly his eyesight failed, and on the 27th June 1873 he died at the age of sixty-eight. He was buried in the nave of Westminster Abbey, beside Clyde, Outram, and Livingstone. He married the daughter of the Rev. Richard Hamilton, Harriette-Katherine, C.L., who survived him; and he was succeeded by his eldest son, John Hamilton, born in 1840.

Beyond numerous minutes and reports, written in plain and trenchant English, and occasional lectures, Lord Lawrence published nothing. These, the printed *Speeches of Affairs* during his term of office as viceroy, the *Friend of India* from 1868 to 1870, the evidence which he gave before the East Indian Finance Committee of the House of Commons in June and July 1873, and the *Causes of the Afghan Wars*, edited by Sir Arthur Hobhouse, are the authorities for his life, until the memoir appears which Mr. Bosworth Smith is preparing. (G. SM.)

LAWRENCE, SIR HENRY MONTGOMERY (1800-1857), one of the greatest military statesmen of India, and provisional governor-general in the mutiny of 1857, was born at Madura, Ceylon, on 28th June 1806 (see last article). He inherited his father's stern devotion to duty and Celtic impulsiveness, tempered by his mother's gentleness and power of organization. Early in 1823 he joined the Bengal Artillery at the Calcutta suburb of Dum Dum where also Havelock was stationed about the same time. The two officers pursued a very similar career, and developed the same Puritan character up to the time that both passed away at Lucknow in 1857. In the first Burmese war Henry Lawrence and his guns formed part of the Chittagong column which General Morrison led over the jungly hills of Arakan, till fever decimated the officers and men, and the lieutenant found himself at home again, wasted by a disease which never left him. On his return to India with his younger brother John in 1829 he was appointed revenue surveyor by Lord William Bentinck. At Gorakhpur the wonderful personal influence which radiated from the young officer formed a school of attached friends and subordinates who were always eager to serve under him. After some years spent in camp, during which he had married his cousin Honoria Marshall, and had surveyed every village in four districts each larger than Yorkshire, he was recalled to a brigade by the outbreak of the first Afghan war towards the close of 1838. As assistant to Sir George Clerk, he now added to his knowledge of the people political experience in the management of the district of Peshawar; and when disaster came he was sent to Peshawar in order to push up supports for the relief of Sale and the garrison of Jalalabad. The war had been begun under the tripartite treaty signed at Lahore on 20th June 1838. But the Sikhs

were slow to play their part when the calamities in Afghanistan made it possible that the British might be driven south of the Jumna. No one but Henry Lawrence could manage the disorderly contingent which they reluctantly supplied to Pollock's avenging army in 1842. He helped to force the Khyber Pass on 5th April, playing his guns from the heights, for eight and twenty miles to recognition of his services Lord Ellenborough appointed him to the charge of the charming valley of Dehra Doo and its hill stations, Mussuri and Landaur, where he first formed the idea of asylums for the children of European soldiers. After a month's experience there it was discovered that the coveted appointment was the legal right of the civil service, and he was transferred, as assistant to the envoy at Lahore, to Ambala, where he reduced to order the lapsed territory of Kaithal. Soon he received the well-paid office of resident at the protected court of Nepal, amid the rest of which, assisted by his noble wife, he began a series of contributions to the *Calcutta Review*, a selected volume of which forms an Anglo-Indian classic. There, too, he elaborated his plans which resulted in the erection and endowment of the noblest philanthropic establishments in the East—the Lawrence military asylums at Sanawar (on the road to Simla), at Murree in the Punjab, at Mount Abu in Rajputana, and on the Madras Nilgiris. From 1844 to his death he devoted all his comparatively large income, above a modest pittance for his children, to this and other forms of catholic Christian charity.

The *Review* articles led the new governor-general, Lord Hardinge, to summon Lawrence to his side during the first Sikh war, and not these articles only. He had published the results of his experience of Sikh rule and soldiering in a vivid work, the *Adventures of an Officer in the Service of Ranjit Singh* (1845), in which he vainly attempted to disguise his own personality and exploits. For the next four years he virtually became Ranjit Singh's successor in the government of the Punjab. After the doubtful triumphs of Mudki and Ferozshah Lawrence was summoned from Nepal to take the place of the heroic Major George Broadfoot, who had fallen. Allwail came, then the guns of Sobraon chased the demoralized Sikhs across the Sutlej. All through the smoke Lawrence was at the side of the chivalrous governor-general. He gave his voice, not for the rescue of the people from anarchy by annexation, but for the reconstruction of the Sikh government, and was himself appointed resident at Lahore, with power "over every department and to any extent" as president of the council of regency till the maharaja Dhalip Singh should come of age. Soon disgusted by the "venal and selfish durbars" who formed his Sikh colleagues, he summoned to his side assistants like Nicholson, James Abbott, and Edwardes, till they all did too much for the people, as he regretfully confessed. But "my chief confidence was in my brother John, . . . who gave me always such help as only a brother could." Worn out he went home with Lord Hardinge, and was made K.C.B., when the second Sikh war summoned him back at the end of 1848 to see the whole edifice of Sikh "reconstruction" collapse. It fell to the marquis of Dalhousie to proclaim the Punjab up to the Khyber British territory on 29th March 1849. But still another compromise was tried. As the best man to reconcile the Sikh chiefs to the inevitable, Henry Lawrence was made president of the new board of administration with charge of the political duties, and his brother John was entrusted with the finances. John could not find the revenue necessary for the rapid civilization of the new province so long as Henry would, for political reasons, insist on granting life pensions and alienating large estates to the needy and sensual remnants of Ranjit

Singh's court. Lord Dalhousie delicately but firmly removed Sir Henry Lawrence to the charge of the great nobles of Rajputana, and installed John as chief commissioner. If resentment burned in Henry's heart, it was not against his younger brother, who would fain have retired. To him he said, "If you preserve the peace of the country and make the people high and low happy, I shall have no regrets that I vacated the field for you."

In the comparative rest of Rajputana he once more took up the pen as an army reformer. In March and September 1856 he published two articles, called forth by conversations with Lord Dalhousie at Calcutta, whither he had gone as the hero of a public banquet. The governor-general had vainly warned the home authorities against reducing below 40,000 the British garrison of India even for the Crimean campaigns, and had sought to improve the position of the sepoy. Lawrence pointed out the latent causes of mutiny, and uttered warnings only to be too soon justified. In March 1857 he yielded to Lord Canning's request that he should then take the helm at Lucknow, but it was too late. In ten days his magic rule put down administrative difficulties indeed, as he had done at Lahore. But what could even he effect with only 700 European soldiers, when the epidemic spread after the Meerut outbreak of mutiny on 10th May? In one week he had completed those preparations which made the defence of the Lucknow residency for ever memorable. Amid the deepening gloom Lord Canning ever wrote home of him as "a tower of strength," and he was appointed provisional governor-general. On the 30th May mutiny burst forth in Oudh, and he was ready. On 29th June, pressed by fretful colleagues, and wasted by unceasing toil, he led 336 British soldiers with 11 guns and 220 natives out to Chinhat to reconnoitre the insurgents, when the natives joined the enemy and the residency was besieged. On 2d July, as he lay exhausted by the day's work and the terrific heat in an exposed room, a shot struck him, and in forty-eight hours he was no more. A baronetcy was conferred on his son. A marble statue was placed in St Paul's as the national memorial of one who has been declared to be the noblest man that has lived and died for the good of India.

The authorities for his career, besides his own writings above mentioned, are his *Life* by Sir Herbert Edwards (vol. 1) and Herman Merivale (vol. II.), and the *Military Papers* (1867-68) published by Parliament. His form was tall, spare, and wasted, as is best seen in the engraving from a Lucknow photograph prefixed to *Rees's Personal Narratives of the Siege*. (G. S.M.)

LAWRENCE, SIR THOMAS (1769-1830), was born at Bristol on the 4th of May 1769. His father was an innkeeper first at Bristol and afterwards at Devizes, and at the age of six Thomas was already shown off to the guests of the Black Boy as an infant prodigy who could sketch their likenesses and declaim speeches from Milton. In 1779 the elder Lawrence had to leave Devizes, having failed in business, and the precocious talent of the son, who had gained a sort of reputation along the Bath road, became the support of the family. His debut as a crayon portrait painter was made at Oxford, where he was well patronised, and in 1782 the family settled in Bath, where the young artist soon found himself fully employed in taking crayon likenesses of the fashionables of the place at a guinea or a guinea and a half a head. In 1784 he gained the prize and silver gilt palette of the Society of Arts for a crayon drawing after Raphael's Transfiguration, and presently beginning to paint in oil, and throwing aside the idea of going on the stage which he had for a short time entertained, he came to London in 1787, was kindly received by Reynolds, and entered as a student at the Royal Academy. He began to exhibit almost immediately, and his reputation increased so rapidly that he became an

associate of the Academy in 1791. The death of Sir Joshua in 1792 opened the way to further successes. He was at once appointed painter to the Dilettanti Society, and principal painter to the king in room of Reynolds. In 1794 he was a Royal Academician, and he became the fashionable portrait painter of the age, having as his sitters all the rank, fashion, and talent of England, and ultimately most of the crowned heads of Europe. In 1816 he was knighted; in 1818 he went to Aix-la-Chapelle to paint the sovereigns and diplomatists gathered there, and extended his residence on the Continent by visiting Vienna and Rome, everywhere receiving flattering marks of distinction from princes, due as much to his courtly manners as to his merits as an artist. After eighteen months he returned to England, and on the very day of his arrival was chosen president of the Academy in room of West, who had died a few days before. This office he held from 1820 to his death on 7th January 1830. He was never married.

Sir Thomas Lawrence had all the qualities of personal manner and artistic style necessary to make a fashionable painter, and at a period when aristocratic opinion had even more weight than at present his public reputation was extravagantly high. The judgment of his fellow artists was less favourable, and in the present day no one would claim for him a place among great portrait painters, while his more ambitious works, in the classical style, such as his once celebrated *Satan*, are practically forgotten. His chief merit lay in a certain dexterity of touch and in the conventional grace with which he contrived to clothe his figures.

The best display of Lawrence's work is in the Waterloo Gallery of Windsor, a collection of much historical interest. "Master Lambert," painted for Lord Durham at the price of 600 guineas, is regarded as one of his best portraits, and a fine head in the National Gallery shows his power to advantage. *The Life and Correspondence of Sir T. Lawrence*, by Williams, appeared in 1831. See also Cunningham's *British Painters*, 1833.

LAYAMON, or LAWEMAN, the author of a chronicle of Britain entitled *Brut*, a poetical semi-Saxon paraphrase of the *Brut d'Angleterre* of Wace, was as he himself informs us a priest who read the services of the church at Eynley, on the banks of the Severn (now Lower Arley or Arley Regis, 3½ miles south-east from Bewdley, Worcestershire). Of his personal history nothing further is known. Nor can the date of the work with which his name is associated be very accurately ascertained, but the probability is that it was not completed before the beginning of the 13th century. The original text, with a literal translation, notes, and a grammatical glossary, was first edited by Sir Frederic Madden in 1847. See ENGLISH LANGUAGE, vol. vii. p. 394; and ENGLISH LITERATURE, s.v. p. 408.

LAYBACH. See LATBACH.

LAYNEZ, DIEGO. See JESUITES.

LAZARITES, LAZARISTS, or LAZARIANS. The origin of the "Congregation of Priests of the Mission" may in some sense be traced back to 1617, the year of the successful labours of St Vincent de Paul, assisted by five other priests, for the evangelization of the common people in the parish of Châtillon-sur-Chalaronne, near Bourg. More immediately it dates from 1625, when the little community acquired a permanent settlement in the Collège des Bons Enfants in Paris. Archbishopal recognition was obtained in 1626; and by papal bull in January 1632 the society was constituted a congregation, with St Vincent de Paul at its head. Shortly afterwards the establishment was confirmed by letters patent from Louis XIII. About the same time the canons regular of St Lazarus in Paris, which henceforth became its chief house, and gave to the fathers of the mission the name by which they are best known. Within a few years they had acquired another house in

Paris and set up other establishments throughout France; and in 1639, 1641, and 1651 they broke ground in Savoy, Italy, and Poland respectively. A fresh bull of Alexander VII. in April 1656 further confirmed the society; this was followed by a brief in September of the same year, regulating its constitution. The rules then adopted, which were framed on the model of those of the Jesuits, were published at Paris in 1659 under the title *Regula seu Constitutiones communis congregationis missionum*. The special objects contemplated were the religious instruction of the lower classes, the training of the clergy, the relief or redemption of prisoners in Barbary, and foreign missions. In the pursuit of these objects the Lazarite priests have had a chequered history in the various quarters of the world where they have gained a footing. At the French Revolution they were dispersed, so far as France was concerned, but permitted to reappear under the empire, and rehabilitated at the Restoration. In Sardinia they had a similar history. Throughout Italy they have been affected by recent political changes just as the rest of the religious orders have been. The Lazarite province of Poland was singularly prosperous; at the date of suppression in 1796 it possessed thirty-five establishments. The order was permitted to return in 1816, but is now extinct there. In Madagascar it had a mission from 1648 till 1674. In 1783 Lazarites were appointed to take the place of the Jesuits in the Levantine and Chinese missions; they still have some footing in China, and in 1874 their establishments throughout the Turkish empire numbered sixteen. In the same year they had fourteen establishments in the United States of America. The total number of Lazarites throughout the world is computed at about 3000.

LAZARUS, ST, ORDEX. This religious and military order dates its origin from the occupation of Jerusalem by the first crusaders, its primary object being the succour of the lepers, of whom Lazarus (Luke xvi. 20 sq.) was regarded as the patron. After the expulsion of the crusaders the hospitaliers of St Lazarus established themselves in France, where Louis VII (1268) gave them the lands of Boigny near Orleans, and a building at the gates of Paris which they turned into a lazaret house for the use of the lepers of the city. A papal confirmation was obtained from Alexander IV. in 1255. The gradual disappearance of leprosy combined with other causes to change the order into a purely civil corporation. In 1572 it was in Savoy merged by Gregory XIII. in the order of St Maurice. In 1608 it was in France united with that of Notre-Dame du Mont-Carmel; abolished at the Revolution, it was reintroduced at the Restoration, but is again in abeyance, the only order at present conferred or recognized being that of the Legion of Honour. In 1633 the buildings of the priory in Paris were handed over to St Vincent de Paul for the use of the fathers of his mission, who from this circumstance came to be generally known as Lazarites.

LEAD. This metal was known to the ancients, and is mentioned in the Old Testament. The Romans used it largely, as it is still used, for the making of water pipes, and soldered these with an alloy of lead and tin. Pliny treats of these two metals as *plumbum nigrum* and *plumbum album* respectively, which seems to show that at his time they were looked upon as being only two varieties of the same species. In regard to the ancients' knowledge of lead compounds, we may state that the substance described by Dioscorides as *μολύβδαβα* was undoubtedly litharge, that Pliny uses the word *minium* in its present sense of red lead, and that white lead was well known to Geber in the 8th century.

Of the various plumbiferous minerals, galena (a compound of lead and sulphur, formula PbS, demanding 86.6

per cent of metal) and white lead ore or cerussite, PbCO_3 (77.5 per cent), might almost be said to be the only ones which come into consideration as lead ores. Occasionally, however, the following also are utilized:—lead-vitrol or anglesite, PbSO_4 (68.3 per cent), and the pyromorphite group, $3(\text{Pb}_2 \text{ or } \text{As}_2)\text{O}_3 \cdot 3\text{PbO} + \text{PbCl}_2$ (76 to 69 per cent). Bournonite, CuPbSbS , may also be named, although containing 13 per cent of copper besides 43.3 per cent of lead; it is rather a copper than a lead ore.

Galena, the principal lead ore of the Old World, is a dark-coloured metallic-looking compact solid of 7.3 to 7.7 specific gravity and 2.5 hardness, crystallizing in cubes or other forms of the regular system, but often presenting itself in non-crystallized granular masses. All galena is contaminated with sulphide of silver,—the proportion of noble metal varying from about 0.01 or less to 0.3 per cent, and in rare cases coming up to $\frac{1}{2}$ or 1 per cent. Galena occurs in veins in the Cambrian clay-slate, accompanied by copper and iron pyrites, zinc-blende, quartz, calc-spar, iron-spar, &c.; also in beds or nests within sandstones and rudimentary limestones, and in a great many other geological formations. It is pretty widely diffused throughout the earth's crust. The principal English lead mines are in Derbyshire; but there are also mines at Allandale and other parts of western Northumberland, at Alston Moor and other parts of Cumberland, in the western parts of Durham, in Swaledale and Arkendale and other parts of Yorkshire, in Salop, in Cornwall, in the Mendip Hills in Somersetshire, and in the Isle of Man. The Welsh mines are chiefly in Flint, Cardigan, and Montgomery shires, the Scotch in Dumfries, Lanark, and Ayr, and the Irish in Wicklow, Waterford, and Down. Of Continental mines we may mention those in Saxony and in the Harz, Germany, those of Carinthia, Austria, and especially those of the southern provinces of Spain, from which country large quantities of lead are now imported into Great Britain.

The native carbonate occasionally presents itself in the form of pure crystals of the compound PbCO_3 ("cerussite"), but more frequently in a state of intimate intermixture with clay ("bleaside"), limestone, oxide of iron, &c. (as in the ores of Nevada and Colorado), and sometimes also with coal ("black lead ore"). All native carbonate of lead seems to be derived from what was originally galena, which, in fact, is always present in it as an admixture. This ore, metallurgically, was not reckoned of much value, until immense quantities of it were discovered in Nevada and in Colorado (U.S.). The Nevada mines are mostly grouped around the city of Eureka, about 200 leagues from San Francisco. The ore there occurs in "pockets" disseminated at random through limestone. The dimensions of these pockets are very variable; one is quoted measuring 300 by 60 by 180 feet. The crude ore contains about 30 per cent of lead and 0.2 to 0.3 per cent of silver. The Colorado lead district is situated pretty high up in the Rocky Mountains, a few miles from the source of the Arkansas river. The ore was discovered as late as 1877 by a mining engineer, Stephens. It forms gigantic deposits of almost constant thickness, embedded between a floor of limestone and a roof of porphyry. Stephens's discovery was the making of the city of Leadville, which, in 1878, within a year of its birth, had over 10,000 inhabitants. The Leadville ore contains from 24 to 42 per cent of lead and 0.1 to 2 per cent of silver. In Nevada and Colorado the ore is worked chiefly for the sake of the silver; but this industry, especially since 1878, has developed at such a rate as to seriously affect the price of lead even in Europe. Of other American lead districts the most important are those of Utah, of Missouri, and of the Upper Mississippi, where the ore consists substantially of galena.

The extraction of the metal from pure (or nearly pure) galena is the simplest of all metallurgical operations. The ore is roasted (i.e., heated in the presence of atmospheric oxygen) until all the sulphur is burned away and the lead left. This simple statement, however, correctly formulates only the final result. The first effect of the roasting is the elimination of sulphur as sulphurous acid, with formation of oxide and sulphate of lead. In practice this oxidation process is continued until the whole of the oxygen is as nearly as possible equal in weight to the sulphur present as sulphide or as sulphate. The heat is then raised in (relative) absence of air, when the two elements named unite into sulphurous acid (SO_2), while a regulus of molten lead remains. In Wales and the south of England the process is conducted in reverberatory furnaces of the form shown in fig. 1. The sole of the furnace is paved with slag from

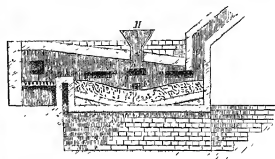


Fig. 1—Reverberatory Furnace. C, chimney; D, opening for feeding the fire.

previous operations, and has a depression in the middle where the metal formed collects to be let off by a tap-hole T. The dressed ore, 12 to 24 cwt., is introduced through the "hopper" H at the top, and exposed to a moderate oxidizing flame until a certain proportion of ore is oxidized, the openings O, O at the side enabling the workmen to stir up the ore so as to constantly renew the surface exposed to the air. At this stage as a rule some rich slags of a former operation are added and a quantity of quicklime is incorporated, the chief object of which is to diminish the fluidity of the mass in the next stage, which consists in this, that, with closed air-holes, the heat is raised so as to cause the oxide and sulphate on the one hand and the sulphide on the other to reduce each other to metal. The lead produced runs into the hollow and is tapped off. The roasting process is then resumed, to be followed by another reduction, and so on.

A similar process is used in Carinthia; only the furnaces are smaller (adapted to a charge of only 420 lb.) and of a somewhat different form. They are long and narrow, the sole is paved, but slopes from the fire-bridge towards the flue, so that the metal runs to the latter end to collect in pots placed outside the furnace. In Carinthia the oxidizing process from the first is pushed on so far that metallic lead begins to show, and the oxygen introduced predominates over the sulphur left. The mass is then stirred to liberate the lead, which is removed as "Ruhblei". Charcoal is now added, and the heat raised on to obtain "Pressblei", an inferior metal famed partly by the action of the charcoal on the oxide of lead. The fuel used is fir-wood.¹

In Cumberland, Northumberland, and Durham the reverberatory furnace is used only for roasting the ore, and the oxidized ore is then reduced by fusion in a low square blast furnace (a "Scottish hearth furnace") as depicted in figs. 2 and 3. The rectangular cavity C is lined with cast-iron, as is also the inclined sole-plate which is made to project beyond the furnace, the outside portion W (the "work-stone") being provided with grooves guiding any molten metal that may be placed on the "stone" into the cast-iron pot P, it is the "tuyere" for the introduction of the wind.

As a preliminary to the melting process, the "blowse" left in the preceding operation (half-fused and imperfectly reduced ore) is intro-

¹ In England coal is employed everywhere, sometimes along with peat.

dined with some peat and coal, and heated with the help of the blast. It is then taken out on the work-stone and divided into a very poor "grey" slag which is put aside and a richer portion which goes back into the furnace. Some of the best ore is shewed upon

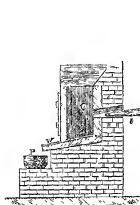


FIG 2—Vertical Section of Furnace

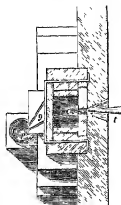


FIG 3—Horizontal Section

it, and, after a quarter of an hour's working, the whole is taken out on the work-stone, where the lead produced runs off. The "brown" after removal of the "grey" slag, is reintroduced, ore added, and, after a quarter of an hour's heating, the mass again placed on the work-stone, &c.

In any form of the lead-smelting process one of the conditions of complete success is the absence of silica, because this when present unites with a certain proportion of the oxide of lead into a fusible silicate (slag). Practically the formation of a plumbiferous slag cannot be altogether avoided in any case, and such slag accordingly must be worked up. At Alston Moor, Cumberland, this is effected by means of a hearth (blast) furnace similar to the one just described. The slags (oxide, sulphate, and silicate of lead) are introduced with coal-ashes, furnace bottoms, and other residues, and melted down, thus leading to the formation of lead and of a poorer slag. The lead is run off as much as possible, the slag is run into water, which disintegrates it so that the particles of metal shut up within it are set free and become recoverable by elutriation.

Lead being very appreciably volatile at a red heat, lead-smelting generally, but more especially the Scottish-hearth process, and pre-eminently the slag-recovery process, involve the production of large quantities of "lead-smoke" (finely divided, highly impure oxide and sulphate of lead), which, for sanitary and economic reasons, must be condensed and recovered. At Alston Moor the smoke for this purpose is led through a very long succession of flues, ascending the slope of a hill, into a chamber at the top which communicates with a chimney. The chamber, by a number of screens going alternately from the floor to near the top, and *vice versa*, is divided into compartments charged with such a quantity of water that the smoke, which is propelled by means of a fan, is compelled to bubble repeatedly through the water, where most of what has failed to come down in the flues is precipitated. The smoke deposit is collected, dried, and worked up for lead.

Carbonate and oxide of lead are easily reduced by charcoal or coal. In Leadville and Eureka (U.S.) the carbonate is smelted with charcoal in small blast furnaces, about 8 feet high, and rectangular section of 31 by 47 inches, worked with charges of about three tons of ore. There are five tuyeres, two at each of the longer sides, and one at the end opposite the outlet-hole. The "crucible" is quite surrounded by hollow wrought-iron plates, kept cool by circulating water.

Complex lead ores of course demand a complex treatment. The famous Frankensharner Huette near Klausthal

in the Haaz, where a very complex ore is worked up with a wonderful degree of exhaustiveness and precision, may serve as an example. The ore in this case consists of argentiferous galena associated with copper pyrites, fahl-ore, bismuthite, zinc blende, and a gangue consisting of silica, limestone, and heavy spar. After the copper pyrites has been, as far as possible, picked out by hand, the remainder is assorted so as to produce an average of about 55 per cent of lead. One hundred parts of such ore are mixed with 11 of hearth-mass and litharge, 90 parts of a variety of slags from previous operations, and 11 parts of metallic iron (or the equivalent of some rich iron ore plus charcoal), and melted down in blast furnaces similar to those used for iron-smelting, but only 32 feet high. The furnace is charged with alternate layers of ore mixture and charcoal. The smelting takes fourteen hours, and yields per charge of 100 parts of ore (containing in all about 74 parts of lead) 26 parts of metallic lead, and 18.4 parts of a "stein" consisting of an alloy of sulphides of lead, iron, copper, zinc, silver, antimony, intimately mixed with particles of metallic and (1 sub) sulphide of lead—apart from the slags formed, which contain 4 to 8 per cent of lead and a trace of silver. The "stein" is subjected to a protracted series of roasting, and then melted down with iron and selected slags. These result a ferruginous slag, a certain proportion of metallic lead, and a "stein" of the second order, which of course is richer in copper than the original one was. This "stein" is again roasted, melted down with iron, &c., until the whole of the lead is extracted, and the copper concentrated in a mass sufficiently rich and pure to be wrought as a copper "stein."

Refining.—The lead obtained by any of the above processes is as a rule contaminated with more or less of iron, antimony, zinc, arsenic, and silver, which must be removed.—The base foreign metals because they deteriorate the lead, the silver on account of its high commercial value. The base metals are easily eliminated by subjecting the crude metal to oxidizing fusion in a shallow cast-iron dish inserted into a reverberatory furnace, the foreign metals, being more oxidizable than lead, go to the top as an oxide-scum, which is constantly removed until pure litharge, instead of the foreign oxides, makes its appearance.

The extraction of the silver is easily effected by means of the process of cupellation, one of the oldest metallurgical operations, which dates back to a time beyond that of Phry. The metal is placed on a shallow kind of dish made of compressed bone-ash powder and forming the sole of a reverberatory furnace, and therein kept at a red heat in the presence of an abundant supply of air. The lead (and with it the foreign base metals) is oxidized into "litharge" (PbO), which, at the temperature prevailing, melts into a thin liquid, and is made to run off through a slit or hole made in the side of the "cupel" (or "test"), the silver remains unchanged, so that the regulus becomes richer and richer as the process proceeds. The foreign base metals, as will readily be understood, go off as oxides along with the first portion of litharge, and accordingly can be removed without contaminating the bulk of the latter product. When the percentage of silver has increased to about 8 per cent, the regulus, as a rule, is transferred to a fresh cupel, and thereon treated in the same way as before, until the last trace of litharge is seen to go off as a thin film on the regulus, presenting, on account of its thinness, in the glow of the fire, the magnificent appearance of a soap-bubble in sunlight. The silver then is "fine," *i.e.*, almost pure, and ready for the market. The lead, however, is all obtained in the shape of oxide, and consequently, if not saleable as such, must

be reduced with charcoal or coal. The process accordingly is expensive, and generally does not pay with a raw lead containing less than 75 per cent. of the noble metal.

The process, in its direct application to the lead, is now almost extinct, being superseded by the following two methods of "concentration," which offer the advantage of desilverizing at least the bulk of the lead without depriving it of its metallicty.

1. *Pattinson's Process* (invented about forty years ago) is founded upon the fact that, when molten argentiferous lead is allowed to cool slowly, a relatively silver-free lead crystallizes out while a richer metal remains as a mother-liquor. It will be readily understood that, by a persistent systematic application of this method of partial separation to the primary products and again to their derivatives, it is possible to, so to say, split the original material into a very poor portion containing most of the lead, and a "rich" one containing almost all the silver. Practical smelters are generally satisfied when the proportion of silver in the former is reduced to from the one to the three millionth of the weight of the lead, and the latter enriched to the extent of 0.5 to 1.5 per cent. of silver, although it is possible to bring up the percentage to 2.5. A lead containing as little as half an ounce of silver per ton can be "Pattinsonized" with a profit.

2. *Karsten's Process* is still more perfect. It has long been known that lead refuses to alloy itself with more than traces of zinc. In 1842 the eminent metallurgist Karsten made the important discovery that, when argentiferous lead is mixed with 1 per cent. or more of zinc (at a temperature insuring liquidity to even the latter metal), about $\frac{1}{2}$ per cent. of zinc remains dissolved in the lead, while the rest rises to the top as a scum, and, besides a deal of lead, takes almost the whole of the silver with it. Parkes subsequently brought the process into a workable form, for which he took a patent in England in 1850. The argentiferous lead is molten in large cast-iron pots, intimately mixed with about 30 parts of zinc per unit of silver present; the mixture allowed to rest, and the argentiferous scum removed by means of perforated ladles. The scum, when subjected to "liquation" (partial fusion) on an inclined sole, lets off a quantity of rich lead, which goes to the cupel. From the residue the bulk of the zinc can be withdrawn by distillation, the non-volatile part being fit for cupellation. The desilverized lead is freed from its zinc and the other base impurities it may contain by "refining" (see above). The Parkes process seems to be on a far wiser way of being superseded by a far more perfect form of the Karsten method which was patented by Corduruf for France in 1886 (October 18, No. 73,167), and of which the most characteristic feature is that the removal of the zinc from the scum and the refining of the desilverized lead are both effected by means of superheated steam. The treatment with zinc is effected in a deep upright half-egg-shaped cast-iron pan (standing on an upper floor), which is provided with a vertical shaft bearing horizontal paddles, and at its lowest point perforated cast-iron box, which serves to accommodate the zinc, 1 kilogramme per 100 kilos of crude lead containing 0.1 kilo of silver, or up to twice the proportion for richer leads. The argentiferous lead—10 tons at a time—is melted down in the pan, and the paddle-shaft with the zinc introduced and made to revolve until all the zinc has become incorporated with the mass. The shaft is then withdrawn, the mixture allowed to rest for a time at a lower temperature, the scum removed, and the zinc treatment repeated once or twice to eliminate the whole of the silver. The desilverized lead runs direct from the pan into another pan standing on the ground floor, which has no tap-hole, but is provided with a wrought-iron hood communicating by means of a pipe with a condensation

chamber. In this pan the metal is heated to redness, and a current of superheated steam is blown through it for two or three hours. The zinc and the rest of the impurities are thereby converted into oxides which mostly remain on the surface of the metal, the rest being carried into the chamber and deposited there. The silver scums, after extraction from them of argentiferous lead by lixiviation, are collected, and, when a sufficient quantity has accumulated, worked with superheated steam like the zinciferous lead,—to produce a richly argentiferous regulus, adapted for cupelling, and an oxide-mixture intimately intermixed with particles of the former and containing even some silver oxide. The working of this bye-product seems to have given the inventor a deal of trouble. Passing over his method, we will mention the one introduced in Lantseh since 1869. There they dispose of the argentiferous oxides by adding them to the rich lead during its cupellation; the silver is sucked in by the regulus, the base oxides amalgamate with the litharge. The "poor" lead resulting from this form of the Karsten process contains only 5 or 6 grammes of silver per metric ton (i.e., per million grammes). The loss of lead with a pure material is only 1 per cent. as against the 4 per cent. involved in the Pattinson process.

It is worth stating that the zinc removes, besides the silver, all the copper that may be present, and no doubt also part of the other foreign base metals. At any rate the purity of commercial lead, since the introduction of Corduruf's process, has undergone a marked increase. Hampé analysed a "refined" lead produced in the "Lautehaler Hütte" in 1870, and found it to contain only .016 per cent. of impurities. This to all intents and purposes means chemical purity, yet even such lead is not fit for silver assaying, or account of the trace of silver contained in it. To obtain silver-free lead, we must prepare silver-free acetate of lead—by digesting its solution in a lead vessel with lead shavings and filtering,—and reduce the dried salt with black zinc in a crucible lined with charcoal.

Properties of Lead and its Oxides—Pure lead is a feebly lustrous bluish-white metal, endowed with a characteristically high degree of softness and plasticity, and almost entirely devoid of elasticity. Its breaking strain is very small, a wire $\frac{1}{16}$ of an inch thick is ruptured by a charge of about 30 lb. The specific gravity was determined exactly by Reaumur, who found for ingot 11,352, for sheet metal 11,354 to 11,355 (water of 4° C. = 1). The expansion of unit-length from 0° C. to 100° C. is 0.02948 (Fizeau). The conductivity for heat (Wiedemann and Franz) or electricity is 8.5, that of silver being taken as unity. It melts at 324° C. = 633° Fahr. (Personne); at a bright red heat it emits vapours, at the rate, according to A. de Biernsky, of about $\frac{1}{1000}$ of its weight per hour; but he does not specify the surface. At a white heat it boils. The specific heat is .0314 (Regnault), that of water near 0° C. being taken as unity. Lead exposed to ordinary air is rapidly tarnished, but the thin dark film (of suboxide?) formed is very slow in increasing. When kept in fusion in the presence of air lead readily takes up oxygen, with formation first of a dark-coloured scum (of suboxide?), then of monoxide PbO, the rate of oxidation increasing with the temperature. This oxide is produced industrially in two forms, known as "massicot" and "litharge."

The former is produced at temperatures below, the latter at temperatures above the fusing-point of the oxide. The liquid litharge when allowed to cool solidifies into a hard stone-like mass, which, however, when left to itself, soon crumbles up spontaneously into a heap of resplendent dark-yellow scales known as "flake litharge." Litharge is much used in the arts for the preparation of lead salts, for the manufacture of oil varnishes, of certain

cements, and of lead plaster, and for other purposes Massicot is important as being the raw material for the manufacture of "red lead" or "minium." Finely divided massicot, freed from admixed metal by elutriation, is spread out on the flat sole of a kind of baker's oven, or (better) of a "mufflo" heated from the outside, and therein exposed for twenty-four hours or more to air at a temperature of about 300° C. or 600° Fahr. The massicot, at a gradually decreasing rate, absorbs oxygen, and as the latter increases the colour becomes more and more intensely red,—the point of saturation corresponding very nearly to the formula Pb_3O_4 . A more highly oxygenated kind of minium ("orange lead") can be produced by substituting white lead for massicot as a raw material. The composition of orange lead approximates to Pb_3O_4 . It is very singular that this higher oxide cannot be obtained from massicot, although the first effect of heat on white lead is its conversion into the oxide PbO . Besides the two named there is another red oxide, of the composition Pb_3O_4 , but it is not much known. Red lead is largely used as a pigment and as an ingredient for flint glass, also for the making of certain cements. Any of these red oxides when treated with dilute nitric acid is converted into the binoxide PbO_2 , protoxide passing into solution as nitrate: e.g., $Pb_3O_4 + 2HNO_3 = 3PbON_3 + PbO_2 + 2H_2O$. The binoxide is a brown powder, insoluble in aqueous oxygenated acids, but converted by hot hydrochloric acid into chloride $PbCl_2$, with evolution of chlorine. To obtain the binoxide in the state of purity, the best method is to pass chlorine into a solution of acetate of lead mixed with excess of carbonate of soda. The hypochlorite formed oxidizes the PbO into PbO_2 , with formation of chloride of sodium and free acetic acid (Wöhler).

Action of Aqueous Reagents.—Water when absolutely pure has no action on lead by itself. In the presence of free oxygen (air), however, the lead is quickly corroded with formation of hydrated oxide ($Pb(OH)_2$), which is appreciably soluble in water forming an alkaline liquid. When carbonic acid is present the dissolved oxide is soon precipitated as basic carbonate, so that there is room made, so to say, for fresh hydrated oxide, and the corrosion of the lead progresses. Now, all soluble lead compounds are strong cumulative poisons, hence the danger involved in using lead cisterns or pipes in the distribution of pure waters. We emphasize the word "pure" because experience shows that the presence in a water of even small proportions of bicarbonate or sulphate of lime prevents the action on lead. All impurities do not act in a similar way. Nitrate and nitrite of ammonia, for instance, intensify the action of a water on lead. It is to be remarked, however, that even pure waters, such as that of Loch Katrine (which forms the Glasgow supply), act so slowly, at least on such lead pipes as have already been in use for some time, that there is no danger in using such lead service pipes even for them, if the taps, as in any house hold under normal circumstances, are being constantly used. Lead cisterns of course must be unhesitatingly condemned. G. Bischoff found that a water pipe made of a "composition" consisting of 1 part cent of antimony and 98.8 of lead was rapidly corroded by a water which, in virtue of its composition, had no action on lead pipes.

Action of Acids.—The presence of carbonic acid in a water does not affect its action on lead (Pattison Muir). Aqueous non-oxidizing acids generally have little or no action on lead in the absence of air. Dilute sulphuric acid (say an acid of 20 per cent of H_2SO_4 or less) has no action on lead even when air is present, nor on boiling. Stronger acid (e.g., any acid strong enough to fairly fall within the meaning of "vitriol") does act, slowly in general, but appreciably, the more so the greater its concentration and the higher its temperature. According to Haaselevier, whose experiments were subsequently confirmed by A. Beuz and by James Maclean, pure lead, *cast par*, is far more readily corroded than a metal contaminated with 1 per cent or even less of antimony or copper. Haaselevier treated an almost pure lead with pure vitriol of 54° Beaumé (1.55 sp. gr., or 34–35 per cent H_2SO_4) in a glass flask. At 42° C. an evolution of gas was observable, which at 85° C. became very distinct. The same lead, after having been alloyed with a little antimony, was not visibly attacked below 85° C. A decided gas-evolution commenced only at 140° C. Boiling concentrated vitriol converts lead into sulphate, with evolution of sulphurous acid. Dilute nitric acid readily dissolves the metal, with formation of nitrate $Pb(NO_3)_2$.

Lead Alloys.—Lead unites readily with almost all other metals; hence, and on account of its being used for the extraction of (for instance) silver, its alchemistic name of saturnus. Of the alloys the following may be named:—

With Antimony.—Lead contaminated with small proportions of antimony is more highly proof against vitriol than the pure metal. An alloy of 83 parts of lead and 17 of antimony is used as type metal, other proportions are used, however, and other metals added besides antimony (e.g., tin, bismuth) to give the alloy certain properties.

With Arsenic.—Lead unites readily with arsenic, and an alloy made by addition of about 5 per cent of arsenic is used for making shot.

Bismuth and Antimony.—An alloy consisting of 9 parts of lead, 2 of antimony, and 2 of bismuth is used for stereotype plates.

Bismuth and Tin.—These triple alloys are noted for their low fusing points. An alloy of 6 of lead, 5 of bismuth, and 3 of tin fuses at 94° C.; i.e., below the boiling-point of water (Rose's metal). An alloy of 15 parts of bismuth, 6 of lead, 4 of tin, and 3 of cadmium (Wood's alloy) melts below 70° C.

Tin unites with lead in any proportion with slight expansion (Kupffer), the alloy fusing at a lower temperature than either component. It is used largely for soldering. The following are the compositions and melting-points of frequently used compounds (Tomlinson)—

	Tin	Lead	Melts at
Fine solder	2	1	540° F.
Common do	1	1	370° F.
Coarse do	1	2	441° F.

"Pewter" may be said to be substantially an alloy of the same two metals; but small quantities of copper, antimony, and zinc are frequently added. Common pewter contains about 5 parts of tin for 1 of lead. In France a tin-lead alloy, containing not over 18 per cent of lead, is recognized by law as being fit for measures for wine or vinegar. "Best pewter" is just tin alloyed with a mere trifle (3 per cent, or less) of copper.

Lead Salts.—Of the oxides of lead the protoxide, PbO , is the only one which under ordinary conditions is capable of forming salts. Towards potash and soda it plays the part of feeble acid, being readily soluble in solutions of either caustic alkali; while with acids it behaves as a decided diacid base. By a "diacid base" is meant a base which can unite with two monovalent acids at the same time, and form a stable salt. Take, for instance, the case of chloride of lead, $PbCl_2$, which is related to HCl and $Pb(OH)_2$ exactly as KCl is to HCl and $K(OH)$, but, while there is nothing between KCl and $K(OH)$, the two lead compounds readily unite into $Cl-Pb-(OH)$, oxychloride of lead. This property, common to all diacid bases, is developed in lead oxide to a characteristically high degree.

The nitrate, $Pb(NO_3)_2$, easily obtained from the metal as explained above, or by dissolving the oxide in aqueous nitric acid, forms white crystals, difficultly soluble in cold, readily in hot water, almost insoluble in strong nitric acid. It is decomposed by heat into oxide, peroxide of nitrogen (N_2O_5), and oxygen. It is used for the manufacture of fuses and other deflagrating compounds. The numerous basic nitrates must here be passed over.

The acetate, $Pb(CH_3COO)_2 \cdot 3H_2O$ (called "sugar" of lead, on account of its sweetish taste), is manufactured by dissolving massicot in aqueous acetic acid. It forms colourless transparent crystals, soluble in one and a half parts of cold water and in eight parts of alcohol, which on exposure to ordinary air become opaque through absorption of carbonic acid, which forms a crust of basic carbonate. An aqueous solution readily dissolves oxides of lead, with formation of a strongly alkaline solution containing basic acetates (*Acetum Plumbi* or *Saturum*). When carbonic acid is passed into this solution the whole of the added oxide, and even part of the oxide of the neutral salt, is precipitated as a basic carbonate chemically similar, but not quite equivalent as a pigment, to white lead.

The carbonate, $PbCO_3$, exists in nature as cerussite. It can be produced by addition of a solution of lead salt to an excess of carbonate of ammonia, as an almost insoluble white precipitate. Of greater practical importance is a basic carbonate, substantially $2PbCO_3 \cdot Pb(OH)_2$, which is largely used as a white pigment under the name of "white lead." For the manufacture of this important substance two methods chiefly are used. In the Old Dutch method, pieces of sheet lead are suspended in stoneware pots so as to occupy the upper two-thirds of the vessels. A little vinegar is poured into each pot; they are then covered with plates of sheet

lead, burned in horse-dung or spent tanner's bark, and left to themselves for a considerable time. The organic bath, through its fermentation, keeps up a suitable temperature and a constant supply of carbonic acid. By the conjoint action of the acetic acid and atmospheric oxygen, the lead is converted superficially into a basic acetate, which is at once decomposed by the carbonic acid, with formation of white lead and acetic acid, which latter then acts *de novo*. After a month or so the plates are converted to a more or less considerable depth into crusts of white lead. These are knocked off, ground up with water, freed from metal-plates by elutriation, and the paste of white lead is allowed to sit and dry in small conical forms. The collection, however, of these plates is not yet in commerce. The German method differs from the Dutch in this that the lead is suspended in a large chamber heated by ordinary means, and there exposed to the simultaneous action of vapour of aqueous acetic acid and of carbonic acid. In the famous works at Ragnersfirth and in the Lavantthal, Carinthia, the sublimed and is produced by the fermentation of apple-must or infusion of raisins kept in tubs below the chambers. The inferior varieties of commercial "white lead" are produced by mixing the genuine article with more or less of finely powdered heavy spar or occasionally zinc-white (ZnO), which latter, we may state in passing, is the most important of the relatively non-poisonous substitutes for white lead.

The chloride, $PbCl_2$, is obtained by adding hydrochloric acid to a solution of lead salt, as a white precipitate, little soluble in cold water, less so in dilute hydrochloric acid, more so in the strong acid, and readily soluble in hot water, from which, on cooling, the excess of dissolved salt separates out in acicular crystals. A basic chloride Pb_2OCl_2 was introduced by Pattinson as a substitute for white lead. Powdered galena is dissolved in hot murettic acid ($PbS + 2HCl = PbCl_2 + H_2S$), the solution allowed to cool, and the deposit of impure chloride of lead washed with cold water to remove iron and copper. The residue is then dissolved in hot water, the dregs are filtered off, and the clear solution is mixed with very thin milk of lime so adjusted that it takes out one-half of the chlorine of the $PbCl_2$. The oxychloride comes down as an amorphous white precipitate. Another oxychloride, $PbCl_2 \cdot PbO$, known as "Cassel yellow," is produced by fusing pure oxide, PbO , with $\frac{1}{10}$ th of its weight of sesquioxide.

The sulphate, $PbSO_4$, is obtained, by addition of sulphuric acid to solutions of lead salts, as a white precipitate almost insoluble in water, less soluble still in dilute sulphuric acid, insoluble in alcohol. Sulphide of ammonium blackens it, and it is soluble in solution of alkaline acetate of ammonia, which dissolves it from sulphate of baryta.

It is often obtained industrially as a bye-product. The chromate, $PbCrO_4$, is prepared industrially as a yellow pigment, by precipitating sugar of lead solution with bichromate of potash. The beautiful yellow precipitate is little soluble in dilute nitric acid, but soluble in caustic potash ley. The vermilion-like pigment which occurs in commerce as "chrome-red" is a basic chromate, prepared by treating recently precipitated normal chromate with a properly adjusted proportion of caustic soda, or by boiling it with normal (yellow) chromate of potash. The approximate composition is $Cr_2O_3 \cdot 2PbO$.

The identification of lead compounds is easy. When mixed with carbonates of soda and heated on charcoal in the reducing flame they yield malleable globules of metal and a yellow oxide-rim. Solutions of lead salts (colourless in the absence of coloured acids) are characterized by their behaviour to hydrochloric acid, sulphuric acid, and chromate of potash. But the most delicate reagent for lead is sulphuretted hydrogen, which produces a black precipitate of sulphide of lead, insoluble in cold dilute nitric acid, less so in cold hydrochloric, easily decomposed by hot hydrochloric with formation of the characteristic chloride.

Statistics.—The lead, pig and sheet, imported into Great Britain during the year 1880 amounted to 85,322 tons, and during 1881 to 93,400 tons. In 1881 there were 12,824 tons exported to China, 8855 to Russia, 4715 to Australia, 3380 to France, 3349 to British India, 1041 to Germany, and 8887 to other countries.

The following table exhibits the production of lead during 1876—

Spain	Tons	Italy	Tons
Germany	101,822	Greece	9000
Great Britain	82,772	Belgium	8000
United States	59,606	Austria	7875
France	57,210	Russia	4261
	21,889		1069

The importation and production of lead in the United States were in the years stated respectively as follows.—

	Imported	Produced
	Tons.	Tons.
1886	28,225	14,680
1889	36,111 (max.)	15,450
1878	285	81,804

(W. D.)

LEADVILLE, a flourishing mining town of the United States, capital of Lake county, Colorado, is situated at a height of 10,300 feet above the sea, on a narrow plateau between the Saguache or Continental Divide and the Park Range of the Rocky Mountains, about 70 miles south-west of Denver. It is connected with Denver by a branch of the Union Pacific Railway (172 miles), and by the Denver and Rio Grande Railway (379 miles). Though a place of 14,820 inhabitants at the census of 1881, Leadville was then the creation of scarcely more than three years.

As early as 1860 gold placers were discovered in the neighbourhood, and for a little time the settlement of Brough Town, as it was then called, was a busy spot in this thinly peopled region. But the gold was soon exhausted, and, though it was vaguely understood that the heavy black sand which had often proved troublesome to the gold-washers was more or less argentiferous, it was not till 1877 that the first practical attempt to turn it to account was made. No sooner, however, was the real character of the ore ascertained than eager adventurers rushed to Leadville by thousands. In August 1877 there were not more than twenty stamens on the site of the town; but the population rapidly increased, and in less than two years numbered upwards of 15,000. The first assaying furnace was set to work in October 1877. It has been estimated that up to the close of 1880 the value of the metals extracted from the soil at Leadville exceeded \$35,700,000—

1860-72, gold from placers	\$8,400,000	1877, gold, silver, and lead	\$659,280
1874, gold and silver	\$4,000,000	1878, do	\$1,192,922
1876, do	118,000	1879, do	10,189,671
1876, gold, silver, and lead	85,200	1880, do	15,096,168

The site consists for the most part of a porphyritic rock resting on a strongly schistified dolomite popularly called "limestone"; and the brown sand, the source of the wealth of Leadville, is sometimes found just below the surface of the soil, sometimes at a depth of several hundred feet. None of the streets maintain the same level throughout, the contour lines of the declivity on which they are built usually running at right angles. Of the dwelling-houses the vast majority are of wood, but among the many substantial brick structures are an opera-house, a Catholic church, and several bank buildings. Water, brought from the higher grounds, is distributed by a regular system of mains. The principal streets are macadamized with slag, there is a well-organized fire department and an efficient police force. The city has 5 churches, 7 schools, 3 daily and 2 weekly newspapers, and 6 banks, and is the centre of supply for a large outlying mining region, the value of its general and mining business averaging for 1880 and 1881 over \$40,000,000 yearly.

LEAKE, WILLIAM MARTIN (1777-1860), antiquarian topographer, was born in London, January 14, 1777. After completing his education at the Royal Military Academy of Woolwich, and spending four years in the West Indies as lieutenant of marine artillery, he was sent by the Government to Constantinople to instruct the Turks in this branch of the service. A journey through Asia Minor in 1800 to join the English fleet at Cyprus inspired him with an interest in antiquarian topography, which he had afterwards frequent opportunities of gratifying. In 1801, after travelling across the desert to Egypt, he was, on the expulsion of the French, employed in surveying the valley of the Nile as far as the cataracts, but having sailed with the ship engaged to convey the Elgin marbles from Athens to England, he lost all his maps and observations when the vessel foundered off the island of Corfu. Shortly after his arrival in England he was appointed to survey the west coast of Albania and the Morea, with the view of assisting the Turks against attacks of the French from Italy, and of this he took advantage to form a valuable collection of coins and inscriptions, and to explore many ancient sites. In 1807 he was made prisoner at Salonic; but, obtaining his release the same year, he was sent on a diplomatic mission to Ali Pasha, whose confidences he completely won, and with whom he remained for more than a year as the representative of England. In 1815 he retired from the army, in which he held the rank of colonel, devoting the remainder of his life to topographical and antiquarian studies, the results of which were given to the world in the following volumes:—*Topography of Athens*, 1821; *Journal of a Tour in Asia Minor*, 1824; *Travels in the Morea*, 1830; *Travels in Northern Greece*, 1835; and *Nismata*

chiefly from the East Indies, the Cape, North Africa, South America, Mexico, Asia Minor, and the hilly regions of Europe. Seal skins, obtained from the arctic regions, are an important material, while hog skins are of value for the purposes of the tanner almost exclusively for making saddle leather. Among the skins which are only occasionally or locally used may be enumerated wolverine, rhinoceros, hippopotamus, and elephant hide, yielding very thick leather used for buffing wheels in cutlery manufacture, &c. and the skins of the numerous species of deer and antelope, dogs, kangaroo, and other Australian marsupials, porpoises, alligators, and occasionally bosa.

Structure of Skin—All hides and skins are externally clothed more or less with wool, hair, bristles, or scales. The skin itself has a thin superficial horny and cellular layer, the cuticle or epidermis, into which neither nerves nor blood-vessels penetrate. This layer is, during the life of the animal, continually in progress of peeling off in the form of small flat scales, and is renewed from the inner portion of the epidermis known as the *rete mucosum* or Malpighian net. The skin proper (*corium, dermis, or cutis*), which is the only portion of the hide of use for the tanner, consists of a dense plexus of fibrous bundles, knit together and interwoven in every direction, the interspaces being filled up with an albuminoid substance. The bundles of fibres terminate on the upper surface of the corium in separate masses, producing the irregularly papillated appearance seen in the "grain" of leather, and hence that surface is distinguished as the grain side in contradistinction to the flesh or under side. Chemically the connective tissue or fibrous portion of the corium consists of gelatinous tissue or collagen, which, according to Reimer, is similar in composition to the fibrin of silk. It is insoluble in cold water, weak acids, and alkalis, but with boiling water it dissolves, forming gelatin, and it is also soluble in concentrated acids and alkalis. It combines with tannic acid, forming the essential basis of leather, and it similarly combines with oils and fats. The inter-fibrous binding albuminoid material called by the same authority corin is soluble in alkaline solutions (being withdrawn from the skin by treatment with lime water, &c.) and in strong hydrochloric acids, but insoluble in water. It is precipitated from solutions by tannin, with which it combines. Many competent authorities maintain that the distinction between the fibrous and non-fibrous portions of skin is only one of physical condition.

Tanning Materials—Tannin or tannic acid is a product of the vegetable kingdom, abundantly formed in a very large number of plants, and secreted in such diverse organs and members as the bark, wood, roots, leaves, seed-pods, fruit, &c. The tannin obtained from various sources is not precisely the same in its chemical relations and reactions. Dr Stenhouse was the first to insist on the principal distinction which possesses practical interest to the tanner. He pointed out that tannin-producing bodies may be divided into two classes, the first class comprising such as by their decomposition develop into gallic acid, and by destructive distillation yield pyrogallol acid. Of these gallo-tannic acid, obtainable from galls, is the type. The other principal tanning materials which yield gallotannic acid are sumach, valonia, divi-divi, and myrobalans. The second class embraces tannins which do not resolve themselves into gallic acid or yield pyrogallol acid, and of this class oak bark, mimosa bark, and gambier yield characteristic types. All varieties of tannin, however, agree in possessing a powerfully astringent but not bitter taste, and a distinctly acid reaction; they yield with solutions of salts of peroxide of iron a deep blue-black or green-black solution, and particularly they combine and form insoluble compounds with gelatin and with the gelatinous

tissue which constitutes the principal portion of animal skins. By the action of ether, containing a little water, on gall-nuts, pure gallotannic acid may be procured. The ethereal solution separates by repose into two layers, the lower one, which is of an amber colour, being a solution of tannin in water, while the upper layer contains gallic acid, mixed with other substances. On gently evaporating the aqueous solution, nearly pure gallotannic acid is procured, to the extent of from 35 to 40 per cent., from galls. Obtained in this way, it is a shining, porous, uncrystallizable mass; it is soluble in water, and then exerts the properties of an acid. By exposure to air it absorbs oxygen and gives off carbonic acid,—two new products, gallic acid and ellagic acid, being formed at the expense of the tannin, the latter is insoluble. Gallotannic acid may be precipitated from its solutions by sulphuric and some other acids; by boiling the precipitate with sulphuric acid for a few minutes in a dilute solution of the same acid, gallic acid is formed, and crystallizes in cooling. Gallic acid also exists ready formed in gall-nuts, sumach, valonia, tea, and other substances. It does not combine with gelatin, and is therefore useless in tanning. Some tanners, however, imagine the gallic acid of the waste liquor to be useful in swelling or raising the hides, preparatory to removing them to a stronger liquor.

Tannin is in no case isolated for use as a tanning agent. It is only brought in contact with skins and hides by the medium of infusions, decoctions, or extracts of the various tanning materials in which a percentage of tannin is present mixed with colouring and other extractive material.

The substances enumerated below comprise the principal tanning materials in use throughout Europe and America.

Oak Bark—In early times the bark of the common oak, *Quercus Robur*, was almost the only tanning material used by British tanners, and it still is the substance from which the highest quality of heavy tanned leather is prepared, although the process is necessarily tedious. Throughout the country there are still a few tanners of sole leather whose boast is that they use nothing but oak bark. The entire supply of British oak bark is estimated at from 800,000 to 800,000 tons annually. This quantity, with the additional import of 80,000 tons from the Continent, is altogether inadequate to meet the demands of the tanners, apart from the necessity which is now felt for forcing the tanning operation much more rapidly than was formerly the rule. The most useful bark is obtained from coppice wood of about twelve years' growth, although in milder bark of longer growth a large proportion of tannin is secreted. The amount of astringent matter in coppice bark may be taken to average from 8 to 10 per cent., but the statements of the quantities of tannin in different samples vary within wide limits, as much as 18 per cent. being in some cases found. There is no doubt that the peculiar excellence of the sole leather of England is due in great measure to the superior oak bark produced there. Oak bark imparts firmness and solidity to leather, while other sorts give softness, thus the peculiar softness of French curried leather is referred to the bark of the evergreen oak, with which the better kinds are tanned, while the other tanning materials next to be named give each its peculiar quality with respect to colour, scent, toughness, or the power of resisting moisture and decay.

Other species of oak also yield tanning materials of much importance, and are extensively used. The cork oak, *Quercus Suber*, of south Europe and north Africa, in addition to its well-known external layer (the cork of commerce), possesses a fibrous inner bark, which is richer in tannin than ordinary oak bark. It is much employed in France, and is imported also to some extent into the United Kingdom. In the United States several varieties of oak yield staple tanning materials. Of these the principal are the rock or chestnut oak, yellow oak or quercuton, both important sources of tan barks, the red oak and white oak are of less consequence.

Mimosa Bark—Under this general name a large amount of bark comes to the English market from Australia, principally from Melbourne and Adelaide, and from Tasmania. It is obtained from a large number of trees belonging to the genus *Acacia*, widely distributed throughout Australia, and the various barks are rich in tannin, which ranges from 15 up to 32 per cent. The qualities imported into England are the richer kinds. They amount to about 80,000 tons annually, and may be assumed to contain on an average 25 per cent. of astringent matter. These richer barks are the produce of *A. acuminata*, a dense tree, the blue wattle (*A. mollissima*), the gold wattle (*A. pycnantha*), the silver wattle of

Tannum (*A. leucophylla*), and *A. cynanophylla*. The red colour of minous bark produces a dark leather, against which there is a prejudice, and the material has therefore to be used sparingly in mixtures. It is also said that minous tanning results in a somewhat hard brittle leather.

Hemlock Bark is the most important tanning material in North America. It is the produce of the hemlock spruce, *Abies canadensis*, which grows in vast forests throughout Canada, and the northern and eastern States of the Union, the principal bark-producing States being Pennsylvania, Michigan, and Wisconsin. Hemlock bark is obtained by cutting down the trees; and, as no provision is made for renewing the denuded forests, the demand for this more accessible portion of the American forests is already beginning to make itself apparent. The bark contains 7 or 8 per cent. of tannin, and the leather it makes has a strong reddish-brown colour. A large and increasing amount of hemlock extract, an impudenced decoction of the bark having a specific richness in tannin, is now imported into Europe, principally to the United Kingdom.

Among barks used to a limited extent and for special purposes are *larch* and *Scotch fir barks*, used for tanning sheep skins into baals, &c. *Willow bark* is used in Russia for tanning russa leather. *Mangrove bark* (*Rhizophora Mangle*), which is exceedingly abundant in India, and rock in tannin, have been used in the United Kingdom, but their use did not prove satisfactory.

Wood—Quebracho wood (*Aspidosperma Quebracho*), a wood rich in tannin, obtained from the river Plate, has recently grown rapidly in favour as a tanning substance in the United States and France, and is now coming into notice in the United Kingdom.

Fruits—Under this head are comprised valonia, myrobalans, and divi-divi, three substances which now play an important part in tanning both in Europe and America. *Valonia* consists of the imbricated acorn cups of a species of oak, *Quercus Agrifolia*, which is indigenous in Asia Minor, Greece, and southern Turkey, and is mainly shipped from Smyrna. It contains as much as from 40 to 45 per cent. of tannin, and the average annual imports into the United Kingdom are now not less than 30,000 tons. *Myrobalans* are the dried immature fruit of species of *Ternstroemia*, principally *T. Bellieria* and *T. Chalcidica*. They vary in size and colour, but in general they are oval hard wrinkled nuts rather like a filbert. The amount of tannin they yield varies from 20 to 35 or sometimes as high as 40 per cent. *Myrobalans* grow abundantly throughout India and are largely and increasingly exported from the three presidencies to the United Kingdom. **Divi-divi** (*g v*) consists of the bark of a species of *Sida* from the East Indies, which is used in tanning with divi-divi is subject to several grave objections. The abundant mucilage of the pods ferments readily, and thereby sometimes causes a rotting of the hides. Leather tanned by divi-divi also dries moisture readily in presence of damp, while in a dry atmosphere it is hard and horny, and further this agent leaves finished leather very dark in colour.

Leaves. **Sumach**—The leaves of various species of *Rhus*, under the name of sumach, or sumac, form materials of the first importance for the tanning of light skins in which it is essential to have a fine white colour, as in the case of light morocco leather, &c. Of the species the most important is the Shellen sumach, *R. Coriaria*, a shrub or low tree indigenous to Italy, Spain, France, and the Mediterranean coasts of Africa. It is cultivated with much care in Sicily, the leaves being gathered from shoots not more than a year old, which thereafter are cut down close to the parent stem. The same shrub is largely cultivated in the southern departments of France, in Spain, and in Portugal. The leaves gathered in June are dried and ground under edge rollers to a fine dust, in which condition the material comes into the market. It has a bright olive green colour with a tinge of red, and should contain in the best qualities from 25 to 30 per cent. of gallicotannic acid, and the same tannin which is present in galls. The leaves of the Venetian sumach, *R. Cotinifera*, are similarly used in the eastern countries bordering on the Mediterranean. In America a large quantity of sumach for tanning is obtained from two species of *Rhus*, *R. copallina* and *R. glabra*, growing principally in Virginia, the Carolinas, Georgia, and Alabama. These are, however, much inferior to European sumach, both on account of the colour they communicate to leather, and also from the smaller percentage of tannin they yield, although it is believed that with careful cultivation and proper attention the quality might be greatly improved.

Bark-acts—**Cutch** and **Gambir**, vegetable extracts obtained from the East, are frequently confounded, and in commerce they indifferently pass under the name of terra-japonica and catachu (see CATACHU, vol. v. p. 220). Gambir, which comes almost exclusively from Singapore, is the inspissated juice of the leaves of *Merris Gambir*, a tall shrub belonging to the natural order *Rubiaceae*. The extract comes into the market in the form of cakes about an inch in size, of a dull brown earthy appearance. In composition and properties it agrees with Cutch. The exports from Singapore amount to about 10,000 tons annually. **Kuto** (*g v*) is exceedingly rich in a variety of tannins, but its high price precludes its use in tanning. These extracts are used in tanning only in conjunc-

tion with other materials; they not only hasten the operation, but, judiciously used, they tend to render the leather soft and mellow.

Galls—Although galls are among the richest of all bodies in tannic acid, they do not form an important item among the materials of the tanner, being most valuable for other industrial purposes, and therefore too costly for use as tanning agents. The "knoppen" galls of Hungary, which are formed on the acorn cups of a species of oak, however, are to some extent used in Continental tanneries. For full information regarding galls, see vol. x. p. 43.

It is to be noted that most of the tanning substances above alluded to may be and are used in dyeing as well as for tanning.

Grinding and Leaching of Tanning Materials.—Bark, valonia, myrobalans, and other tanning bodies are reduced to a small and as far as possible uniform size by means of grinding or comminuting machinery. The main object in such machines is to produce uniformity of size with as little dust as possible, and the apparatus most commonly used is similar in principle to the ordinary coffee-mill, with breaking arms for the bark and segmental cutters for smaller materials. Various forms of disintegrator are also used, which produce their effect by violent concussion obtained by the revolution in opposite directions of two large and strong disks armed with projecting spikes on the sides of the disks facing each other. These disks are enclosed within a stout iron drum; and, as they revolve at a speed rising to three thousand revolutions per minute, some conception of the violence with which the tanning materials are struck and smashed may be formed. The tanning materials so prepared are next leached, latched, or infused for preparing the strongest tanning solutions for use in the "layers" or lay-away pits noticed below. In making these leaches or infusions, some tanners use hot (even boiling) water, others use cold water alone; some employ only pure water, and by some the weak and exhausted oozes or wooses from the pits are strengthened up by renewed leaching. The sole object of the tanner is to obtain the greatest amount of the tanning principle contained in the materials operated on, and to take care that what he gets is not lost or wasted. The method of leaching commonly adopted in the United Kingdom is to pass the bark through a series of leachers or spender pits. New or fresh bark is put into the first of the series, and over it is pumped cold the well-strengthened ooze from the next leacher. In this first pit the ooze or infusion is brought up to the full strength required for the lay-away tan-pits, and after the infusion is pumped off the tan (now somewhat reduced in strength) is passed over into No. 2 leacher, where it is treated with liquor in its turn also somewhat lower in strength. In this manner the bark passes by stages through a series of pits, diminishing in richness in tannin at each stage, and in the same gradual manner being infused in a weaker and weaker liquor, till in the last of the series it is fully exhausted with pure warm water. Thus pure water is put in at one end of the range and fresh tanning material at the other; the water as it ascends is gradually strengthened till it reach the maximum richness in tanning principle, while the tanning material as it descends is in like proportion deprived of its extractive constituents, till in the end nothing further soluble remains. From the last pit the bark, &c., are tuned out as "spent tan," usually to be burned in a special form of tan-burning furnaces for raising steam. The use of leaches or infusions was first insisted on by Seguin about the end of the 18th century, and the adoption of his suggestion led to the shortening of the time occupied in tanning heavy leather by about one half.

Testing Tan Liquors.—The methods by which the tanning value of any substance is determined are numerous, but few of them are at once capable of simple application and minutely accurate. One of the commonest plans for ascertaining the strength of the tan liquor technically called ooze, or woose, is by means of a kind of hydrometer called a

barkometer. It is graduated to the standard of pure water, and, when it is placed in a specimen of ooze, the strength of the latter is judged of by the position of the stem above or below the water-mark. But, as bark or other tanning material may contain several soluble substances besides tannin, the barkometer obviously cannot be relied on. Some farmers judge of the strength of ooze by its astringency to the taste. Seguin, who in the end of the 18th century was the first to insist on the advantage of tanning with previously prepared infusions, proposed the use of a solution of gelatin as a test of the presence of the tannin. In trying the quantity of tannin by Seguin's process, 480 grains of the bark in coarse powder should be acted on by half a pint of boiling water. The mixture should be frequently stirred, and suffered to stand twenty-four hours, the fluid should then be strained through a linen cloth, and mixed with an equal quantity of solution of gelatin, made by dissolving glue, jelly, or isinglass, in hot water, in the proportion of a drachm of glue or isinglass, or six table-spoonfuls of jelly, to a pint of water. The precipitate should be collected by passing the mixture of the solution and infusion through folds of blotting-paper, and the paper exposed to the air till its contents are quite dry. Every 100 grains of precipitate contains 40 grains of tannin nearly. As, however, some kinds of tannin produce larger precipitates of gelatin than other kinds, and as the composition of tanno-gelatin varies with the strength both of the solution of gelatin and of tannin, this method is not reliable. Sulphate of cinchonin is said to afford a better test, a solution of this, acidulated with a few drops of sulphuric acid, will, it is said, precipitate tannin completely from the solution. Lowenthal's method, founded on the fact that solutions of tannin in presence of sulphuric acid are readily oxidized by permanganate of potash, is very useful for the comparative determination of the value of different tanning substances. A given weight of tanning material is infused, and the solution is brought up to a definite volume. One half of this measured quantity of tannin solution is mixed with definite quantities of a standard indigo-carmin solution and sulphuric acid, and to this mixture permanganate solution is added from a graduated tube till the colour of the indigo is completely discharged, when both tannin and indigo are oxidised. A parallel experiment is next made with similar measured amounts of indigo and sulphuric acid solutions, but without any tannin infusion. The difference between the quantity of permanganate required to discharge the colour in the two experiments gives the standard for calculating the amount of tannin in the solution to be tested. Another good method of testing the value of tanning material is to digest a piece of dry prepared hide or skin in a known quantity of the infusion, until the whole of the tannin and other matters be separated. The skin is then taken out, slightly washed, dried, and weighed, when the increase of weight is supposed to be the weight of tannin and of the other matters required. An apparatus devised by MM Muntz and Ramepacher has recently been introduced for facilitating this last test. It consists essentially of a small vessel sufficient to hold a measured quantity of a tanning infusion, the specific gravity of which is carefully ascertained. That vessel is so arranged that strong pressure can be brought to bear on it by means of a screw acting on an india-rubber surface, thereby forcing the liquid through a piece of skin which covers the lower part. The skin absorbs the whole of the tannin during the passage through it of the infusion, and by ascertaining the specific gravity of the escaped liquor the percentage of the tannin material in the infusion can be readily determined. This apparatus has been extensively introduced in practice in England and on the Continent.

Sole Leather, or Heavy Leather Tanning.—The hides of oxen are received in the tan-yard in four different conditions. These are—(1) market or slaughter hides, which, coming direct from local abattoirs, are soft, moist, and covered with dirt and blood, (2) wet salted hides, (3) dry salted hides, and (4) sun-dried or "flint" hides,—the three last forms being the condition in which the imports of foreign hides are made. The first operation in the tannery is to clean the hides, to free them from salt, and to bring the hard dry hides to the uniformly soft flaccid condition in which all market hides are obtained. The treatment at this stage requires skill and attention to prevent the more soluble constituents of the hide from dissolving out in the washing and soaking processes, and also to secure the complete softening of the entire substance, upon which the successful tanning greatly depends. In the case of market hides cleaning and softening are principally effected by washing and soaking in spent lime-water, while for dry hides and dry salted hides brine is essential. The softening of these materials is helped and rendered thorough by working them for some time in the stocks (fig 1) after they have been well soaked. After being thus brought

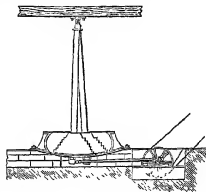


FIG. 1.—Double-acting Stocks

to throw the hide or skin into a strong watery ley of slaked lime, with lime in excess. By this, in a few days, more or less according to the proportion of lime present, the hair is easily detached, the hair-sheath having been dissolved. The hair was formerly taken off by making a sour liquor from fermented vegetable matter, in which the hides lay for several days, they were also smoked in a damp state for the same purpose, but both those methods are now abandoned. They are still sometimes, especially on the Continent, sweated, that is, they are laid in heaps and kept wet and warm, a plan which is still adopted in England for skins. In America the sweating is performed cold; the hides are hung up wet in a damp underground cellar, and are kept moist for ten days or a fortnight. In either of these sweating processes incipient putrefaction takes place sooner or later, when the hair and scarf-skin are easily removed; but the fatty matter remains, and in some cases prevents the hide from taking the tan.

There have been numerous other methods proposed and patented for unhairing skins, few of which have been received with much favour. Among the agents proposed may be mentioned caustic soda, sulphide of sodium and sulphide of calcium, borax, sugar, and charcoal—substances which it is obvious must act in very different manners. Lime and alkaline solutions not only loosen the hair and scarf-skin, but also "plump" the corium or true skin, that is, they swell it and render it consequently porous and more permeable to the tanning solution. Lime further forms with the fatty matter of the flesh and calcareous soap, thus neutralizing the fat which would otherwise interfere with

the tannin. Some tanners, especially Americans, who work the so-called acid process, plump their hides by the use of sulphuric acid, hanging them six or eight hours in a solution containing $\frac{1}{10}$ th of acid. The plumping is sometimes done as a preliminary operation, and again others add the acid to the colour pits, or the first pit into which the hides go for the tanning process. Among non-acid tanners the plumping of sweat stock in which there is no lime is secured in the weak acid liquors of the colouring and handling pits. In the case of limed stock the hides, at the proper stage, are withdrawn from



FIG. 2—Tanner's Beam

the pits and stretched over an unhairing beam (fig. 2), when with a working knife (fig. 3, a) a workman partly scrapes partly shaves off the hair and scarf-skin. Another workman in a similar way with a fleshing knife (fig. 3, b) removes the fatty compounds and flesh from the flesh side.

For these operations several machines have been adopted, working mostly with revolving knives or cutters, under which the hides or skins pass in a fully extended state. Such machines are, however, only applied to the smaller skins. The next step in the preparation of the hide is to remove from it as thoroughly as possible all traces of lime. This is partly accomplished by going over the hide on the beam with a scudding knife, pressing the combined lime and interfibrous matter out of the tissue. For more complete neutralization of lime in the larger hides the influence of the weak acid of the colouring pits is trusted to. Harness hides are washed by some means in pure water, the most convenient and generally adopted method being to place them in the dash wheel (fig. 4), in which they revolve and tumble about whilst fresh water is continually being poured on them within the revolving wheel.

The hides now come to be trimmed and prepared for tanning in the shape in which they are intended ultimately to be sent into the market. An entire untrimmed hide (fig. 5) is termed a crop; a side is half a crop, the dividing line of the two sides being shown at EF, a butt is the back portion ABCD, and a bend is half a butt ABFE. G, G are belly pieces, and H, H the cheeks, both together

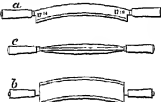


FIG. 3—Tanner's Knives and Pin.

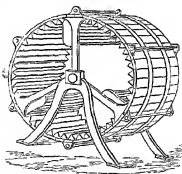


FIG. 4—Dash Wheel

being the offal. When the shoulder (the upper part of the butt) is removed, what remains is a short butt.

The actual tanning now commences, and the operations involved may be divided into a series of three—(1) colouring, (2) handling, and (3) the laying away. The

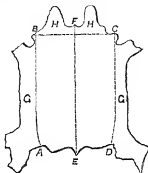


FIG. 5—Divisions of a Hide

a series of four or six, this stage usually occupying about a week. As the hides are moved forward in the series they are exposed to a liquor containing a small and steadily increasing proportion of tannin, and this, it may be said, holds good till the hide reaches the last lay-away pit, in which the tanning is completed. The objects attained in the colouring pits are the superficial colouring or dyeing of the hide, some amount of plumping from the acids of the ooze, and a dissolving out of remaining traces of lime, principally by the acetic acid to which the hide is exposed. After colouring, the hides pass on to the handlers or handling pits, a round or series of which may consist of from four to twelve, according to the mode of working. In the handlers the hides are spread out horizontally; and in the first series they are "handled" once a day or more frequently if convenient. The handling consists of hitting the hides out of the pit by means of a tanner's hook (fig. 6), pulling them on the side till they drain, and returning them into the pit, the hide on the top in one handling going to the bottom in the next. This operation is continued throughout the series, only as the hides advance the necessity and advantage of frequent handling decreases, while the strength of the tan liquor in which they are handled increases. The whole handling stage consumes on an average about six weeks. Finally, the hides are carried over into the lay-aways or lay-downs. In these the stock is exposed to the strongest tanning liquors, and between the hides thin layers of the tanning bark or mixture are shown. The object of this interstratification is to separate the mass of hides so as to secure the more ready permeation of the entire mass by the liquor, and also to feed and strengthen the ooze itself as its tannin is absorbed by the hides. In these lay-aways the hides are allowed to rest for about six weeks, after which the pits are cleared out, charged with fresh ooze, and filled with the hides and tan as before. These processes may be repeated three or four times before the tanning is completed. When the process is deemed complete, each hide, on being taken out, will be found to be converted into leather, and a portion of its gelatin which has been dissolved from its interior is, by combination with a portion of tannin from the strong solution, deposited upon its surfaces, where it is found in the form of a yellow deposit, technically known as bloom, or pickling, which disguises the under colour of the leather just as if it were covered with yellow paint. This, prejudice says, must be on its surface, or it is not saleable, but it is so much quality and weight lost to the

FIG. 6—Tanner's Hook
(without handle)

consumer, as he pays for it on the outside of his leather to be worked off in the dressing and currying operations. By some tanning agents—mimosas, for example—there is little or no bloom deposited.

The theory of the formation of the bloom is this. As soon as ozone has penetrated into a hide it loses its tanning material, but by capillary attraction is detained, this exhausted ozone acts by imbecation on the finer and more soluble interstitial gelatin, and dissolves it. In handling, about one-twelfth of this flows out, the remaining eleven-twelfths accompany the hide into the next stronger solution, of which only one-twelfth is absorbed directly, and a small portion is slowly exchanged by endosmosis and exosmosis. The small portion of strong solution which passes into the pores of the hide contributes to tan the hard fibrous portions not dissolved, and the small portion of weak solution passing out of the hide by exosmosis gives up its dissolved gelatin to the tan of the stronger solution outside to form tannate of gelatin, which partly adheres to the surface as bloom, and partly falls to the bottom of the pit as pitching.

From the time when the raw or hide is taken in hand till the leather is fully dried, not less than a year is consumed in the case of the best qualities of sole leather. It was formerly the practice in England, as it still is on the Continent, to tan by the process of *stratification*, for which purpose a bed of bark is made upon the bottom of the pit, upon this is laid the hide, then bark, then a hide, and so on until the pit is full, water is sometimes pumped in, and the pit left for some months, it is then emptied, and the same hides returned with fresh bark and water for a few months longer, this is repeated again and again, until the tanning is completed, the time varying from one to four years for heavy leather.

The devices and processes which have been proposed and to some degree put in operation with the view of shortening the time consumed in tanning are beyond all enumeration. In scarcely any case have time-saving processes proved successful in practical working, so far as the production of good leather is involved, and now the opinion appears to be completely established that for the thorough tanning of heavy leathers, a slowly operating machine and consequently long time are essential. The devices for the hastening of tanning have for the most part turned upon some plan for forcing the tan liquor into and through the hide, or for alternate soaking and squeezing of the hides. Among the plans which have been tried on a commercial scale may be enumerated tanning by the application of hydrostatic pressure to force the liquor through the hides, a method which failed simply because the pressure was equal on both sides. The vacuum tanning principle is another which has been extensively tried, only to result in disappointment. It consists in hanging the hides in a pit or cylinder so constructed that the air can be exhausted by an air pump, after which the hides are forced into the vessel and readmitted, and again withdrawn. Hides, however, loaded with water swell little under diminished atmospheric pressure, and the practical difficulty of procuring and maintaining a vacuum in tan pits is very great. More promising results have been obtained by setting up in tan pits the physical process of endosmosis and exosmosis. This is done by sewing up hides two and two in bags which, being filled with solution differing in specific gravity from the tan liquor in which they are immersed, thereby set up transpiration through the hide. This process failed chiefly through the brittleness of the leather if cykled. A plan of sewing hides into bags and suspending them filled with strong tan liquor, which as the fluid exuded was renewed, was also tried for some time. Again, it has been attempted to keep the hide suspended stationary in the pits and move the liquors instead of carrying over hides from one pit into another. A more recent device, which may not yet be fully tested, consists in keeping up the strength of the liquor by a continuous circulation through pipes from the stronger into the weaker liquors. By this system of circulation, instead of the osmoses in which hides are immersed becoming weaker and weaker the longer they rest in the liquor, the osmosis is kept up at least to its original strength, and it may indeed, if desirable, be increased in proportion as the tannin combines with the hide.

Heavy hides for sole leather, belting, and similar purposes do not require to undergo any elaborate dressing or currying. When finally removed from the tan pits they are piled grain to grain and flesh to flesh to drain, cure

being taken that no tan liquor is allowed to lurk in the pile, which is covered over from the light. When sufficiently drained, they are brushed or scoured to free them from adhering impurities, and removed to the drying loft, where, after lightly rubbing over with oil, they are hung on poles to dry. In the loft steam-heated pipes keep a dry atmosphere during winter, and enable the attendants to regulate and control the drying of the leather. The leather when dried in this condition is rough tanned, and for finishing as sole leather it has to be struck out or "pinned" and compressed by rolling. For striking or pinning by hand the hide is dampened with water, thrown over a beam, and worked all over the grain side with a striking pin (fig 3, c). This operation smooths and levels the grain, removes smaller wrinkles, and to some extent compresses and solidifies the leather. Striking machines (fig 7) are now very generally used for the operation.

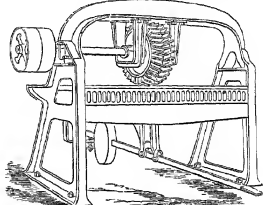


FIG 7.—Leather Striking Machine

These consist of a drum or cylinder having a parallel series of projecting knives, or plates of gun-metal, set angularly across its surface. Underneath the drum is a brass bed, fixed on a yielding cushion, which can be pressed up or eased by means of a foot lever, according as the leather operated on is thick or thin. The drum is made to revolve at a very rapid rate, the blunt edges and external angles of the knives thereby striking the surface of the leather with great violence, and thus the grain is struck out, smoothed, and compressed in a very rapid and efficient manner. Finally, the leather is rolled and compressed on a level zinc-lined wooden bed by a heavy hand roller, such as is shown in fig 8, or on the platform of one of the numerous forms of machines designed for that purpose.

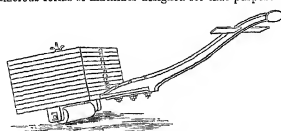


FIG 8.—Hand Roller

The yield of leather from a given weight of dry hide varies very much according to the different styles of tannage and materials used. As a mean outcome, it may be said that 100 lb of green hide, tanned with from 300 to 400 of oak bark, will yield 40 to 50 lb of leather, 100 lb of green hide, however, when deprived of hair, flesh, and moisture, will weigh only 18 lb, and, taking 100 lb of dry hide, which, fleshed and unhaird, weighs 85 lb, the yield of leather will be from 180 to 200 lb according to tannage.

The percentage of tannin alone absorbed from different tanning agents has been found to be for hemlock, 64.3, pine, 90.8, chestnut, 85.2, oak, 76.9, oak, three years in pit, 70.2. Heavy leathers, being sold by weight, are subject to adulteration, and have fictitious weight given them without any benefit to the material, but rather the opposite, by impregnation with such salts as sulphate of magnesium or chloride of barium, or with glucose, the last being the most frequently used adulterant.

Upper Leather—Under this head are included the thin, soft, and pliable leathers which find their principal, but by no means exclusive, application in making the uppers of boots and shoes, which may be taken as the type of a class of leathers. Upper leathers are made from such hides and skins as East Indian kips, light cow hide, calf skins, horse hide, and also from split heavy hides. The preparatory dressing of such skins, and the tanning operations, do not differ essentially from those already described. In proportion to the thinness of the skin treated, the processes are more rapidly finished and less complex, while at the same time the skins absorb a large percentage of tanning extract. The time used for unhairing must be removed in the preliminary stage, with greater thoroughness than is essential in the case of hides for sole leather, and for this purpose the skins are washed in the dash wheel, and undergo a process of *bating* or *graining*. A quantity of pigeon's dung is dissolved in water, and in this the hides are steeped for a week or ten days, with occasional removals and striking. The theory of this process is obscure, but it has been explained on the supposition that the muc acid of the dung removes the excess of lime, and that the ammonia generated by the putrefaction of the mixture tends to form an ammoniacal soap with any remaining fat of the hide, but as the gelatin of the hide exists in two states,—one the principal, hard, or fibrous portion, and the other (which is more soluble) contained between the fibres, and more affected by agents and putrefaction—this softer portion is removed by graining, and the leather, when tanned, is light and porous, and more readily permeable by water. Small skins are not fitted one by one out of the colouring and handling pits, but the whole contents of the pits are tied together, so that when the upper skin is seized it is thrown over a spoked cylinder erected between each pair of pits, and the wheel being set in motion, the entire string of skins comes up over its surface and is passed into the neighbouring pit with the utmost rapidity. Such an apparatus is used for handling all small pieces and fragments, as for example the cheeks and bellies of heavy hides.

The time occupied in tanning an upper leather, say an East Indian kip, with a mixed mimoso, sumach, valonia, and tannin, may be about three months. In the fine tanning of calf and kip skins on the Continent, for which French and German tanners are famous, the duration of the operation may be from four to eight months.

Splitting—In the preparation of most kinds of upper leather, the hides are split into two, or three, and sometimes more portions. In the case of a single split the portions form a grain and flesh side, when three sections, or slices, are made they result in grain, middle, and flesh splits. Some tanners split their hides in the green condition, others after colouring, and in many instances the splitting is done, after the leather is fully tanned, by the currier, as a regular part of his operations, this being particularly the case with imported tanned East India kips, and other fully tanned leather of foreign origin. Splitting machines will be alluded to in connexion with the operations of currying.

Currying—Leather as it leaves the tannery is a comparatively rough, harsh, and intractable substance, and the duty of the currier is to dress and otherwise fit it for

the use of the shoemaker, coachbuilder, saddler, and the numerous other tradesmen who work in it. The currier has to smooth the leather, so to pare it down as to reduce inequalities of thickness, to impregnate it with fatty matter in order to render it soft and pliable, and to give it such a surface-dressing, colour, and finish as will please the eye and suit the purposes of its consumers. The operations of currying are complex and varied, each particular class of goods receiving a treatment in many respects peculiar to itself. The fact also that machinery is used by some curriers for nearly every mechanical operation, while others adhere to the old manual system, renders it almost impossible to give in brief an outline of operations which will be consistent with the practice of any considerable number of curriers.

Regarding currying as principally a handicraft, the following may be taken as an outline of the range of operations for the preparation of a waxed calf leather, the commonest form of upper leather in use. The leather is first made pliable by soaking in water, after which it is shaved on the flesh side, and a tolerably smooth surface is produced. This operation is carried on at a beam, or strong frame of wood, supporting a stout plank faced with lignum vitae, and set vertically, or nearly



Fig. 9—Currying Knife

so. The knife (fig. 9) is a double-edged rectangular blade, about 12 inches by 5 inches, with a straight handle at one end, and a cross handle at the other in the plane of the blade. The edges of this knife are first made very keen, and are then tuned over so as to form a wire edge by means of the thicker of the two straight steel tools shown in fig. 10. The wire edge is preserved by drawing the thinner steel



Fig. 10—Currying Apparatus. C, plank; R, raising board; S, slider

tool along the interior angle of the wire edge from time to time as required, for which purpose the man holds this smaller tool between his fingers, together with the beam-knife. The skin being thrown over the plank, the man presses his body against it, and leaning over the top holds the knife by its two handles, almost perpendicularly to the leather, and proceeds to shave it, shifting it from time to time so as to bring all the parts under the action of the knife, and frequently passing a fold between his fingers to test the progress of his work. The skin is then placed in hot water, and removed to a mahogany or stone table, to which the wet flesh side adheres, and is worked with a tool called a stretching-iron, or slicker S (fig. 10), consisting of a flat, rectangular piece of iron, copper, or smooth hard stone, fixed in a handle. With this tool a man scrapes the surface of the skin, exerting a strong pressure with both hands, and dashing water upon it from time to time, by which means lumps and inequalities are made to disappear, the leather is equalized, and extended, and the bloom is brought to the surface. The superfluous moisture and the superficial bloom are now *sicked* out, and a stuffing, or *dubbing*, of cod oil and tallow is rubbed into both sides of the skin, but chiefly the flesh side, by means of a brush, or with the woolly side of a piece of sheep skin. The skin is now dried in a loft, and, as the water only evaporates, the dubbing sinks into the pores. When dry enough for the

purpose, the skin is *boarded*, or worked with a graining board or pommel C (fig. 10), the effect of which is to bring up the grain, or give a granular appearance to the leather, and also to make it supple. The pommel is a piece of hard wood, grooved like a clamping-board, and attached to the hand by means of a strap, whence the word pommel, from the French *pommelé*, or palm of the hand. The leather passes through various manipulations, each having its distinct name, thus *graining* consists in folding the skin with the grain sides in contact, and rubbing strongly on the flesh side, *blissing*, or rubbing the extended skin on the grain side, *whitening*, or passing a knife with a very fine edge over the skin at the beam, so as to clean the flesh side preparatory to *waxing*, which is done just before the skins are sold; for at this point the currier stores his skins, as they can be kept best in the state of *finished russet*, as it is called, previous to waxing. Waxing consists of two parts: the first is the laying on the *colour*, or blacking of oil, lampblack, and tallow, which is well rubbed in on the flesh side with a hard brush, then, secondly, the skin is black-sized with stiff size and tallow, laid on with a sponge or a soft brush, and thoroughly rubbed with a glass slicker, a finishing gloss being given with a little thin size. The curried skin is now said to be *black on the flesh*, or *varnished*, in which state it is used for the upper leathers of men's boots and shoes. In the case of any of the numerous varieties of grained leather which are blackened and dressed on the grain side, the finishing operations are different. These are hard dried after slicking, and the operation of stuffing or dubbing is omitted. They are grained in the dry state, often by machinery, then boarded to soften them, and next blackened on the grain side with a solution of copraes. The flesh side is whitened or *stuffed*, and the grain is treated with sweet oil or some similar oil, and finally glazed with a thin solution of gelatin or of shellac.

For almost every operation in enying efficient machinery has now been adapted, the use of which not only modifies the operations of the currier, but also enables him to split up hides and to finish his splits in numerous of any kind of leather. He may desire to copy in a machine carrying the tanned hide, duly damped, are struck out in a "storing" machine. It consists of a strong oscillating arm or bar having a blunt steel blade fixed on its end, which works back and forward over a concave bed on which the hide is laid, and which by its scraping and striking action on the softened leather smooths and equalizes the grain, and produces a compact uniform surface on

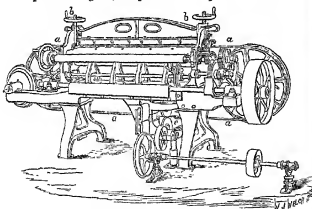


FIG. 11.—Belt Knife Splitting Machine.

it. From the storing machine the hide may pass to the splitting machine, of which there are numerous forms, the American *splitter* with a fixed knife being the oldest and best known. A much more perfect machine, however, is the belt or band splitting machine. In this machine (fig. 11) the knife or cutter *a* is an endless band of steel which revolves at considerable speed with its cutting edges close to the sides of a pair of rollers through which the leather is fed and pressed against the knife. The lower of these rollers is made of short segments or rings, each separately capable of yielding to some extent so as to accommodate itself to the unequal

thickness of various parts of a hide. The thickness of the slice of leather to be cut is gauged to the utmost uniformity by means of the hand severs *b*, which pass at lower the upper roller. The knife edge of the cutter is kept keen by rubbing against revolving emery wheels *c* as it passes round. So delicately can this machine effect its work that slices of leather uniform throughout and as thin as paper can be easily prepared by it, and with its help it is an uncommon practice to divide a comparatively thin East Indian key into three useful splits. Another machine now largely used by curriers is the scoring machine (fig. 12), a level table or platform freely movable in all directions, having mounted over it a scumming cutting frame in which are fixed brushes and pieces of slate or flint

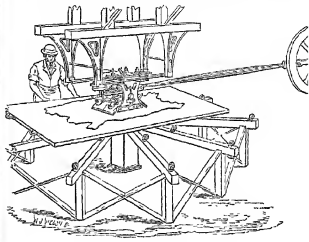


FIG. 12.—Scumming Machine.

stone. These, with a small jet of water, scum and level the entire surface of the leather lying on the platform, effectively removing all bloom and all scummy impurities. Other machines are used in stuffing, bluing, and whitening machines. In the latter the leather is pulled and equalized by the cutting action of a small cylinder armed with oblique cutting edges. The cylinder, moved to and fro with pendulum motion, and revolving at the enormous rate of from 3000 to 4000 revolutions per minute, passes and shaves the leather on the same principle as the lawn-mower cuts grass. Embossing or graining cylinders, bonding cylinders, glazing machines, emery wheels for finishing the flesh side of levant leather are all among the mechanical adaptations for curriers' use.

Patent or Enamelled Leather.—Leather finished with a brilliant, smooth, and glossy surface, used for dress boots and shoes, dress belts, and fine harness, is known under a variety of names, as lacquered, varnished, japanned, or enamelled leather, &c. Such leather is finished principally from tanned calf skins, and in more recent times from seal goat, and sheep skins, but lighter ox hides and horse leather are also japanned for special purposes. The finishing of leather in this style involves two processes—(1) the grounding or preparation of a smooth surface, and (2) the varnishing and polishing. The grounding material used by French and German harness-makers, who greatly excel in the production of such leather, consists of a thick syrup mixture of lamp-black with a varnish of boiled linseed oil, umber, and litharge. This is uniformly spread over the surface of the leather, which has been previously stretched and tacked on a wooden frame. The first coating is dried in the air, then exposed in the japanning stove to a heat of about 170° Fahr., and afterwards rubbed smooth with pumice stone. This process of coating, drying, and smoothing is repeated several times, and the leather is next varnished with a compound of boiled oil, Berlin blue litharge, and some dryer, thinned either with oil or turpentine or petroleum spirit. Two or three thin coatings of such varnish are given, the surface being carefully polished after each, but the composition of the varnishes &c., and the number of coatings applied, vary much in the hands of different manufacturers. Coloured enamel leather receive two preliminary coatings of oil, rosin, and spurt of turpentine, which are sun-dried, they are then brought up

with several coatings of oil, varnish, and the special colouring substance, and finished with a thin coat of copal varnish.

Seal Leather.—The tanning of seal skins is now an important department of the leather industry of the United Kingdom, in which this branch has been specially developed. The skins form one of the items of the whaling industry, which principally centres in Dundee, and at that port, as well as at Hull and Peterhead, they are received in large quantities from the arctic regions. A considerable number are also imported at Greenock from the coast of Newfoundland. The skin of these seals is light but exceedingly close in texture, and yields a very strong tough leather. The skins are prepared, split, and tanned in the same way as other light leathers, tanning with mixed oak bark and sumach usually occupying about six weeks. Seal leather is generally finished on the grain side as "levant" seal with a large coarse grain, and in that form it is principally used by bootmakers. A proportion of seal leather is finished as enamel and japanned leather.

Russia Leather was originally, as the name implies, a speciality of Russia, where it was made from the hides of young cattle, and dressed either a brownish-red or a black colour, for upper leather or for bookbinding, dressing cases, purses, and similar objects. Russia leather is now made throughout both Europe and America, the best qualities being obtained from Austria. Horse hides, calf, goat, and sheep skins, and even splits, are now finished as russia leather, but most of these are decidedly inferior in quality, and, as they are merely treated with birch bark oil to give them something of the odour by which an ordinary observer recognizes russia leather, they scarcely deserve the name under which they pass. Genuine russia leather is tanned like other light leathers, but properly in willow bark, although poplar and spruce fir barks also are used. After tanning, scouring, and setting out, the hides are treated on the flesh side with an empyreumatic oil obtained by the dry distillation of birch tree bark and buds, to which the peculiar smell of the leather is due. The red colour commonly seen in russia leather is given by dyeing with a preparation of brazil wood, rubbed over the grain side with a brush or sponge. Black-coloured russia leather owes its colour to repeated stainings with acetate of iron. The leather of genuine quality is very water-tight and strong, and, owing to its impregnation with empyreumatic oil, it wards off the attacks of insects.

Morocco and Thin Leathers.—Originally morocco leather was a product of the Levant, Turkey, and the Mediterranean coast of Africa, where the leather was made from goat skins tanned with sumach, and finished either black or various bright colours. Such leather was peculiarly clear in colour, elastic, and soft, yet firm and fine in grain and texture, and has long been much prized for bindings, being the material in which most of the artistic work of the 16th century binders was executed. Now, in addition to genuine morocco made from goat skins, we have imitation or French moroccoes, for which split calf and especially sheep skins are employed, and it may be said that, as the appearance of morocco is the result of the style of grain, which can be artificially produced on any leather, and of the finish, morocco can be made from all varieties of thin leather. The Germans distinguish between saffian and morocco, including under the former term leather tanned with sumach, and dyed bright colours without previous stuffing with fat, while as morocco proper they reckon leather which may be prepared with mixed tannage, is stuffed, and afterwards is finished black. Saffians are, according to this classification, the leathers principally used for bindings and fancy purposes, morocco being more especially devoted to shoe work.

The preparation of skins for morocco leathers must be

conducted with much care. The skins, being usually hard and dry when received, are first soaked and softened by milling in the stocks and working on the tanner's beam. They are next limed, unhaired, fleshed, and trimmed in effect as already described in the section on sole leather, and they are pured or bated in a preparation of dog's dung. After undergoing the influence of this preparation, the skins are washed and slated with a knife-edged piece of slate to remove from their surface fine hairs and adhering dirt, and then they are put into a druch of bran and water, heated to about 185° Fahr., after which they ought to be perfectly free from deleterious impurities and ready for tanning. Several processes are adopted in tanning, but that most approved is based on the original Eastern practice, which consists in first treating the skins with an already used sumach infusion. Next they are, in pairs, sewed up as bags, grain side outwards, and these bags are filled with concentrated sumach liquor and a proportion of powdered sumach, and by the exudation of the liquor through the skins, partly aided by pressure, the tanning is quickly completed. After ripping out, the skins are thrown into vats containing sumach liquor, to tan the edges and shanks, which are not reached by the liquor in the bags. The fully tanned skins are now struck out on the beam with the striking pin, and hung in the lott to dry, when they are ready for the finishing processes. A large proportion of the goat skins imported into western Europe from the East Indies, whence they are exported in enormous quantities, are received in the fully tanned condition, and ready for the morocco finishing operations, after a short treatment with sumach liquor. For finishing, the leather is first damped in soap-suds, and shaved on the flesh side to equalize the thickness of the leather, and next on a table worked over repeatedly with slickers, which renders the skin firm, smooth, and uniform. The skins are next blacked on the grain side with a solution of acetate of iron, and from this point the methods of finish diverge in an endless manner according as it is desired to finish the leather as "kid," "levant," "pebbled," "bright," or "dull," &c. The bright-coloured moroccoes are dyed in two different methods, the dyeing being done as a preliminary to the finishing operations. In the case of genuine moroccoes, the skins are dipped and drawn through small troughs containing the dye liquor; two skins are taken, placed flesh side to flesh side, and so worked through the liquor by hand, the operation being repeated as often as necessary to bring up the requisite strength of colour. Imitation morocco, on the other hand, is usually dyed by stretching the skins on a table and brushing the dye liquor over the grain side. After the dyeing the skins are shaved and dressed, the dyed surface is rubbed over with an emulsion of white of egg, luscied oil, and dye liquor, and afterwards grained and glassed, or finished smooth and glossy, according to the purpose for which the leather may be required. In recent times aniline colours have been very largely employed in the dyeing of all bright leathers.

In the tanning of sheep and lamb skins the general operations outlined above in the case of goat skins are necessary. Previous to tanning, the prepared skins are submitted to hydraulic pressure, to expel the oleaginous matter with which sheep skins are richly impregnated. Sheep skins tanned, generally with beech bark in the United Kingdom, and uncoloured are known as *banis*. *Roman Leather* is sheep skin tanned in sumach, coloured and dressed throughout in the same manner as imitation morocco, excepting that it is finished smooth and glassed. *Skivers* are split grain sides of sheep skins tanned in sumach, and similarly finished,—the flesh split being shayed for inferior qualities of shamoy or wash leather. Skivers from their thinness are quickly tanned through in a sumach

liquor, and in no case are they sewed into bags, as is most commonly the case with entire sheep and goat skins. The splitting machine used for split sheep skins has two rollers, the lower one of gun-metal and solid, and the upper made of gun-metal rings, while between the two rollers, and nearly in contact, is the edge of the sharp knife, to which an oscillating movement is given by a crank. When a skin is introduced between the two rollers, it is dragged through against the knife edge and divided, the solid lower roller supporting the membrane, while the upper one, being capable of moving through a small space by means of its rings, adjusts itself to inequalities in the membrane; where this is thin the rings become depressed, and where it is thick they rise up, so that no part escapes the action of the knife. Skivers are finished white, or in colours in variously lined or diced patterns, and in imitation grain, and are principally employed for hat and other linings and various purposes in which they meet little strain or tear and wear.

Danish Leather is tanned sheep and lamb skins principally, but goat and kid skins also are used. The tanning medium is willow bark, and the leather, bright in colour and highly elastic, is used for strong gloves. The same name is also applied to tawed lamb skins, dressed and finished on the flesh side.

Alligator Leather.—For a number of years leather tanned from the skins of the Mississippi alligator has formed an item in the trade lists of the United States, and it is now also being sought after in the European markets. The industry was started about the year 1860, and centred first at New Orleans, the raw skins being obtained from the rivers of Louisiana. Now, however, the skins are principally procured in Florida, and the tanning is a considerable industry in Jacksonville. The parts of the skin useful for leather making are the belly and flanks, and these portions alone are steeped in lime to preserve them for the tanner. Alligator leather, which has a scaly surface, is useful for fancy boot and shoe making, and for many small articles such as cigar cases, pocket books, &c.

Kangaroo Leather.—The Australian colonists have turned their attention to the preparation of leather from the skins of the kangaroo, wallaby, and other marsupials native to their continent. These skins are both tanned and tawed, the principal tanning agent being the mimosa bark, which abounds in Australia. The leathers they yield are of excellent quality, strong, and elastic, and rival in texture and appearance the kid of European tanners. The circumstance that the animals exist only in the wild state renders this a limited and insecure source of leather.

Tawed Leather

Under the term tawing is embraced the preparation of leather by the action of mineral substances on hides and skins. In the process of tawing the substance principally employed is alum or some of the simple aluminous salts, although many other mucous salts have been proposed, some of which have given considerable promise of practical success. The system of tawing is principally applied to thin and light skins of sheep, lambs, kids, and goats, although in former times much heavy leather was tawed for military belts, heavy gloves, machine belts, &c., for most of which purposes, however, sun-dried or similar leathers are now found more applicable and durable. The products obtained by tawing are of a pure white colour, whence the name white leather is frequently applied to goods of this class. The most important departments of the tawing industry are the calf kid manufacture for boots and shoes, and glove and lined leather tawing, the products of which are exclusively devoted to glove making. A large number of white tawed sheep skins are also used by druggists and perfumers as a base for leather for bottles, and for linings by bootmakers, &c.

Calf Kid.—The various steps of preparation through which the light skins suitable for the manufacture pass, in respect of softening, liming, unliming, purging, and drenching, are similar to the process by which morocco skins are prepared for tanning. The tawing itself is accomplished in a drum or cylinder the same as the carrier's stuffing wheel, into which is introduced for one hundred average skins a mixture consisting of 20 lb of alum, 9 lb salt, 40 lb flour, 250

eggs (or about 1½ gallons of egg yolk), 1 pint of olive oil, and 12 to 16 gallons of water. In this mixture, at a temperature of not more than 100° Fahr., the skins are worked for about forty minutes, by which action the tawing is completed. After the withdrawal from the drum the skins are allowed to drain, dried rapidly by artificial heat, dampened, stacked out by drawing them over a blunt steel tool, and then wetted and shaved down on the beam to the required thickness. Next they receive, if necessary, a second treatment with the tawing mixture. The dyeing or colouring follows, which in the case of calf kid is always black, the colour consisting of a compound of bichromate of potash, stale urine, logwood extract, and copraea. It is applied either by brushes on a table, or by dyeing the leather in small vats as in the parallel case of morocco leather. The dyed leather is washed with pure water, dried, grounded with a curious moon knife, stretched in all directions, ironed, and oiled on the flesh side with a mixture of oil, wax, &c.

Glaze Kid.—In the preparation of kid leather for gloves the tender skins of young kids alone are used for the best qualities, but for a large proportion of such leather young lamb skins are also tawed. The genuine kid leather is for the most part produced in France, specially at Annomy and Paris, while lamb kid is more particularly a product of Germany, Austria, and Denmark. In all stages of the preparation of this leather the utmost care and attention are required, and it is specially of consequence that the operations preparatory to tawing should receive thorough attention. The unliming is best effected by steeping the skins in a mixture of lime and oil of pomace, and, while the general sequence of unliming, fleshing, beating with dog's dung, scudding, washing, and treating with the bean drench, is the same as in the case of other skins, much more attention is bestowed on each stage in order to maintain the smoothness of grain, and to obtain a thoroughly clean elastic pelt, than is absolutely needful for any other variety of leather. The tawing mixture consists for each 100 lb of skins of about 25 lb of flour, 34 lb of alum, nearly 1 lb of common salt, and 250 eggs. These substances are made into the consistency of a cream with water, and placed either in a vat or in a revolving drum. In the former case, the skins are trodden with the feet, while in the latter they are tumbled about. The tawed skins, being over-poled, grain side upwards, and dried rapidly; when hardy they are heated in a damp place to soften a little, then damped by passing them through water, next trodden out by foot on a ridged or barred floor, stacked or stretched over a blunt knife, partly dried, and again stacked and dried thoroughly. For dyeing, the skins are first washed out in warm water to free them from superfluous lime, then given a "fel" with yolk of eggs and salt. For bright colours such as soft greys, lavenders, and yellows, the skins are plunged into small dye vats of the proper dye colours, but for all the darker colours the skins are stretched out on a table and the dye stuffs applied with brushes. In the latter case the skins are given a greenish or some alkaline solution, then dyed mostly with logwood, Brazil wood, fustic, Prussian berries, or preparations of indigo, aniline colours being now little used for glove dyeing. The dye is mounted by a wash of the sulphate of either zinc, copper, or iron, which operation also clears and develops the colour. After dyeing it only remains to free the leather from superfluous moisture, dry it, and then with slight damping stake or stretch it out once or twice, which finishes the preparation of this valuable class of leather.

The "feeding" of kid leathers with yolk and sometimes oil produces partial shaming, softening the texture and giving the leather that peculiar suppleness to which much of its value is due. The flour added, by means of the gluten it contains, is supposed to facilitate the absorption of the alumina and thus hasten the tawing.

Hungarian Leather consists of hides and heavy skins partly tawed and partly shamed. In the preparation of this leather it was formerly the practice to shave off the hair with a sharp knife, but now the hides are unshaved either by sweating or liming. After tawing with alum and salt the leather is stuffed by first heating it over a charcoal fire and impregnating the hot leather with tallow, or, as is now common, by working it in a drum with a hot mixture of cod oil and tallow. This leather, being comparatively cheap, is much used on the Continent for common saddle purposes, for which it is blackened, and it is also serviceable for machinery belts.

A leather has been patented by Professor Knapp, in which the active tanning or tawing principle is a basic salt of the oxide of iron. It was intended principally for sole leather, but it does not appear to have met with practical success, and its manufacture is understood to have been abandoned.

Heinsberg's Chroma-Tanned Leather.—Quite recently a large amount of attention has been devoted to a system of tanning or tawing by means of chromum compounds patented by Dr Heinsberg, a German chemist. The oxidizing power of chromate salts, and their powerful effect when combined with organic matter, has long been recognized, and the knowledge of this action and counter-action has led to many unsuccessful attempts, in the past, to use chromates in tanning. It is claimed, however, that the difficulties have been overcome by Dr Heinsberg's process, which consists practically in the use of bichromate of potash, chloride of

potassium or chloride of sodium, and sulphate of alumina. These are mixed together in one large stock tank, from which is drawn by means of a system of piping communicating with each pit the quantity required to make the necessary strength of liquor, thus at first, as in tanning by bark, is very weak, but is strengthened systematically every few days according to the thickness of the hides being tanned. The quantity of chrome and used ordinarily amounts to from about 2½ to 5 per cent. of the weight of leather produced. The price of bichrome at present is 8½d per lb, so that 100 lb weight of leather would cost for this agent from 1s. to 3s.

Light skins such as sheep skins and calf skins are tanned in less than a week, ox and buffalo hides in about a fortnight, and values above 5 inches thick, in six weeks. After being tanned, the hides, which are at this stage of a yellowish tint like sumach-tanned leather, are dipped in chloride of barium, which converts the soluble chromates on the surface into the insoluble chromate of barium. If any particular shade of colour is desired it is then put on, and in general hides are coloured like ordinary leather. After being coloured the leather is allowed to get nearly dry, when it is immersed in pure paraffin wax and resin dissolved together in certain proportions. These materials, with chloride of potassium or chloride of sodium and sulphate of alumina, go to give the necessary smoothness, weight, and waterproofing to the leather. The hides are afterwards dried and brushed clean by brushing machinery. Thus finished, the leather differs very little in appearance from ordinary leather.

Dr Henselwager claims as the meritorious and original feature of his process the complete use of chromate compounds and fatty matters. The stuffing with fat or paraffin of chrome leather, he maintains, in the first place, reduces chromic acid to chrome oxide, and secondly the oxygen thus liberated in the substance of the hide oxidizes the fatty oil and bodies, which, uniting with the chrome oxide, form a third insoluble compound mediant in the fibre of the leather, rendering it at once supple and waterproof.

The leather has been reported on by Mr David Kirkcaldy, London, as considerably stronger than the best bark-tanned leather he was able to procure. After stepping samples of it in cold water six days it has been found that the total quantity of tannin material extracted amounted to from 0·14 to 1·85 per cent., while first-class bark-tanned leather similarly treated yielded 6·79 per cent. By boiling chrome leather in water for half an hour, the loss ranged from 0·05 to 0·64 per cent.

The process seems to offer the means of utilizing classes of hides, such as sheep skins, and values above 5 inches thick, and the values of hippopotamus, &c., in a way which has not hitherto been found practicable by other processes. Sheep skins in chrome-tanning do not require to be pured and freed from their oleaginous constituents, and when finished by this process are no longer porous, but become waterproof, and may be shaved and whitened like calf skins, and may be used for shoe purposes.

The Henselwager process is at work in various localities throughout Germany. For the United Kingdom and British colonies the patent rights have been acquired by the Reignton Chemical Company of Glasgow, who, as manufacturers of bichromate of potash, have an indirect interest in the development of the system. Although the method has yet scarcely passed the critical stage of practical experiment, the products appear to be gaining the favour of men of experience, and, should the system meet the expectation of its originator and promoters, it cannot in the end fail greatly to cheapen many useful classes of leather.

Shamooy or Oil Leather.

The process of preparing leather by impregnating hides and skins with oil is probably the oldest system of leather manufacture. It is that which in earlier times was most largely followed, and among rude and semi-civilized people it is still commonly practised. Notwithstanding this, well-shamooyed leather requires the exercise of much care and numerous manipulative processes. Hides and skins of all classes are prepared by shamooying; but sheep, goat, deer, antelope, and small animal skins in those usually treated, an enormous number of fish splits of sheep being shamooyed for common purposes. The extensive employment of deer skins in shamooying gives the product the name of buck or doe leather, and from the use of the chumens skin of the Alp is derived the name of the process chumens or shamooy, while from the fact that it may be easily washed like cloth it is called wash leather. In former times a large number of ox hides were shamooyed, but now that is little practised.

Skins for shamooying are in the preliminary stages treated almost as for ordinary tanning; but, beyond unhairing, the surface of the grain is shaved off in all except the small thin skins. They are afterwards treated with fish line solution, and repeatedly washed to bring the pelt to somewhat open and porous condition, drenched with brine to remove all lime, and rinsed in an acid liquor. The skins are next stacked out and taken to the filling machine or stocks, where, after being rubbed over individually with fish oil, they are hammered for about two hours to force the oil into the substance of the skin. They are then stretched, hung up for some time, again

oiled, and filled, and these operations may be repeated from six to twelve times according to the thickness of the skins treated. After thorough impregnation the skins are dried, then heaped up in a heated room, where a process of oxidation is quickly set up. So soon as the skins assume a yellow colour and give off a peculiar odour, not at all like fish oil, the process is complete and the fermentation is stopped. It is now found that about one-half of the oil is oxidized within the skin and combined with the tissue to form leather, while the remainder is present only in the condition of mechanical impregnation. This uncombined oil is washed out with a weak potash solution, and the fat so recovered, known as *degras*, forms a valuable material for the dressing of common leather by curriers.

Parchment, Vellum, and Shagreen.

These substances, properly speaking, do not come under the heading of leather at all, seeing they are neither tanned nor tawed, but simply are dressed skins dried and prepared for their peculiar uses. Parchment is made from calf, goat, sheep, and swine skins by the unhairing and dressing processes through which all skins pass preparatory to tanning. When they are thoroughly skinned and fleshed, the skins are stretched tightly in every direction over a frame, and in that condition shaved and equalized on both sides with the currier's knife. After drying, the skins are ready for use as drum leather and for the other ordinary applications of parchment. The common kinds of vellum are made from sheepskin splits, of which two may be obtained from a single skin. To prepare these for use, the splits are, after stretching and drying, repeatedly rubbed over with powdered chalk and powdered stone to raise the fine even velvety surface peculiar to vellum. Common shagreen consists of the skins of various species of sharks and rays prepared in a similar manner to parchment, and Persian shagreen is a kind of tawed parchment with an artificial grain embossed in it, by passing into the substance while in a damp condition the small round seeds of a species of *Ctenopodium*. Shagreen is frequently dyed in bright colours, and used for ornamenting the surfaces of small articles, and the handles of daggers, swords, &c.

Commerce and Statistics.

It is quite impossible to form any adequate estimate of the extent and value of such a trade as that in leather. The raw materials are obtained, in almost equal abundance, throughout the civilized world, and the manufacturing operations are, to a greater or less degree, carried on in every country. The raw materials are largely supplied by local producers, and much of this trade is never recorded in any statistical returns. There can be no doubt that leather takes rank among the foremost half dozen of human industries. Both in Europe and America there is a large number of small and new manufactures and manufactured products, while from the East Indies and the British colonies the largest supplies of various untanned and tanned hides and skins are now exported. Taking cattle hides alone, the import trade of the great manufacturing centres has been stated for 1879—

United Kingdom	... 1,129,458	Hamburg	... 940,880
Marseilles	... 652,597	Boston and New York (U.S.)	3,165,000
Havre	... 825,741		
Antwerp	... 808,413	Total for Europe and America	7,420,881

These came principally from the River Plate, Rio Grande, and Brazil, and are exclusive of 250,000 horse hides imported into Europe, and the whole of the enormous exports of the East Indies. The total number of hides, raw and tanned, exported from India in the year 1877-78 was 9,300,955, and the average for the four preceding years exceeded 7,250,000. A great proportion of these are tanned skins, shipped from Madras almost exclusively to the United Kingdom,—buffalo and the heavier flint dry hides going more largely to the United States. The imports of East Indian skins into the United Kingdom during 1880 amounted to 1,735,978, and in 1881 the number fell to 4,680,803. Of tanned goat and sheep skins, again, the annual export from Madras alone reaches nearly 10,000,000 skins, the numbers for 1880 having been 9,799,900 skins. The total number of sheep and goat skins, raw and rough tanned, imported into the United States in 1880 was 11,781,855, of which 6,533,855 were raw soft stock, 8,859,750 were raw hard East Indian skins, principally from Bengal, and 9,055,500 were tanned East Indian skins.

The following table shows the sources and number of hides imported into the United Kingdom during 1880—

River Plate, salted hides	... 819,743	West Indies	... 10,884
" "	... 81,087	" "	... 12,000
Rio Grande, salted	... 173,287	Cape tops and grubs	... 12,087
Cape	... 80,283	North America	... 10,988
" "	... 290,173	East India Islands	6,707,149
Australia	... 126,140	Horse hides	... 95,200
Brazil	... 96,249		

The following are the Board of Trade returns of articles connected with tanning imported into the United Kingdom, and exported, during the five years ending 1880—

Imports.

	1876	1877	1878.	1879	1880
I Quantities					
Back for tanners' use, cwts	672,810	615,095	597,636	417,864	445,001
Raw hides—					
Cattle and gumbo, tons	26,804	29,618	26,438	26,684	22,107
Sheep	19,797	18,408	18,022	19,231	11,616
Hides	84,925	29,989	28,677	24,217	35,773
Hides	35,884	26,422	31,478	18,619	21,028
Hides—					
Raw	1,005,676	1,446,864	1,611,964	1,011,001	1,941,738
Tanned, tawed, curried, or dressed	44,708,591	40,917,089	37,131,326	38,185,856	47,653,449
Leather manufactures—					
Boots and shoes, per pair	100,898	98,399	101,699	127,584	94,849
Gloves	1,497,487	1,244,150	1,090,438	1,062,747	1,456,768
Unenumerated .. value \$	283,204	779,008	618,492	261,011	278,768
Skins—					
Sheep and lamb, number	18,136,849	13,077,581	11,231,648	9,402,011	12,881,418
Goat	8,651,112	8,151,089	7,806,864	10,194,108	11,467,236
Seal	607,373	728,737	792,779	864,208	835,379
Other sorts .. value \$	244,598	281,078	221,147	200,129	86,844
II Value					
Back for tanners' use ..	215,378	282,926	254,110	161,678	180,585
Cattle and gumbo	510,645	738,942	694,080	650,000	471,100
Sheep	214,368	224,862	231,838	170,699	145,045
Valonia	628,821	698,497	532,810	649,540	530,054
Galls	94,734	73,024	49,509	138,364	138,364
Hides—					
Raw	8,902,398	5,645,901	5,490,068	2,916,077	5,978,582
Tanned, tawed, curried, or dressed ..	2,077,028	2,088,722	2,871,029	2,300,880	3,050,022
Leather manufactures—					
Boots and shoes	228,470	248,738	270,147	479,498	351,570
Gloves	1,840,565	1,618,557	1,800,688	1,938,089	1,743,591
Skins—					
Sheep and lamb ..	1,654,042	1,200,138	1,103,928	894,104	1,414,387
Goat	860,670	862,272	899,008	1,148,429	1,277,745
Seal	219,440	244,538	246,784	265,271	238,275

Exports.

	1876	1877	1878.	1879	1880
I Quantities					
Leather—					
Tanned, unwrought cwts	149,511	144,431	180,956	218,690	146,986
Boots and shoes, per pair	433,230	402,156	440,278	438,974	409,189
Other articles ..	1,469,274	1,681,234	1,448,948	1,486,004	1,293,727
Saddlery and harness ..	397,581	382,939	461,446	494,020	496,275
Skins and furs, all sorts ..	821,647	329,376	1,022,007	1,886,130	1,044,547
II. Value.					
Leather—					
Tanned, unwrought ..	1,511,346	1,188,136	1,377,282	1,807,497	1,132,860
Boots and shoes	1,404,078	1,288,678	1,514,781	1,311,000	1,203,727
Other articles ..	829,775	868,176	725,377	728,284	574,694

The imports of hides to the United States through the two principal ports, New York and Boston, and the receipts of horse hides in these cities for 1878-80, are shown in the following tables—

New York

	1878.	1879	1880
Brazil	150,282	99,079	89,358
Buenos Ayres	297,323	280,744	449,598
Montevideo	436,202	620,088	181,044
Orizaba	81,859	84,209	81,443
Rio Grande	60,631	177,063	141,103
South America (other states) ..	131,511	111,267	46,697
Central America	907,022	947,056	406,009
Mexico	121,371	96,901	119,476
West Indies	51,505	51,505	50,002
East Indies (Congo) ..	21,914	709	27,617
Europe	119,588	805,015	328,416
China	65,242	65,242	171,839
Africa	85,070	128,770	105,061
Sundry	1,882		
Total foreign ..	1,783,944	2,169,273	2,047,002
" domestic ..	785,470	800,180	679,063
foreign and domestic ..	2,623,414	3,019,471	2,626,180
Calcutta value buffalo ..	7,092	8,698	6,694
" cow	1,468	1,684	5,640

Boston.

	1878.	1879	1880.
Buenos Ayres	448,880	306,944	422,677
Montevideo	8,500	10,920	16,277
Rio Grande	189,083	221,458	809,007
European ports			121,177
Other foreign ports ..	247,061	437,802	848,909
Total foreign ..	884,004	1,040,278	1,387,847
" domestic ..	888,406	678,290	794,346
Grand total ..	1,772,410	1,718,468	2,082,194

Value in Dollars of Leather Exported from the Port of New York during the three years 1878-80.

	1878	1879.	1880.
Liverpool	2,179,489	1,943,810	2,292,881
Baltimore	1,022,000	971,117	639,358
Hull	888,673	449,684	786,106
Rotterdam	129,219	89,474	128,266
Amsterdam	188,328	157,063	36,475
London	118,442	89,024	120,792
Rotterdam	91,032	104,598	60,688
Glasgow	83,881	62,840	67,199
Bremen	137,199	170,499	20,183
Havre	8,817	2,640	430
Trieste	81,492	18,600	16,831
Total	4,576,402	8,909,018	6,118,884

The principal leather markets of the United Kingdom are London, where there are quarterly fairs, Leeds, with eight fairs yearly, and Bristol, which has two leather fairs per year. In the United States the commerce centres principally in New York, Boston, and Philadelphia. On the European continent Paris, Marseilles, Vienna, and Berlin are the most important centres of the leather trade, with Antwerp and Havre as great markets for the sale of hides and skins. (J. P. A.)

LEATHER, ARTIFICIAL. Under the name of artificial leather, or of American leather cloth, large quantities of a material having, more or less, a leather-like surface are used, principally for upholstery purposes, such as the covering of chairs, lining the tops of writing desks and tables, &c. There is considerable diversity in the preparation of the material, but most commonly it consists of a web of calico first prepared with a thick paste to fill up the interstices, and thereafter coated with a mixture of boiled linseed oil mixed with dryers and lamp-black or other pigment, uniformly spread, smoothed, and compressed on the cotton surface by passing it between metal rollers. When the surface is to possess a glossy enamel-like appearance, it receives a finishing coat of copal varnish. A grained morocco surface is given to the material by passing it between suitably embossed rollers. Another material now largely used for preparing artificial leather consists of gelatin mixed with appropriate colouring material, and such chemical agents as, by their reaction on that body, render it insoluble,—calico being coated with the mixture in the manner indicated above. Such insoluble compounds are obtained by the action of acetate of alumina on gelatin, with exposure to a temperature of about 160° Fahr., or by the addition of about one per cent. of bichromate of potash to gelatin solution and exposure to light. The addition of a proportion of glycerin to the gelatinous mass renders the resulting "leather" softer and more plastic than it would otherwise be. These preparations have a close affinity to cloth water-proofed with India-rubber, and to such manufactures as ordinary waxcloth. An artificial leather has been patented and proposed for use as soles for boots, &c., composed of powdered scraps and cuttings of leather mixed with solution of gutta-percha dried and compressed. In place of the gutta-percha solution, oxidized linseed oil or dissolved resin may be used as the binding medium for the leather powder.

LEAVENWORTH, the largest city in the State of Kansas, and chief town of Leavenworth county, is situated in an amphitheatre formed by the bluffs of the right bank of the Missouri, in the midst of a rich agricultural country. The distance from St Louis by river is 496 miles, and by rail 309 miles. In 1853 the site of the city was covered with thick hazel brush, without a trace of human habitation. The following year saw the laying out of the first streets, and by 1864 the value of the taxable property, real and personal, amounted to \$4,103,562. Among the principal buildings are a large Roman Catholic cathedral, a State penitentiary, and a State normal school. Its position on the river, and an extensive railway system, have given Leavenworth a flourishing trade. It possesses two practically inexhaustible mines of bituminous coal,

and has more large manufacturing establishments than any other town on the Missouri, including grist mills, foundries, and manufactories of waggon, carriages, furniture, and shoes. About 2 miles above the city is Fort Leavenworth, the military headquarters of the department of the Missouri. The Government reservation has a river frontage of 6 miles, with a depth of 1 mile. The population was 7429 in 1860, 17,873 in 1870, 16,546 in 1880. At this last date the reservation contained 1115 individuals.

LEBANON. The name of Mount Lebanon (Heb. *לְבָנוֹן*), from the Semitic root *laban*, "to be white, or whitish," probably refers, not to the perpetual snow, but to the bare white walls of chalk or limestone which form the characteristic features of the whole range. Syria is traversed by a branch thrown off almost at right angles from Mount Taurus in Asia Minor, and Lebanon is the name of the central mountain mass of Syria, extending for about 100 miles from north-north-east to south-south-west. It is bounded W by the sea, N. by the plain *Jûn Akkâr*, beyond which rise the mountains of the Nussirieh, and E. by the inland plateau of Syria, mainly steppe-land. To the south Lebanon ends about the point where the river Litâny bends westward, and at Bannâs. A valley narrowing towards its southern end, and now called El-Bukâ's, divides the mountainous mass into two great parts. That lying to the west is still called *Jebel Libân*; the greater part of the eastern mass now bears the name of the Eastern Mountain (*Jebel el-Sharkî*). In Greek the western range was called *Libanus*, the eastern *Antilibanus*.¹ The southern extension of the latter, Mount *HERMON* (*q. u.*), may in many respects be treated as a separate mountain.

Lebanon and Antilibanus have many features in common, in both the southern portion is less arid and barren than the northern, the western valleys better wooded and more fertile than the eastern. In general the main elevations of the two ranges form pairs lying opposite one another; the forms of both ranges are monotonous, but the colouring splendid, especially when viewed from a distance, when seen close at hand, indeed, only a few valleys with perennial streams offer pictures of landscape beauty, their rich green contrasting pleasantly with the bare brown and yellow mountain sides.

Geology.—The Lebanon strata are generally inclined, curved, and twisted, often vertical, seldom quite horizontal. Throughout the whole of Syria the prevailing line of cleavage runs from north to south; subordinate to this is another at right angles to it. The rocks belong to the Middle Chalk system, and fall into four subdivisions. The first consists of an under hippurite zone about 3000 feet thick. Sometimes light grey dolomites boldly rise to a height of several hundred yards (as in *Kasrawân*); sometimes masses of marble present equally grand mountain forms (*Jezzin*); sometimes again friable marl and clay occur, producing rich pasture lands. The last member of this lower zone is a brown colite containing sponges, corals, and echinoderms, amongst which the best known fossil is *Otaris gladius* (Salina). Here also belong the *Radiolaria* of Hakei, above which occurs the famous bed of fossil fishes. The second subdivision of the Middle Chalk consists of a thick sandstone formation, distinguished by the presence of *Trigonia scabra* and *syriaca*, and by a fossil balsam poplar (*Nicotia*). To the period of the formation of this member of the system belong volcanic eruptions of melaphyre and basaltine, and also copious eruptions of ashes, which are now met with as tufa in the neighbourhood of the igneous rocks. These eruptive rocks, which every-

where have again been overlaid by the thick sandstone, yield bitumen (mineral oils, asphalt, and dysochi), and have also had a great influence upon the superficial aspect of the country, the sandstone stratum (1300 to 1600 feet thick) having become the centre of its life and fertility, unusual as here alone water can gather. In the third subdivision, the Turon strictly so-called, oyster beds (*Ostrea africana*) and a stratum of orbiculites have the widest diffusion. Above the oysters come the ammonites (*Ammonites syriacus*, Von Buch). The fourth subdivision is formed by a light grey chalk of the upper hippurite zone, which begins in the Bukâ's, and can be traced as far as to the Red Sea. The latest member is the Eocene nummulite (especially in Antilibanus). Generally speaking the prevailing colours are white in the first district, brown in the second, yellow in the third, and grey in the fourth. Apart from the formations already named, there only remain to be mentioned one or two more recent Tertiaries, which in some cases may go back to the end of the Miocene period, but for the most part are Pliocene. They are met with partly on the coast, being due to the action of the sea (Tripoli), partly in the Bukâ's (Zahleh), the result of the action of fresh water. Finally, throughout the whole of the Lebanon district, there are unmistakable traces of ice action in the shape of ground moraines and erratic blocks. The glacier remains may practically be said to be associated with the four chief streams (Nahr Kadisha, Jôr, Ibrâhim, and Kelb).

Vegetation.—The western variant has the common characteristics of the flora of the Mediterranean coast, but the eastern portion belongs to the poorer region of the steppes, and the Mediterranean species are met with only sporadically along the water-courses. Forest and pasture land in our sense of the word do not exist: the place of the first is for the most part taken by a low brushwood; grass is not plentiful, and the higher ridges maintain a growth of alpine plants only so long as patches of snow continue to lie. The rock walls harbour some rock plants, but many absolutely barren wildernesses of stone occur. (1) On the western variant, as we ascend, we have first, to a height of 1600 feet, the coast region, similar to that of Syria in general and of the south of Asia Minor. Characteristic trees are the locust tree and the stone pine; in *Melba Asdarach* and *Ficus Sycomorus* (Bayrou) we have an admixture of foreign and partially subtropical elements. The great mass of the vegetation, however, is of the low-growing type (*maquis* or *garrigue* of the western Mediterranean), with small and stiff leaves, and frequently thorny and aromatic, as for example the ilex (*Quercus coccifera*), *Smilax*, *Cistus*, *Lentiscus*, *Calycotome*, &c. (2) Next comes, from 1600 to 6500 feet, the mountain region, which may also be called the forest region, still exhibiting as it does sparse woods and isolated trees wherever shelter, moisture, and the bad husbandry of the inhabitants have permitted their growth. From 1600 to 3200 feet is a zone of dwarf hard-leaved oaks, amongst which occur the Oriental forms *Fontanella phyllagroides*, *Acer syriacus*, and the beautiful red-stemmed *Arbutus Andracina*. Higher up, between 3700 feet and 4200 feet, a tall pine, *Pinus Bruta*, Ten., is characteristic. Between 4200 and 6200 feet is the region of the two most interesting forest trees of Lebanon, the cypress and the cedar. The former still grows thickly, especially in the valley of the Kadisha; the horizontal is the prevailing variety. In the upper Kadisha valley there is a cedar grove of about three hundred trees, amongst which five are of gigantic size; it is alleged that other specimens occur elsewhere in Lebanon. The *Cedrus Libani* is intermediate between the *Cedrus Deodara* and the *C. atlantica* (see CHÉDAR). The cypress and cedar zone exhibits a variety of other leaf-bearing and coniferous

¹ Lat., *Antilibanus*. The popular form Antilebanon is not legitimate.

trees; of the first may be mentioned several oaks—*Quercus Meliut*, *Q. subulpinia* (Kotschy), *Q. Cerria*, and the hop-hornbeam (*Ostrya*); of the second class the rare Cilician silver birch (*Abies cilicia*) may be noticed. Next come the junipers, sometimes attaining the size of trees (*Juniperus excelsa*, *J. repens*), and, with fruit as large as plums, *J. drupacea*). But the chief ornament of Lebanon is the *Rhododendron ponticum*, with its brilliant purple flower clusters; a peculiar evergreen, *Vincetoxicum*, also adds beauty to this zone. (3) Into the alpine region (6200 to 10,400 feet) penetrate a few very stunted oaks (*Quercus subulpinia*, Kotschy), the junipers already mentioned, and a barberry (*Berberis cretica*), which sometimes spreads into close thickets. Then follow the low, dense, prone, pillow-like dwarf bushes, thorny and grey, common to the Oriental high lands—*Astragalus* and the peculiar *Acantholimon*. They are found up to within 300 feet of the highest summits. Upon the exposed mountain slopes thubarb (*Rheum Ribes*) is noticeable, and also a vetch (*Vicia cuneata*, Lab.) excellent for sheep. The spring vegetation, which lasts until July, appears to be rich, especially as regards corolla-bearing plants, such as *Corydalis*, *Gagea*, *Bulbularia*, *Colchicum*, *Puschkinia*, *Geranium*, *Ornithogalum*, &c. The flora of the highest ridges, along the edges of the snow patches, exhibits no forms related to our northern alpine flora, but suggestions of it are found in a *Draba*, an *Androsace*, an *Alysse*, and a violet, occurring, however, only in local species. Upon the highest summits are found *Saxifraga Puntica* (resembling our *Silene acaulis*) and varieties of *Galium*, *Euphorbia*, *Astragalus*, *Veronica*, *Jurinea*, *Festuca*, *Scrophularia*, *Geranium*, *Asphodelus*, *Allium*, *Asperula*, and, on the margins of the snow fields, a *Taraxacum* and *Ranunculus* *Scutellaria*. The alpine flora of Lebanon thus connects itself directly with the Oriental flora of lower altitudes, and is unrelated to the glacial flora of Europe and northern Asia.

Zoology.—There is nothing of special interest about the fauna of Lebanon. Bears are no longer numerous, the panther and the ounce are met with; the wild hog, hyena, wolf, and fox are by no means rare; jackals and gazelles are very common. The polecat and hedgehog also occur. As a rule there are not many birds, but the eagle and the vulture may occasionally be seen; of eatable kinds partridges and wild pigeons are the most abundant. In some places the bat occasionally multiplies so as actually to become a plague.

Geography.—The district to the west of Lebanon, averaging about six hours in breadth, slopes in an intricate series of plateaus and terraces to the Mediterranean. The coast is for the most part abrupt and rocky, often leaving room for only a narrow path along the shore, and when viewed from the sea it does not lead one to have the least suspicion of the extent of country lying between its cliffs and the lofty summits behind. Most of the mountain spurs run from east to west, but in northern Lebanon the prevailing direction of the valleys is north-westerly, and in the south some ridges also run parallel with the principal chain. The valleys have for the most part been deeply excavated by the rapid mountain streams which traverse them; the apparently inaccessible heights are crowned by numerous villages, castles, or cloisters embosomed among trees. Of the streams which are perennial, the most worthy of note, beginning from the north, are the Nahr Akkâr, N. Arka, N. el-Bârid, N. Kadisha, "the holy river" (the valley of which begins far up in the immediate neighbourhood of the highest summits, and rapidly descends in a series of great bends till the river reaches the sea at Tripoli), Wâdy el-Joz (falling into the sea at Batrin), Wâdy Fidar, Nahr Ibrahim (the ancient Adonis, having its source in a recess of the great mountain amphitheatre where the

famous sanctuary Apheca, the modern Afke, lay), Nahr el-Kalb (the ancient Lycus), Nahr Beirut (the ancient Magora, entering the sea at Beyrout), Nahr Dâmir (ancient Tamyras), Nahr el-Awaly (the ancient Boetrenus, which is in the upper part of its course is joined by the Nahr el-Barik). The 'Awaly and the Nahr el-Zaherâni, the only other streams that fall to be mentioned before we reach the Litâny, flow north-east to south-west, in consequence of the interposition of a ridge subordinate and parallel to the central chain. On the north, where the mountain bears the special name of Jebel Akkâr, the main ridge of Lebanon rises gradually from the plain. A number of valleys run to the north and north-east, among which must be mentioned that of the Nahr el-Kabir, the Eleutherus of the ancients, which takes its rise in the Jebel el-Abyad on the eastern slope of Lebanon, and afterwards, skirting the district, flows westward to the sea. To the south of Jebel el-Abyad, beneath the main ridge, which as a rule falls away suddenly towards the east, occur several small elevated terraces having a southward slope; among these the Wâdi en-Nasr ("vale of eagles"), and the basin of the lake Yammina, with its intermittent spring Neb'a el-Arba'in, deserve special mention. Of the streams which descend into the Bukâ'a, only the Bârdâni need be named; it rises in Jebel Sunnin, and enters the plain by a deep and picturesque mountain cleft at Zahleh. With regard to height, the most elevated summits occur in the north, but even these are of very gentle gradient, and are ascended quite easily. The names and the elevations of the several peaks, which even in summer are covered with snow, have been very variously given by different explorers; according to the most accurate accounts the "Cedar block" consists of a double line of four and three summits respectively, ranged from north to south, with a deviation of about 35°. Those to the east are 'Uyân Urghush, Makmal, Muskiyya (or Naba' esh-Shemâil), and Ras Zahr el-Kasb; fronting the sea are Karn Saûd or Tumârûn, Fumm el-Misâb, and Zahr el-Kandil. The height of Zahr el-Kasb, by barometric measurement, is 10,018 feet; that of the others is almost the same. South from them is the pass (8351 feet) which leads from Baalbec to Tripoli; the great mountain amphitheatre on the west side of its summit is remarkable. Further to the south is a second group of lofty summits—the snow-capped Sunnûn, visible from Beyrout; its height is 8554 feet, or, according to other accounts, 8895 feet. Between this group and the more southerly Jebel Kuneish (about 6700 feet) lies the pass (4700 feet) now traversed by the French post road between Beyrout and Damascus. Among the other bare summits still further south are the long ridge of Jebel el-Barik (about 7000 feet), the Jebel Nîha, with the Tan'amât Nîha (about 6100 feet), near which is a pass to Sidon, and the Jebel Rihân (about 5400 feet). The Bukâ'a, the broad valley which separates Lebanon from Antilibanus, is watered by two rivers having their watershed near Baalbec, at an elevation of about 8800 feet, and separated only by a short mole at their sources. That flowing northwards, El-'Asy, is the ancient Orontes; the other is the Litâny. In the lower part of its course the latter has scooped out for itself a deep and narrow rocky bed, at Burghuz it is spanned by a great natural bridge. Not far from the point where it suddenly trends to the west lie, immediately above the romantic valley, at an elevation of 1500 feet, the imposing ruins of the old castle Kafât esh-Shakîf, near one of the passes to Sidon. In its lower part the Litâny bears the name of Nahr el-Kasimiyeh. Neither the Orontes nor the Litâny has any important affluent.

The Bukâ'a used to be known as Caesayria (Strabo, xvi. 2, 21), but that word as employed by the ancients had a

much more extensive application. At present its full name is Bukā'a el-'Aziz (the dear Bukā'a), and its northern portion is known as Sahlet Ba'albek (the plain of Baalbek). The valley is from 4 to 6 miles broad, with an undulating surface. It is said to contain one hundred and thirty-seven hamlets or settlements, the larger of which skirt the hills, while the smaller, consisting of mud hovels, stand upon dwarf mounds, the debris of ages. The whole valley could be much more richly cultivated than it is at present; but fever is frequent.

The Antilibanus chain has in many respects been much less fully explored than that of Lebanon. Apart from its southern offshoots it is 67 miles long, while its width varies from 16 to 13½ miles. It rises from the plain of Hasya-Homs, and in its northern portion is very arid and barren. The range has not so many offshoots as occur on the west side of Lebanon; under its precipitous slopes stretch table-lands and broad plateaus, which, especially on the east side looking towards the steppe, steadily increase in width. Along the western side of northern Antilibanus stretches the Khassā'a, a rough red region lined with juniper trees, a succession of the hardest limestone orests and ridges, bristling with bare rock and crag that shelter tufts of vegetation, and are divided by a succession of grassy ravines. On the eastern side the parallel valley of 'Asal el-Ward deserves special mention; the descent towards the plain eastwards, as seen for example at Ma'kila, is singular,—first a spacious amphitheatre and then two deep very narrow gorges. The perennial streams that take their rise in Antilibanus are not numerous; one of the finest and best watered valleys is that of Helbin, the ancient Chalybon, the Helbon of Ezek. xxvii. 18. The highest points of the range, reckoning from the north, are Halimat el-Kabu (8287 feet), which has a splendid view, the Fatly block, including Tal'at Mīsa (8721 feet) and the adjoining Jebel Nebi Bārth (7900 feet), and a third group near Bīdān, in which the most prominent names are Shakif, Akhyār, and Abul-Hin (8330 feet). Of the valleys descending westward the first to claim mention is the Wady Yaffa; a little further to the south, lying north and south, is the rich upland valley of Zebedāni, where the Banādā has its highest sources. Pursuing an easterly course of several hours, this stream receives the waters of the romantic 'An Fijā (which doubles its volume), and bursts out by a rocky gateway upon the plain of Damascus, in the irrigation of which it is the chief agent. It is the Amāna of 2 Kings v. 12; the portion of Antilibanus traversed by it was also called by the same name (Cant. iv. 8). The French post road after leaving the Bukā'a first enters a little valley running north and south, where a projecting ridge of Antilibanus bears the ruins of the ancient cities Chalcis and Gerbia. It next traverses the gorge of Wady el-Harir, the level upland Sahlet Judeidh, the ravine of Wady

el-Karn, the ridge of 'Akabāt el-Tin, the descent Daurat el-Bīllān, and finally the unpeopled plain of Dimās, from which it enters the valley of Barādā. This route marks the southern boundary of Antilibanus proper, where the Hermon group begins (vol. xi. p. 751). From the point where this continuation of Antilibanus begins to take a more westerly direction, a low ridge shoots out towards the south-west, trending further and further away from the eastern chain and narrowing the Bukā'a, upon the eastern side of this ridge lies the elevated valley or hilly stretch known as Wady el-Teim. In the north, beside 'Ain Fālūj, it is connected by a low watershed with the Bukā'a; from the gorge of the Litāny it is separated by the ridge of Jebel ed-Dahr. At its southern end it contracts and merges into the plain of Bannās, thus enclosing Mount Hermon on its north-west and west sides, eastward from the Hasbāny branch of the Jordan lies the meadow-land Merj 'Iyūn, the ancient Ijōn (1 Kings xv. 20).

Political Divisions and Population.—The inhabitants of Lebanon have at no time played a conspicuous part in history. These are remains of prehistoric occupation, but we do not even know what races dwell there in the historical period of antiquity. Probably they belonged partly to Canaanites, but chiefly to the Aramean group of nationalities; the Bible mentions Hivites (Judg. ii. 8) and Gibeites (Josh. xii. 6). A portion of the western coast land was always, it may be assumed, in the hands of the Phœnicians, and it is possible that once and again their sovereignty may have extended even into the Bukā'a. Lebanon was also included within the ideal boundaries of the land of Israel, and the whole region was well known to the Hebrews, by whose poets its many excellences are often praised. In the Roman period the district of Phœnicie extended into Lebanon, in the 2d century it, along with the inland districts pertaining to it, constituted a subdivision of the province of Syria, having Emesa (Homs) for its capital; from the time of Diocletian there was a Phœnicie ad Libanum, with Emesa as capital, as well as a Phœnicie Maritima of which Tyre was the chief city. Remains of the Roman period occur throughout Lebanon, and more especially in Hermon, in the shape of small temples, in more or less perfect preservation, for the more sacred ruins of Baalbek see that article (vol. ii. p. 176). Although Christianity only obtained a footing in Lebanon, the pagan worship, and even human sacrifice, nevertheless survived for a long time, especially in remote valleys such as Akfa. The present inhabitants are for the most part of Syrian (Aramean) descent, Islam and the Arab language at no time penetrated very deep into the mountain land. At present the eastern range belongs to the vilayet of Damascus (Soria), of which Damascus itself constitutes the first subdivision (mutasarriflik); the subordinate divisions (kaza) of the government are Damascus, Baalbek, Hāsaway, Rasbiya, and Bukā'a Ghari or Western Bukā'a. Included within the vilayet of Soria, but with an independent administration, is the government of Lebanon properly so called, a region some 87 miles long, which in virtue of an ordinance published by the Porte in concert with the protecting powers in 1861 and revised in 1864 is ruled by a governor, who must be a Christian, in direct dependence on Constantinople. The seat of the pasha is at present at Ba'alda, 6 miles south-east from Beyrut, his summer residence being at Bētēdin. The pashalik is subdivided into the hutenances of Jurd, Bātrūn, Kasrawān, Metn, Zehle, Shūf, and Jezzin. A somewhat different account of the districts is given in the statistical statement (1876) of the English consul at Beyrut—

Districts	Chief Places	Mohammedans.	Maronites
Shūf	Baalbek	4,458	14,472
Jazīra	Jazīra	170	9,160
Dal el-Kamar	Dal el-Kamar	9,842	92
Metn	Beisun	110	2,568
Zahle	Zahle	78	1,894
Kasrawān	Qhazir	80	26,560
Bātrūn	Town	78	46,000
Kūra	Beisun	1,016	1,008
Total		5,244	116,786

The statistics accompanying the French map of 1862 give the population of Lebanon proper as some 100,000 in excess of these figures, but there can be no doubt of the inaccuracy of this estimate. The same authority gives the districts (taken in order from north to south) as follow—'Akkr, ed-Dunayir, el-Kūm (Upper and Lower), ez-Zāwīya, Beherra, Bātrūn, Jebel, Manaster, el-Fetūh, Kasrawān, el-Metn, Zehle, ez-Sūlū, el-Gharb, el-Mansaf, Shahr, Jurd, Arkub, Shūf, Metn, Rihā, Kharrūb, Tūfāh, Shakif, Shahr, Baalbek, Merj 'Iyūn. Hule and the towns of Sidon,

Districts	Mohammedans.	Orthodox Greeks.	Catholics.	Maronites.	Other Sects.	Total.
Shūf	4,458	14,472	20,774	4,242	2,740	48,286
Jazīra	170	9,160	810	8,042	1,402	11,130
Dal el-Kamar	9,842	92	849	849	849	11,531
Metn	110	2,568	2,510	2,510	798	8,486
Zahle	78	1,894	1,894	1,894	80	4,756
Kasrawān	80	26,560	1,006	1,006	2,498	40,750
Bātrūn	78	46,000	266	266	1,070	47,680
Kūra	1,016	1,008	5,932	5,932	60	12,986
Total	5,244	116,786	26,388	27,882	17,800	220,554

Beyrut, and Tripoli are also reckoned in this account as belonging to Lebanon. It also enumerates the following districts—

Districts	Mohammedans.	Orthodox Greeks.	Cath.	Maronites.	Other Sects.	Total.
Hāsaway	890	4,610	170	6,580	...	8,150
Rasbiya	820	4,000	7,000	...	...	19,820
Bal'at	4,110	5,000	2,100	2,100	7,800	20,230
Baalbek	6,020	2,000	4,000	...	8,000	15,230

The Maronites, as the preceding statistics show, are the principal element of the Lebanon population, for the *Druzes*, see vol. vi. p. 483. The *Metawile*, who enjoy no good reputation, are *Shi'ite* Mohammedans; their shi'ite reside at *Jeb'a* in South Lebanon. Of late years Protestants, through the agency of the American mission at *Byrrout*, has begun to take some hold of the population, and is daily gaining ground. The Catholic missions also, with *Byrrout* for their centre, are meeting with some success, and the Western schools are indisputably affecting the culture and manners of the country. The present comparative security of life and property are highly favourable to its development. Since the violent outbreak of 1860, the bloody contests between the Maronites and *Druzes* have not been renewed, although the mutual hatred still continues. To what has been already said on this subject (vol. vi. p. 485), it may here be added that the primary object of the Lebanon mountaineers is before everything the maintenance of their national freedom, and that the responsibility for the massacres of 1860 rests chiefly upon the Turkish Government (*Ahmet Pasha* of *Damascus*). The property of the Maronites had been promised to the *Druzes*, and the Maronites on the other hand had been persuaded to disarm; as soon as the latter had done so they were attacked by *Druzes* and *Turks* together. In *Deir el-Kamar* alone, the chief place of South Lebanon, eighteen hundred Maronites perished. Since the pacification of the country by foreign intervention, particularly on the part of *Napoleon III.*, the *Druzes* have withdrawn more into the inaccessible *Hauan*. Although every inhabitant of Lebanon still retains his warrior habits, and willingly enough joins the high-land troops (six hundred regular soldiers), the situation is now much more pacific, a circumstance due in large measure to the fact that the power of the numerous noble families has been much curtailed. On the other hand the clergy, although for the most part an extremely uneducated body of men, has great influence among the Maronites. The number of Maronite monks in the mountain district is said to reach eight thousand. The monasteries possess a large portion of the best land, which is cultivated by the monks themselves, and is quite exempt from all public burdens. Other land is liable to be taxed annually at the rate of 3s 6d. upon every £55 of assessed value; there is, besides, a poll tax exigible from every healthy male from the age of fourteen until he becomes unfit for work. The village head (*sheikh*), for every £8 of taxes, is entitled to exact from the inhabitants 4s. for his own remuneration. Every inhabitant must devote to the public service four days of free labour in the year. The gross revenue of Lebanon, which amounts to about £32,000 per annum, does not cover the expenses of administration.

The Lebanon mountaineers are a fine vigorous set of men. In what relates to dress they show a preference for gay colours. Tattooing is universal in both sexes. Their diligence is worthy of all praise. In the upper regions cattle breeding is the chief occupation, the numerous flocks of sheep and goats are the great obstacle to forestry in these parts. No care is taken to protect the woods. For practical utility the trees which are planted (besides various fruit trees, especially figs) are the white poplar (for building purposes), the walnut, the olive, and above all the mulberry,—silk culture being an important industry with the mountain population, and still remunerative notwithstanding the occasional fall of prices. In 1872 the production amounted to 2,000,000 oaks (about 5,000,000 lb) of fresh cocoons, from which 1,200,000 oaks of raw silk and 200,000 oaks of silk fabrics were produced, the latter exclusively for home use. The vine is cultivated,

and with great care, at an elevation of 3900 to 5200 feet. Unfortunately the wine is simply stored in large stone jars, there being neither barrels nor cellars; the consequence is that it cannot be kept—in point of fact it is seldom more than a year old—and exportation is impossible. The excellent Lebanon white wine known as *vino d'oro* belongs to the class of sweet wines. Amongst the mineral products coal deserves special mention, the beds are thick, but the presence of iron pyrites prevents it from coming into more general use. Some shafts, from which bitumen is obtained, occur in the neighbourhood of *Hasbaya*, also petroleum wells. The chief food crops are wheat, *Holcus scirpoides*, and barley, the last being cultivated as high as 6500 feet above the sea. Tobacco culture is universal.

Throughout the whole of Lebanon, but especially on the slope towards the sea, carefully tended terraces occur. The houses, little four-cornered boxes, generally shaded by a walnut or fig tree, stand as a rule upon the slope; the roof is formed by pine stems upon which other timber, brushwood, and finally a coating of mud clay are laid. Under good government Lebanon, with its able and vigorous population, would rapidly develop.

Literature.—Ritter, *Die Erdkunde von Asien. Die Syrische Halbinsel, Palästina, u. Syrien*, 2d ed., Berlin, 1848–65. Robinson, *Political Geography of Palestine and the adjacent Kingdoms* (London, 1855), and *Physical Geography of the Holy Land* (London, 1856); R. F. Burton and C. F. Tyrwhitt Drake, *Unexplored Syria*, London, 1872. Churchill, *Ten Years' Residence in Mount Lebanon*, 3 vols., 1853. De Ruelle, "L'Antiliban," in the *Bull. de la Soc. de Géogr.*, 6th ser., xvi, 225 sq., Paris, 1868. O. Finau, *Dieu Moutan am Libanon* (Stuttgart, 1870), and *Das alte Orient*, pt. ii, "Geologische Beobachtungen am Libanon," Stuttgart, 1878; Kotschy, "Der Libanon u. seine Alpenflora" in the *Verhandl. d. K.-K. zoolog.-botan. Gesellschaft*, Vienna, 1884. Porter, *Handbook for Travellers in Syria and Palestine*, London, 1876; Socon, *Palestine and Syria*, a handbook for travellers, Baedeker, Leipzig, 1878. For maps, see Burton and Socon-Baedeker, also Van de Velde's *Map of the Holy Land* (Gotha, 1858; Germ. ed., 1866), and the *Carte du Liban d'après les reconnaissances de la brigade topographique du corps expéditionnaire de Syrie en 1860–61*, prepared at the French War Office, Paris, 1862 (A. 90).

LEBANON, a manufacturing "borough" of the United States, capital of Lebanon county, Pennsylvania, is situated on the Union Canal, 24 miles east of Harrisburg by the Lebanon Valley branch of the Philadelphia and Reading Railway. It is substantially built in brick and stone, and is steadily increasing in importance. Its principal industrial establishments are blast furnaces, rolling mills, car-works, planing mills, foundries, and manufactories of organs, paper, cigars, carriages, and agricultural implements. About 7 miles distant are the Cornwall Ore Banks, three eminences—Grassy, Middle, and Big Hill—consisting almost entirely of iron-ore veined with copper. The town was laid out in 1750, and incorporated as a borough in 1813; gas was introduced in 1857, and in 1872 water was brought into the place by gravitation at an expense of \$250,000. The population of Lebanon has increased from 2184 in 1850 to 6727 in 1870, and 8778 in 1880.

LEBDA. See LEPTIS.
LE BEAU, CHARLES (1701–1778), a French historical writer, was born at Paris on October 15, 1701, and was educated at the Collège de Sainte-Barbe and the Collège du Plessis; at the latter he remained as a teacher after the termination of his course as a pupil, until he obtained the chair of rhetoric in the Collège des Grassins. In 1748 he was admitted a member of the Academy of Inscriptions, and in 1752 he was nominated professor of eloquence in the Collège de France. From 1755 he held the office of perpetual secretary to the Academy of Inscriptions, in which capacity he edited fifteen volumes (from the 25th to the 39th inclusive) of the *Histoire* of that institution. He died at Paris on March 13, 1778.

The only work with which the name of Le Beau continues to be associated is his *Histoire du Bas-Empire, en commençant à Constantin le Grand*, in 23 vols 12mo (Paris, 1756-1778), being a continuation of Rollin's *Histoire Romaine* and Crevier's *Histoire des Empereurs*. Its usefulness arises entirely from the fact of its being a faithful record of the Byzantine historians, for Le Beau had no originality or artistic power of his own. Five volumes were added by Amelion (1781-1811), which brought the work down to the fall of Constantinople. A later edition, under the care of Saint-Martin and afterwards of Brunet, has had the benefit of careful revision throughout, and has received considerable additions from Oriental sources.

LEBEDIN, a district town of the Kharkoff government in European Russia, 102 miles north-west of the government town, near the Okhanka and Buravka, two small tributaries of the Dnieper. Its population has increased from 13,137 in 1863 to 17,019 in 1879. There are four annual fairs, and a good trade in grain and cattle.

Lebedin dates from the middle of the 17th century. In 1700 it was the headquarters of the operations of Peter the Great against Mazepa, and the scene of the execution of nine hundred of that hetman's followers, whose common grave is still marked by a mound 70 feet square.

LEBEDYAN, a district town of the Tamboff government in European Russia, situated 132 miles west of Tamboff, on the bluffs of the right bank of the Don. It possesses a modern cathedral (Kazanaki) and several churches of architectural and antiquarian interest; and in the immediate vicinity is the great Eletski Troitski monastery, which under the name Yablonoivi Pustuin was founded in 1621. The prosperity of the town is closely bound up with that of its three annual fairs, of which the first two continue for a month and the last for six days,—many of the inhabitants deriving the better part of their income from the rents paid by their merchant visitors. The chief fair is held near the monastery, and is known as the Troitskaya. The population, returned in 1863 as 5849 (exclusive of the suburbs, with 3046), was 6010 in 1879.

Lebedyan probably dates from the 16th century. It was reckoned a town in the beginning of the 17th, and about 1678 it became the centre of a district.

LEBRJA, or **LEBRJA**, a town of Spain, in the province of Seville, near the left bank of the eastern arm of the Guadalquivir, and on the eastern edge of the flat fluvial tract known as "Las Marismas," formed by that river. It is 44 miles by rail from Seville, which lies north by east, and about 60 miles from Cadiz. The climate is somewhat unfavourably affected by the proximity of the marshes, but the sierra beneath which it lies protects the town from the hot eastern winds, and it enjoys during the heats of summer the pleasant alternation of land and sea breezes. The parish church, the only building of any note, is a somewhat imposing structure in a variety of styles—Moorish, Gothic, Romanesque—dating from the 14th to the 16th century; it contains some early specimens of the carving of Alonso Cano. The manufactures, which are unimportant, consist chiefly of bricks, tiles, and earthenware, for which a useful clay is found in the neighbourhood; there is some trade in the grain, wine, and oil of the surrounding district. The population in December 1877 was 12,864.

Lebrja is the Nabrisia or Nobrisa, surnamed Yeneria, of the Romans; by Julius Africanus (c. 200), who associates it with the worship of Dionysus, the name is derived from *oxyph*. Nabrisah was a strong and populous place during the period of Moorish domination; it was taken by St Ferdinand in 1249, but again lost, and became finally subject to the Castilian crown only under Alphonso the Wise in 1264. It was the birthplace of Elío Antonio de Lebrija or Nobrija (1444-1529), better known as Nebrienseño, one of the most important leaders in the revival of learning in Spain, the tutor of Queen Isabella, and a collaborator with Jimenez in the preparation of the Complutensian Polyglott.

LE BRUN, CHARLES (1619-1690), French painter, was born at Paris 24th February 1619, and attracted the notice of Chancellor Séguier, who placed him at the age of eleven

in the studio of Vouet. At fifteen he received commissions from Cardinal Richelieu in the execution of which he displayed an ability which obtained the generous commendations of Poussin himself, in whose company Le Brun started for Rome in 1642. In Rome he remained four years in the receipt of a pension due to the liberality of the chancellor. On his return to Paris Le Brun found numerous patrons, of whom the celebrated Superintendent Fouquet was the most important. Employed at Vaux la Vicomte, Le Brun, who had an immense amount of worldly tact, ingratiated himself with Mazarin, then secretly pitting Colbert against Fouquet. Colbert also promptly recognized Le Brun's powers of organization, and attached him to his interests. Together they founded the Academy of Painting and Sculpture (1648), and the Academy of France at Rome (1666), and gave a new development to the industrial arts. In 1680 they established the Gobelins, which at first was a great school for the manufacture, not of tapestries only, but of every class of furniture required in the royal palaces. Commanding the industrial arts through the Gobelins, of which he was director, and the whole artist world through the Academy—in which he successfully held every post—Le Brun imprinted his own character on all that was produced in France during his lifetime, and gave a direction to the national tendencies which endured even after his death. The nature of his emphatic and pompous talent was in harmony with the taste of the king, who, full of admiration at the decorations designed by Le Brun for his triumphal entry into Paris (1660), commissioned him to execute a series of subjects from the history of Alexander. The first of these, Alexander and the Family of Darius, so delighted Louis XIV. that he at once ennobled Le Brun (December 1662), who was also created first painter to his majesty with a pension of 12,000 livres, the same amount as he had yearly received in the service of the magnificent Fouquet. From this date all that was done in the royal palaces was directed by Le Brun. The works of the gallery of Apollo in the Louvre were interrupted in 1677 when he accompanied the king to Flanders (on his return from Lille he painted several compositions in the Chateau of St Germain), and finally—for they remained unfinished at his death—by the vast labours of Versailles, where he reserved for himself the Halls of War and Peace, the Ambassadors' Staircase, and the Great Gallery, other artists being forced to accept the position of his assistants. At the death of Colbert, Louvois, who succeeded him in the department of public works, showed no favour to Le Brun, and in spite of the king's continued support he felt a bitter change in his position. This contributed to the illness which on 22d February 1690 ended in his death in the Gobelins. Besides his gigantic labours at Versailles and the Louvre, the number of his works for religious corporations and private patrons is incredible. He modelled and engraved with much facility, and, in spite of the heaviness and poverty of drawing and colour, his extraordinary activity and the vigour of his conceptions justify his claim to fame. Nearly all his compositions have been reproduced by celebrated engravers.

LECCE, one of the most important cities of Southern Italy, and the administrative centre of the province of Lecce (formerly Terra d'Otranto), is situated on the railway between Brindisi and Otranto, about 8 miles from the coast of the Adriatic. Down to the middle of the 18th century it was defended by regular fortifications constructed in the 16th century, and it still preserves some of the gateways, as well as a triumphal arch erected in honour of the entry of Charles V. Among his public buildings are the cathedral (dedicated to St Oronzio, traditional first bishop of the city, whose statue, on a lofty column, adorns the principal square), the old convent of the Celestines now

occupied by the prefecture, the old convent of the Capuchins, and the marble church of St Nicholas. Beauvoisin institutions are specially numerous, and include a hospital dating from 1389, and a communal orphanage from 1608. A public library was founded in 1863. The name of Lecco has long been familiar throughout Italy in connexion with the great tobacco factory now located in the Dominican convent, and cotton and woollen goods, lace, artificial flowers, hats, &c., are among the products of the local industry. The population increased from 17,856 in 1801 to 18,400 in 1871.

Lecco is identified with *Lepagus*, a city of the Salustines, and, though remains of ancient edifices are no longer to be seen, there is evidence of the existence of extensive substructions as late as the 15th century. The name *Lycea*, or *Lycia*, begins to appear in the 8th century. The city was for some time held by counts of Norman blood, among whom the most noteworthy is Bohemond, son of Robert Guiscard. It afterwards passed to the Orsini. The rank of provincial capital was bestowed by Ferdinand of Aragon in acknowledgment of the fidelity of Lecco to his cause. Scipione Ammirato (*Florentinus historiam*), Democeno de Angelis, and G. Bighini the anatomist were natives of the city.

LECCO, a city of Italy, in the province of Como, situated near the southern extremity of the eastern branch of the Lake of Como, which is frequently distinguished as the Lake of Lecco. It is the meeting place of several important roads, and the terminus of a railway from Bergamo, which joins the line from Milan. To the south the Adda is crossed by a fine bridge originally constructed in 1335, and rebuilt in 1609 by Fuentes. Lecco, in spite of its real antiquity, presents quite a modern appearance; and it is the seat of no small industrial activity. Besides the iron-works, which are particularly important, there are brass foundries and oil-works; and silk spinning, cotton spinning, and wood carving are successfully prosecuted. The annual cattle fair lasts fifteen days. In the neighbourhood of the town is Caleotto, the residence of Manzoni, who in his *Promessi Sposi* has left a full description of the district. The population of Lecco was 6815 in 1871.

In the 11th century Lecco, which had previously been the seat of a marquessate, was presented to the bishops of Como by Otto II.; but in the 12th century it passed to the archbishops of Milan, and in 1127 it assisted the Milanese in the destruction of Como. During the 18th century it was struggling for its existence with the metropolitan city; and its fate seemed to be sealed when the Visconti drove its inhabitants across the lake to Valmadrera, and forbade them to raise their town from its ashes. But in a few years the people returned; and Azzone Visconti made Lecco a strong fortress, and united it with the Milanese territory by a bridge across the Adda. During the 15th and 16th centuries the rock of Lecco was an object of endless contention. In 1647 the town with its territory was made a comitatus. The fortifications were finally sold by Joseph II. to Count Serbelloni. Marfisi, one of the first Italian printers, and Morona, Charles V.'s Italian chancellor, were born in Lecco. See Apostolo, *Lecco e suo territorio*, Lecco, 1856.

LE CLERC, JEAN (1657-1736), or CLERICUS, theologian and man of letters, was born March 19, 1657 (o.s.), at Geneva, where his father Stephen Le Clerc was professor of Greek. The family had originally belonged to the neighbourhood of Beauvais in France, and several of its members have acquired some name in literature. On the completion of his grammar school course (in which he made himself remarkable for his omnivorous reading), he applied himself to the study of philosophy under Chouet the Cartesian, and from his nineteenth to his twenty-first year he attended the theological lectures of Mestrezat, Turretin, and Louis Tronchin. In 1678-79 he spent some time at Grenoble as tutor in a private family; on his return to Geneva he passed his examinations and received ordination. Soon afterwards he went to Saumur, where in 1679 were published *Liberi de Sancto Amore Epistolæ Theologicæ* (Irenopol: Typis Philalethianis), usually attributed to his pen; they deal with such subjects as the doctrine of the Trinity, the hypostatical union of the two natures in Jesus Christ, original sin, and the like, in a manner sufficiently

far removed from that of the conventional orthodoxy of the period. From Geneva, which he still continued to regard as his home, Le Clerc in 1682 went to London, where he remained six months, preaching on alternate Sundays in the Walloon church and in the Savoy chapel. Passing over to Amsterdam he was introduced to Locke and Limborch; the acquaintance with the latter soon ripened into a close friendship, which naturally strengthened his preference for the Remonstrant theology, already favourably known to him by the writings of his granduncle Curcellæus, and by those of Episcopius. A final attempt to live at Geneva, made at the request of his relatives there, satisfied him of the unwholesomeness of its stifling theological atmosphere, and in 1684 he finally settled at Amsterdam, first as a moderately successful preacher until ecclesiastical jealousy shut him out from that career, and afterwards as professor of philosophy, belles-lettres, and Hebrew in the Remonstrant seminary. This appointment, which he owed to his friend Limborch, he held from 1684 till 1712, when on the death of the latter he was called to occupy the chair of church history also. His suspected Socinianism was the cause, it is said, of his exclusion from the chair of dogmatic theology. Apart from his varied and immense literary labours, his life at Amsterdam was quite uneventful. His marriage to the daughter of Gregorio Leti took place in 1691. In 1728 and following years repeated strokes of paralysis gradually reduced him to a state of mental imbecility, from which he was released by death on January 8, 1735.

A full catalogue of the publications of Le Clerc will be found, along with adequate biographical material, in Heag's *France Protestante* (where seventy-three works are enumerated), or in *Classique des Docteurs*. Only the most important of these can be mentioned here. In 1685 he published *Sentimens de quelques théologiens de Hollande sur l'Histoire Critique du Vieux Testament composé par le P. Richard Simon*, in which, while pointing out what he believed to be the faults of that author, he undertook to make some positive contributions towards a right understanding of the Bible, among these last may be noted his argument against the Mosaic authorship of the Pentateuch, his views as to the manner in which the five books actually were composed, his opinions (singularly free for the time in which he lived) on the subject of inspiration in general, and particularly as to the inspiration of Job, Proverbs, Ecclesiastes, Canticles. Simon's *Réponse* (1688) elicited from Le Clerc a *Défense des Sentimens* in the same year, which was followed by a new *Réponse* (1687). In 1692 appeared his *Logica seu Ars Ratiocinandi*, and also *Ontologia et Pneumatologia*; these, with the *Physica* (1696), are incorporated with the *Opera Philosophica* which have passed through several editions. In 1693 his series of Biblical commentaries began with that on Genesis, it was not completed until 1731. The portion relating to the New Testament books included the paraphrase and notes of Hammond. Le Clerc's commentary had a great influence in breaking up traditional prejudices and opening men's eyes to the necessity for a more scientific inquiry into the origin and meaning of the Biblical books. It was on all sides hotly attacked,—often for opinions which now seem innocent to the most orthodox. Le Clerc's new edition of the *Apostolic Fathers* of Octavianus, published in 1698, marked an advance in the critical study of these documents. But the greatest literary influence of Le Clerc was probably that which he exercised over his contemporaries by means of the *sermo*, or, if one may so call them, reviews, of which he was editor. These were the *Bibliothèque universelle et historique* (Amsterdam, 25 vols. 12mo, 1688-93), begun along with De la Croix; the *Bibliothèque choisie*, Amsterdam, 26 vols. 18mo, 1703-15; and the *Bibliothèque ancienne et moderne*, 20 vols. 18mo, 1714-25. See Le Clerc's *Paraphrasæ on Pœneus sur des notions de critique, d'histoire, de morale, et de politique; avec la défense de divers ouvrages de M. L. C. par Théodore Parrhasius*, Amsterdam, 1699; and *Vita et opera ad annum MDCCXII, cunctisque operum, philosophæ Clericæ operibus subjunctum*, also attributed to himself. The supplement to Hammond's acts was translated into English in 1699, *Parrhasiana, or Thoughts on Several Subjects*, in 1700, and the *Harmony of the Gospels* in 1701. Twelve *Dissertationes* out of M. Le Clerc's *Genesis* appeared in 1699.

LECTION, LECTONARY, LECTOR. The Jewish custom of reading the books of Moses in the synagogues every Sabbath day was already ancient in the apostolic age, and we learn from Luke iv. 16, 17, that portions were also

read from the prophets, though the system of prophetic lessons at least had not yet reached the fixity of the later ritual. For obvious reasons the reading of Scripture at public worship was continued by the Christian Church with certain modifications (1 Thess. v. 27; Col. iv. 16). An authority so early as Justin Martyr (*Apol.*, I. 67) states that in the Christian assemblies of his day "the memoirs of the apostles, or the writings of the prophets, are read as long as time permits." What we are presently to understand by these "memoirs of the apostles" is doubtful; but the evidence we have, fragmentary though it is, may be said to make it certain that neither in his day, nor for many years afterwards, was the canon of sacred books to be read in public worship rigidly fixed, and still less were definite portions of Scripture appointed to be read on particular days of the ecclesiastical year. Traces of the office of reader as distinct from that of deacon begin to appear in Tertullian (*De Præser.*, 41), who makes frequent allusions to the public reading of both Old and New Testament Scriptures (*Apol.*, 39, *De Præser.*, 36; *De An.*, 9), but says nothing that can be construed as implying anything like a fixed table of lessons. Towards the end of the 4th century, however, indications of a widely spread custom of reading the Scriptures according to a uniform and rigid scheme became frequent; and the practice even then was spoken of as ancient. Thus Chrysostom and Augustine both show incidentally that the Acts of the Apostles were publicly read between Easter and Pentecost and then laid aside, while Genesis was read in Lent. In the *Apostolical Constitutions* (ii. 87) a very methodical service is enjoined, it prescribes two lessons from the Old Testament by a reader, the Psalms of David are then to be sung, next the Acts of the Apostles and the epistles of Paul, and finally (by a deacon or presbyter) the gospels, are to be read. The labours of Scholz and Tischendorf have brought to light a large body of MS. Greek lectionaries ranging between the 7th and the 10th century, from which, when fully collated, it will probably be possible to ascertain with precision the order of yearly lectures contemplated within the circles to which the documents respectively belong. Most of them contain gospel lessons only; the rest lessons from the Acts and the epistles. The *Evangelion* and *Apostolos* of the modern Greek Church has a proper gospel and epistle, not only for every Saturday and Sunday, but for every day of the week. The order of (continuous) lessons for the five ordinary week days cannot be traced with certainty further back than to the 10th century, but those for the Sundays, also for the most part continuous, can be traced, so far as the gospels at least are concerned, to the 8th, and large coincidences with the Armenian lectionary lend to the inference that much had been already fixed before 595. Of Western lectionaries the earliest is probably the *Liber Comitis sive Lectorarius*, which used to be attributed to Jerome. On the whole it does not observe a *lectio continua*, but is characterized rather by free selection of suitable passages for each Sunday. Next in chronological order is the *Tubala*, drawn up by Victor of Capua (546); it was printed by Gerbert in his *Memoria. Vel. Liturg. Alem.* in 1777. It also has no trace of *lectio continua*. The same remark applies to the Luxueil lectionary, edited by Mabillon in the *De Liturgia Gallicana* (Migne, *Patr.*, lxxii.), it is assigned by Mabillon to the end of the 7th century, and certainly is not later than the time of Charlemagne; besides the usual gospel and epistle, it prescribes a lesson from the Old Testament.

The earliest allusion seeming to imply an order of lectures or readers as one of the standing orders of the church occurs, as already mentioned, in a solitary passage in Tertullian. In Cyprian, allusions much less ambiguous are frequent. The *Apostolical Constitutions* give a form of prayer to be used

at the ordination of lectors by the imposition of hands. In the modern Greek Church the functions of the Anagnostes are strictly confined to the reading of the epistle, that of the gospel being reserved for the deacon. In the old Catholic Church, the ordination of lectors was by publicly placing the Bible in their hands, with some such formula of exhortation as is prescribed in can. 8 of the fourth council of Carthage. By the council of Trent the order of lector was recognized as one of the minor orders of the Roman Catholic Church, but it has no actual independent existence, being regarded merely as a necessary step in promotion to a higher office.

LEDA. See CLASTOR AND POLLEX.

LEDRU-ROLLIN, ALEXANDRE AUGUSTE (1807-1874), was the grandson of a celebrated quack-doctor of the reign of Louis XV., who took the name of Comins, and made a large fortune in curing or attempting to cure epilepsy by magnetism. He himself was born in the house of Sarrasin at Fontenay-aux-Roses, on February 2, 1807, was educated at Paris, and had just been entered at the Paris bar, when the revolution of July 1830 broke out. He soon made himself a great name as an advocate, and was engaged on the republican side in all the great political trials of the next ten years. He also wrote many political tracts, and edited more than one republican newspaper, so that when he was elected as deputy for Le Mans in 1841 he was expected to take up an advanced republican position in the chamber. From this time to the outbreak of the revolution of February 1848 he was regarded as the chosen leader of the working men of France, and spoke and wrote in favour of liberty of labour and universal suffrage. It was in the speeches of himself and his friends Lamartine and Louis Blanc at Lille, Dijon, and Chalons at working men's banquets during the latter months of 1847 that the revolution of 1848 was most clearly foreshadowed and prepared. When it did actually break out, it was Ledru-Rollin who overthrew the project of making the duchess of Orleans regent, and obtained the nomination of a provisional government. In this provisional government he was clearly pointed out by his influence among the working men for the ministry of the interior. When he resigned on June 24, 1848, he found that his four months of office had lost him his old leadership, as the conscientious performance of such an office inevitably would, but he had the credit of having for the first time established a working system of universal suffrage. He tried to regain his old influence, but in vain, and at the election of president in December had but 370,000 votes. The earlier months of 1849 he spent in protesting against the policy, especially the Roman policy, of the president Louis Napoleon Bonaparte and his ministry, which culminated in his moving their impeachment. His motion being defeated on June 19 by 289 to 8, he on June 13 headed what he called a peaceful demonstration, and his enemies an appeal to arms, which was soon dispersed. Ledru-Rollin himself escaped to London, where he signed the manifestoes of the revolutionary committee of Europe with Kossuth, Mazzini, Ruge, and sometimes Desatz. He also employed his leisure in writing a work on the *Décadence d'Angleterre*, in which he attempted to deduce the necessary fall of England from its aristocratic form of government and the misery of the lower classes. In 1870 he returned to Paris, but though elected in three departments he refused to sit in the national assembly of 1871. In 1874 he consented to sit for the department of Var, and spoke at length on June 3 on an electoral scheme, upholding the one great aim and achievement of his life, universal suffrage. The effort was too much for his health; he steadily grew weaker and weaker, and died on December 31, 1874. Perhaps the best succinct description of his character and political position in the sixteen short months of his real

power is to be found in the speech of Victor Hugo at the unveiling of his bust in Père La Chaise: "Louis Blanc was the apostle of the revolution of February, Lamartine the orator, and Ledru-Rollin the tribune."

The *Discours politiques et oratoires* of Ledru-Rollin were published by his widow in 1879, his *Discours d'Angleterre* was published in 1880, and an account of his political position is to be found in all histories of the revolution of 1848.

LEDYARD, JOHN (1751-1789), traveller, was born in Groton, Connecticut, U.S., in 1751. After vainly attempting to settle down to the study of law and theology, Ledyard adopted the life of a seaman, and, finding his way to London, was engaged in 1776 as a corporal of marines by Captain Cook, for his third voyage of discovery. On his return in 1778 Ledyard had to give up to the Admiralty the copious notes he had kept, but was nevertheless able to publish a somewhat meagre narrative of his experiences (Hartford, U.S., 1783). He continued in the British service till 1782, when, his ship being off Long Island, he managed to escape. Ledyard returned to Europe again in 1784, his purpose being to obtain the means of fitting out an expedition to the north-west coast of America. Having failed in his attempts, he decided to reach his goal by travelling across Europe and Asia. On his arrival in Stockholm (1786) he attempted to cross to Åbo in Finland on the ice; but, meeting with open water, he turned back, walked all the way round the head of the gulf, down through Finland, and on to St Petersburg, where he arrived in March 1787 without shoes or stockings, and penniless. He made friends, however (among others Pallas), and got permission from the Government to accompany Dr Brown, a Scotch physician in the Russian service, to Siberia. Ledyard left Dr Brown at Barnaul, went on to Tomsk and Irkutsk, then visited Lake Balkal, and, reaching the Lena, sailed down to Yakutsk, where he arrived on September 18. With a Captain Billings he returned to Irkutsk, where on February 14, 1788, he was suddenly arrested, hurried across Siberia and Europe to the frontier of Poland, and ordered not to return under pain of death. On reaching London, Ledyard was befriended by Sir Joseph Banks, who engaged him on behalf of the African Association to carry on their work of exploration in Africa. His career was, however, cut short at Cairo, where he died on January 17, 1789. Ledyard was a born explorer, and, had he fallen into good hands in good times, and his energies been properly directed, would probably have done good work. As it was, no results of permanent value came of his wide and aimless wanderings. His life, with extracts from his journals, was written by Jared Sparks for the Library of American Biography (1828), and is also published separately.

LEE, NATHANIEL (c. 1650-1692), dramatist, was the son of Dr Lee, incumbent of Hatfield, Hertfordshire. He studied at Westminster School and Trinity College, Cambridge. After essaying the profession of an actor with very slight success, he wrote several tragedies, the best known of which are *The Royal Queens*, 1677, and *Theodosius*, 1680. He also assisted Dryden in producing *Edipus* and *The Duke of Guise*. From 1684 to 1688 he was an inmate of Bedlam, and afterwards until his death he was subject to intermittent attacks of insanity. Though he wrote the *Princess of Cleve* in 1689, and the *Massacre of Paris* in 1690, he was in his later years dependant chiefly on charity. He died in London in 1692, not in 1690 as is usually stated, the register of St Clements Danes church giving the date of his burial as the 6th May. The dramas of Lee are of course written in the artificial style characteristic of the period, and they also display occasionally a tendency to wild extravagance, but they nevertheless contain many passages of true poetic tenderness and grace.

LEE, RICHARD HENRY (1732-1794), an American statesman and orator, born in Westmoreland county, Virginia, U.S., January 20, 1732, was one of six distinguished sons of Thomas Lee, a descendant of an old Cavalier family. After obtaining the foundation of a liberal education in England, and spending a little time in travel, he returned to Virginia in 1752, coming into possession of a fine property left him by his father, and for several years applied himself to varied studies. At the age of twenty-five he was appointed justice of the peace, and soon after was chosen a delegate to the house of burgesses. He kept a diffident silence during two sessions, his first speech being in strong opposition to slavery, which he proposed to discourage, and eventually to abolish, by imposing a heavy tax on all further importations. In 1764 Lee had applied for a collectorship under the Stamp Act, which afterwards roused the determined hostility of the colonies, but on reflexion he regretted doing so, and became an outspoken promoter of the most extreme democratic ideas. In February 1766 he organized an association in Westmoreland, in accordance with Patrick Henry's famous resolution against the Act. At the winter session of the burgesses in 1766, Lee, with the aid of Patrick Henry, succeeded in carrying the house upon a test question against the united aristocratic elements of the colony. In 1767 he spoke eloquently against the acts levying duties upon tea and other articles, and in 1768, in a letter to John Dickinson of Pennsylvania, he made the suggestion of a private correspondence among the friends of liberty in the different colonies. Lee is said also to have originated, in a conversation with fellow burgesses in 1773, the plan of an inter-colonial or so-called continental congress, which was carried into effect next year. At this first congress in Philadelphia in 1774, Lee is said to have penned the address to the king, and is known to have prepared that to the people of British America, together with the second address to the people of Great Britain, directed by congress in 1775, both of which are among the most effective papers of the time. On June 7, 1776, instructed by the Virginia house of burgesses, he introduced in congress the resolutions declaring "that these united colonies are, and of right ought to be, free and independent states, that they are absolved from all allegiance to the British crown, and that all political connexion between them and the state of Great Britain is, and ought to be, totally dissolved." Lee was in congress in 1778-80 and 1784-85, and was one of the first senators chosen from Virginia after the adoption of the federal constitution. Though strongly opposed to the adoption of that constitution, owing to what he regarded as its dangerous infringements upon the independent power of the States, he accepted the place of senator in hope of bringing about amendments. He became a warm upholder of Washington's administration, and his prejudices against the constitution were largely removed by its working in practice. He retired from public life in 1792, and died at Chantilly in Westmoreland county, June 19, 1794.

See *Memoirs*, by his grandson E. H. Lee, 2 vols., 1825.

LEE, ROBERT EDWARD (1807-1870), general of the Confederate States army, and one of the greatest of modern commanders, was born at Stratford, in Westmoreland county, Virginia, on January 19, 1807. His father, General Harry Lee, better known in the War of Independence as "Light-Horse Harry Lee," and afterwards governor of Virginia, was the son of a cousin of the subject of last article. Robert Lee entered the military academy at West Point in 1825, and graduated in 1829, when he received a commission in the corps of engineers. When the Mexican war broke out Lee, who was then captain, served in the army under General Scott. He distinguished himself greatly throughout the campaign, and was brevetted as

colonel for his conduct at the siege of Chapultepec, where he was wounded. In 1852 he was appointed superintendent of the academy at West Point, and in 1855 he was promoted lieutenant-colonel of the second regiment of cavalry, with which he served in Texas. In March 1861 he was made colonel of the first regiment of cavalry, but in the following month, learning that his native State had withdrawn from the Union, he resigned as an officer of the United States army, and was forthwith put in command of the Virginia forces. When Virginia joined the Confederacy he was the third of five generals appointed by the Southern Congress. No adequate opportunity of gaining distinction was afforded him, however, until the beginning of June 1862, when he received command of the army of northern Virginia, and commenced the series of operations the result of which before the month had closed was to compel McClellan to abandon the siege of Richmond. Following up this advantage and Jackson's victory at Cedar Run on August 3, Lee advanced in person to lead the army that was being formed on the south bank of the Rappahannock, after crossing that river he inflicted upon Pope at Manassas the disastrous defeat by which the Federal army was compelled to retire within the fortified lines of Washington. Lee now decided on the invasion of Maryland, and advanced to Frederick city, but, being compelled to divide his forces, he sustained a check in the passes of South Mountain (September 16, 17) which compelled him to recross the Potomac. After a few weeks' breathing time he found himself again face to face with the Federal army near Frederickburg early in November; on December 13 the enemy, having crossed the Rappahannock on the previous day, assailed his position in strength, but was defeated with great loss. In the following spring the hostile armies still faced one another on the Rappahannock, but the brilliant strategy of Lee, as exhibited in the battles at Chancellorsville (May 2-4), against vastly superior forces, resulted in the retreat of the enemy, while Lee was left free to resume his old policy of throwing the Federal forces on the defensive by an advance into Pennsylvania. He encountered the enemy near Gettysburg on July 1, and decided advantages were gained, but the struggle was renewed on the two following days with disastrous consequences to him: he retreated, however, in good order, and reached Virginia on the 12th, when the campaign of the year practically closed. That of 1864 began on May 4, when Grant crossed the Rapidan, the passage itself was unopposed, but his subsequent progress was hotly contested in a series of well-fought battles which did not prevent the Federal general from reaching the south side of the Appomattox. The siege of Petersburg began in June, and lasted until April 2, 1865. A week afterwards Lee surrendered with his whole army, thus virtually terminating the war. In the same year he was elected president of Washington and Lee university at Lexington, Virginia, which office he retained until his death on October 12, 1870.

The events of Lee's military career briefly indicated in this notice belong to the history of the United States, and will call for further notice in that connexion. To do justice to his extraordinary ability as a general, displayed under circumstances of extreme difficulty, when his movements were continually hampered by political necessities, as well by the lack of material resources, would require an elaborate military biography, it was never more nobly displayed than in the last hopeless stages of the fatal struggle. The personal history of Lee is lost in the history of the great crisis of America's national life; political friends and foes alike acknowledged the disinterestedness and purity of his motives, his self-denying sense of duty, and the unrepining loyalty with which he accepted the ruin of his party.

LEECH. The medicinal leech (*Hirudo medicinalis*, L.) is a species grouped under the family *Gnathodactylidae* (with a dental apparatus composed of armed muscular ridges) of the descriptitious *Aneides*. The body of a leech is spindle-shaped, and flattened dorsally and ventrally so as to be elliptical in transverse section. It is somewhat pointed in front except when the mouth is in action, while posteriorly it is terminated by a disk or sucker. The surface is marked by a series of annulations reaching from ninety-five to one hundred, but such are only cutaneous, as indicated by the gongyli, the segmental organs, the white spots on each side, and even by the arrangement of the two outer yellowish stripes, for the primary segments of the body comprise from three to five of these. The anterior sucker (fig. 1, *a*) is composed of four incomplete annuli and another surrounding the mouth, while the posterior (*a'*) has seven. The color of the dorsum is generally dull olive or olive-brown, with six yellowish, rusty, or greenish-yellow bands more or less interrupted with black, the spots of the latter being somewhat symmetrically arranged in the two outer rows. The ventral surface is speckled with black spots on a greyish ground. Several varieties occur, according as the dorsum is lighter or darker brownish or olive, and the ventral surface with or without spots. Thus Moquin-Tandon, Desing, and others indicate six or seven, each of which again has various subvarieties, ranging from two to five. Externally the body is invested by a thin translucent chitinous cuticle, which is perforated, apparently with some regularity, by the apertures of the glands. This coat is shed at intervals. Beneath is the hypoderm (epidermis of some), which is much firmer and thinner than in the Nemertea. It contains the pigment, though part of the latter intrudes into the subjacent layer, and is composed as usual of columnar granular cells, a horizontal section presenting a somewhat regularly areolated aspect. Rawlins Johnson alludes to the vascularity of the surface of the leech, and Day Lankester notes the extension of the capillaries into this layer. The latter has not been verified, even in the hypoderm of the snout, though preparations presenting such appearances are not uncommon. The hypoderm is closely united to the subjacent muscular layer, though it can hardly be said with Gegenbaur that it is continued into the parenchyma of the body. It is this layer and the cuticle which are marked by the superficial annulations. Various unicellular glands occur underneath the hypoderm, in particular two chief sets—superficial and deep. The former are situated amongst the outer (circular) muscular fibres and pigment, while the latter lie amongst the connective tissue, muscular fibres, and vessels that constitute



Fig. 1.—Medicinal Leech (*Hirudo medicinalis*, L.), after Moquin-Tandon and Hodgson. *a*, anterior sucker, *a'*, posterior sucker, *b*, first and second pairs of gongyli—directly approximated, *c*, first division of the alimentary canal, *d*, small intestine (most solid of Gubioles), *e*, eleven part of coeca (long and large), *f*, first part of the same, *g*, last part of the same, *h*, last part of the same, *i*, last part of the same, *j*, last part of the same, *k*, last part of the same, *l*, last part of the same, *m*, last part of the same, *n*, last part of the same, *o*, last part of the same, *p*, last part of the same, *q*, last part of the same, *r*, last part of the same, *s*, last part of the same, *t*, last part of the same, *u*, last part of the same, *v*, last part of the same, *w*, last part of the same, *x*, last part of the same, *y*, last part of the same, *z*, last part of the same.

the "parenchyma" between the muscular layers of the body-wall and the alimentary canal. It has been suggested that the former secrete the ordinary mucus, the latter the cocoons. Both open by ducts on the surface of the cuticle, and it is stated that those in the neighbourhood of the genital segments are enlarged at the time of oviposition. In the Nemertean it is the homologous of the leech's hypoderm which secretes the envelopment of the ova.

The muscular layers consist of external circular fibres in several strata, between which the hypodermic glands, pigment-cells, and vessels intrude. When this coat is examined in thin superficial (horizontal) sections the fasciculi are observed to be separated by intervals. Other circular fibres occur within the longitudinal layer. The latter muscles form the great mass of the body-wall, and are grouped into various bands by the connective tissue and radiating muscles. The latter pass directly from the dorsal to the ventral surface laterally, and thus become vertical fibres; and they are very well seen in *Nephele*, where they form four or five conspicuous bands between the circular layer dorsally and ventrally, and thus appear to have a considerable influence in determining the shape of the body. The extensible snout presents a muscular structure analogous to that of the tongue in the higher animals, and it is capable of even more extensive and varied movements. A complex series of muscles (circular, radial, and longitudinal) exists in connexion with the posterior sucker. The muscles of the leech are unstriated, and are formed of long spindle-cells with nuclei. The locomotion of the leech is affected by the alternate attachment of the suckers, or by swimming through the water like an eel. It is fond of waving its body to and fro in the water when attached by its posterior sucker, and this would certainly aid the secretion of the blood in the superficial vessels.

There is no special body-cavity, the blood-vessels and connective tissue alone occurring between the muscles and the digestive chamber. Rolleston speaks of dissepiments between the digestive diverticula, that between the last two not being prolonged to the ganglia. In the histology of the leech an important part is played by the connective tissue, which envelops all the organs, traverses the muscles, and is filled in certain places and in its cellular elements by brown granules. Moreover, certain of these cells are stated by Ray Lankester to form the walls of the blood-vessels.

^{Suctorial apparatus.} The inferior surface of the snout constitutes a spoon-shaped cavity leading into the mouth, which thus with its marginal lip is capable of forming a most efficient sucker. At the junction of the buccal with the pharyngeal region are a median dorsal and two lateral prominent semicircular or sometimes slightly hatchet-shaped elevations, which in contraction fit into pits in the wall. On the free edge of each of these muscular cushions the cutaneous buccal lining is furnished with a closely arranged and microscopic series of transverse processes (eighty or ninety in number), each of which somewhat resembles the middle valve of a *Chiton* or the upper jaw of *Ptycho*. They are arranged indeed after the manner of the ridge-tiles of a roof, the lateral pieces sloping downward on each side from the prominent median point. These angular transverse plates are separated by a well-marked interval, and they commence as small processes. They are distinctly calcified. It is these organs, mounted on the three muscular cushions, which cause the somewhat tridactylate wounds, and which may pass through the true skin to the cellular tissue, a feat which Poirer's notion of suction could hardly accomplish. Great ambiguity seems to run throughout text-books on this subject, and yet the figures of Brandt and Moquin-Tandon represent the condition very fairly, though some appear to have mistaken the lateral view of the muscular

cushion for a "horny jaw." These teeth can only act *en masse* with the muscular pad on which they rest, and have not the individual movement seen for instance in the long hook-teeth of certain polychaetes. As Leuckart and others have shown, each of these muscular cushions has a most complex structure. The superficial fibres are for the most part oblique, the central vertical (that is, at right angles to the teeth) and cut into lamellae by transverse fibres. The whole forms a very efficient motor apparatus for both cushion and teeth in all their varied functions.

The mouth opens into the pharynx, the structure of ^{of *Opus*} which, as in other *Gnathobdellids*, differs essentially from ^{Station} that of the *Rhynchobdellids*. In ordinary connected preparations the central canal in front is either triangular or tridactylate. Internally it is covered by the cuticular and the tough hypodermic layers, from which the radiating musclicles pass to the body-wall, the space between the hypoderm and the strong circular fibres of the organ being occupied by regularly arranged longitudinal fibres clasped by the radial fibres. The mixed muscular layer of the body-wall occurs outside the foregoing. The entire arrangement is well adapted for dilating, shortening, and lengthening the canal, and performing all the complex actions of a powerful suctorial apparatus. In the *Rhynchobdellids*, on the other hand, the protrusible proboscis, with its intussusceptive structure and its sheath, presents little in common with the foregoing. The pharynx terminates in the stomach, an elongated chamber having eleven lateral diverticula (*c* to *g*), which form short pouches directed backward on each side, with the exception of the posterior pair (*g*), which are so large and long as to be almost in apposition when distended, and nearly to reach the termination of the body. From the point of bifurcation the canal proper (*g*) is continued as a somewhat small tube—to end in an anus on the dorsum, immediately in front of the posterior sucker. The inner surface of the alimentary canal is lined by a minutely granular epithelium. Salivary glands have been described by various authors as situated in the parenchyma outside the pharynx, and the number of large granular glands in this region is certainly great. Digestion seems to be slow in leeches, and breeders feed them with blood only once in six months. It is well to remember that the alimentary canal contains blood in those brought direct from their native marshes.

The nervous system consists of twenty-three pairs of ^{Nerves} ventral ganglia, the first being connected by commissures, ^{and sense-organs.} (between which the gullet passes) with the supra-pharyngeal, or cephalic ganglia. An intermediate stomato-gastric ganglion sends branches to the central muscular cushion for the teeth, and another on each side gives twigs to the lateral cushions. The cephalic mass supplies the eyes and the cup-shaped sense-organs. The former, to the number of ten, are situated on the three anterior segments and on the fifth and eighth segments, the whole forming an ellipse, and their structure has been carefully investigated by Leydig and others. Dr. E. M. Gunn observed that in the leech they are formed of cup-shaped or bell-shaped depressions of the skin, surrounded by numerous pigment-cells. The fundus is furnished with large clear cells having peculiar nuclei. They are merely altered epithelial cells, and are found to be continuous with them. Between them in the axis of the cup is a space traversed by a nervous filament which pierces the fundus. According to Leydig this nerve-filament ends in a freely exposed papilliform elevation at the mouth of the cup-shaped eye. No connexion has been found between the nerve and the cells. Milne-Edwards, again, suggests that these refracting cellules are very like the principal cellules of the refracting cone of the retinal composite eye of insects. Near the

mouth of the sup Ranke figures retinal cones (Glaskorperkugeln), which are arranged like nerve end-organs in a mosaic, on a flat extension of the optic ganglion. These cones are very like those of the vertebrate eye, consisting of a somewhat rounded granular body, connected at the base with a nerve filament, and having a clear, stiff, rod-like projection on its outer part. Dr Gunn has been unable to see these cones or the termination of the optic nerve. The wall of the clear cell is very thick, and the "nucleus" is generally seen to be an inward projection of this wall ending in a knob-like enlargement. Where it appears free, that is probably due to the plane of section, the side or end of the knob being severed from its connexion. Besides the cells having this inward projection of the wall there are others containing highly refractive spherules like oil globules. Ranke observes how little these "optic cups" differ from the touch or taste organs scattered on the snout and sides of the animal, and he is of opinion that they probably serve equally for the three kinds of sensory perception (sight, taste, and touch). If Ranke's account is correct, and if the cone-mosaic situated at the mouth of the cup be directly stimulated by the rays of light, it is difficult to account for the function of the large clear cells, and more especially the pigment around. From the position of the pigment it cannot serve for the isolation of Ranke's elements, and it can hardly be required for the prevention of the confusion of images. Yet by its presence the eye of the leech is distinguished from the adjacent and very similar touch-organs. Dr Gunn is of opinion that the light acts on the pigment, and develops some form of energy which affects the contents of the cell, whence a stimulus is communicated to the nerve. Unfortunately a nervous connexion with these cells has not been found.

The three anterior pairs of ventral ganglia (b) coalesce into a single mass, and in the same way the last large ganglion (e') is composed of seven. The ordinary ventral ganglia give off two branches on each side, one of which has a small ganglion developed on it. The penultimate ganglion sends off only a single branch on each side, while the last gives off from seven to nine for the supply of the posterior sucker. The nerve-cells, as usual in these ganglia, are chiefly external, and the fibrous region internal, while the whole is surrounded by a neurilemma. This system has been the subject of many elaborate researches, amongst which those of Leydig and Hoffmann are conspicuous. A sympathetic or splanchnic nerve discovered by Brandt runs along the ventral surface of the digestive tract. In development it is found that in many leeches the long cords are originally separate, but afterwards come close together so as to resemble a single connecting cord.

The circulatory system presents a median dorsal, a median ventral, and two large lateral longitudinal trunks, all anastomosing with each other, and giving off numerous branches to the muscular layer of the mesoderm and various internal organs. The median sinus in the head surrounds the ganglia and oesophageal ring. It has a ventral development in the rest of the body, where it encloses the alimentary canal and the ganglionic nerve-cord. The blood-vessels have a well marked systole and diastole—from eight to ten times per minute. The fluid is red, and devoid of corpuscles. Old observers noticed the finely reticulated condition of the integuments when the vessels were injected, but, as formerly noticed, vessels could not be seen in the hypoderm proper. The active and free waving movements of leeches in the water when attached by the posterior sucker are probably connected with cutaneous respiration.

No part of the leech has caused more discussion than the series of seventeen pairs of segmental organs (g, g') which occur in a line external to the testes, and alternating in position with them. Some considered them respiratory, others

secretory, while a few connected them with the reproductive system. They consist of a muscular sac-like ciliated organ which communicates with the exterior near the posterior part of each primary segment, and externally of a loop-shaped gland, labyrinthine in structure, one end of which opens into the former sac, while a canal process is prolonged on each of the testes in their region. In minute structure it has been found that the cells which constitute the gland are all penetrated by ductules, which, however, do not communicate with the large duct in the axis of all the lobes (Bourne). The gland is surrounded by an elaborate plexus of blood-vessels. These organs are in the embryo preceded, in the posterior region of the body, by three pairs of looped canals, which disappear before the permanent ones are developed.

The leech is hermaphrodite, but congress of different individuals is necessary for reproduction, and therefore spermatophores, which ductules have a special covering, are found in the respective vaginas. The male organs consist of an intromittent apparatus (h) with a muscular and glandular basal structure (g), and a duct (f) on each side from the *vesicula seminales*. The latter has a *vas deferens* connecting it with the same globular testes (d, d', d'', d''') ranged along each side of the body, one of which is directed outward at the tip. The intromittent organ reaches the exterior at the junction of the first and second sixth of the body (between the twenty-fourth and twenty-fifth rings). The female apparatus is placed in the segment between the conical vesicles and the first testis, four annuli intervening between the respective sexual openings. The external opening of this system (between the twenty-fourth and twenty-fifth rings) leads into an oval sac (i), the vagina—furnished with thick muscular walls. A coiled oviduct passes from its apex through glandular tissue, which probably secretes the albuminous matter surrounding the eggs, and divides into branches, one leading to each ovary (j). In *Hirudo* the ovaries form a coiled filament, and on this the ovarian germs are lodged. The ova are connected with the filament by a thin envelope which is drawn out into a stalk. There is no cord in *Agelastus*, but the ovarian germs form groups of cells.

Three or four days after congress the leech may be observed to be contracted above and below the genital apertures, and an abundant secretion is poured out so as to surround this region of the body as in the Nemertean. Into this investment the contents of the female organs and their opaque gelatinous envelopment are forced. The animal disengages the anterior part of its body, withdraws its head, and the structure just mentioned slips into a cocoon, containing from five to eighteen ova, and frequently showing slight elevations at the points through which the body passed. The cocoons are deposited in cavities in the mud during the summer and autumn, and some seem able to deposit them during the winter. The ovoid cocoons consist of a network of spongy fibres, and indeed have been mistaken for a sponge. The older authors considered the leech viviparous until Noble and Rawlins Johnson observed the foregoing phenomena.

There is little difficulty in rearing leeches in confinement if a Leech proper method is followed, and accordingly various leech tanks and breeding ponds have been constructed. One of the largest schemes of the kind is a leech farm of 18 acres near Newton, Long Island, U. S. The breeding ponds are in oblongs, each of 14 acres in extent, and 8 feet or more in depth. The bottom is composed of clay, and the margins of peat. The cocoons are deposited in the soft peat from June onward, the chief cocoons being marked, water-sheds, and water-sheds, which dig the cocoons out of the peat. The adult leeches are fed every six months on fresh blood placed in linen bags suspended in the water. It is also the opinion of some that leeches which have been filled with blood make good breeders.

In regard to the development of the *Planoides*, *Apeloides*, *Devotop*, perhaps, has been more completely worked out than *Hirudo* (though many observations of Weber, Leuckart, Robin, and others on the latter are important), and, as the former very much resembles the latter, except in the presence of eia in the embryo anteriorly, a brief notice of it will suffice. Butschli describes the usual divisions of the eggs, which need not be given in detail, especially as an excellent summary is to be found in Balaban's *Comparative Embryology*. According to these authors the cells which constitute the epiblast give origin to others which form the hypoblast and vitelline sphaera. Two patches of epiblast gradually spread over the vitelline sphaera. Then the hypoblast cells increase and fill up a space bounded behind by three vitelline sphaerae and in front by the epiblast of the anterior end. At the sides of the hypoblast the mesoblast has become established, probably as two lateral bands. The hypoblast cells range themselves round a central cavity, increase, and become filled with food-yolk. The mouth and thick-walled oesophagus are then developed, probably by epiblastic invagination.

The mesoblast now forms two lateral curved bands at the sides of the body. The three vitelline spheres become covered with the flattened cells of the epiblast. The cephalic region becomes chitinous, and the chila enter the oesophagus. The epiblast develops the outside, which is raised into transverse rings, without, however, having any relation to the true segments of the mesoblast. The nervous system is probably derived from the epiblast, the ventral cord breaking up into a series of ganglia, which correspond with the true somites, except that the first and last, as already mentioned, are composed of several. The supra-oesophageal ganglia arise independently. The mesoblast probably takes its origin from the two mesodermic bands, and the segments formed by it grow upward and meet in the dorsal line, and septa are formed between the somites. The somatic layer of the mesoblast gives rise to the muscles. The mesoblast also gives origin to the excretory (segmental) and generative organs, and the vascular system. A delicate musculature, however, would appear to be developed independently of the mesoblastic bands. The mouth and pharynx are formed by the epiblast; the rest of the oral by the hypoblast, which from the first has a sac-like shape. The posterior oesaculation of the stomach in *Hirudo* is originally unpaired. The dental pads are formed about the same time as the eyes as protuberances of the oral cavity. The anus is developed very late about the posterior sucker. In the embryo of *Hirudo* Leuckart found three pairs of segmental organs at the posterior end of the body, consisting of an enlargement from which a convoluted tube is continued for some distance backward, and then bends forward to open on the exterior. The anterior part is broken up into a labyrinthine network. These organs disappear in the adult. The recent researches of Whitman on *Oligone* and of Hoffmann have greatly extended our information with regard to the histology and morphology of the parts in the embryos of the leeches.

The time between the deposition of the ova and their hatching is variable, and probably depends, as in the ova of the *Salamandra*, on temperature and other causes. It is said to range from twenty-five to forty days. The young arrive at perfect coloration when two years old, and become sexually mature at three years, about which age they become fit for medicinal use, their food consists at first of microscopic organisms, and afterwards, when the mouth has attained more complete development, of the larvae of insects and other small animals.

There is no animal that has been more prominently brought under notice than the leech, both on account of its use in medicine from very early times, and its fitness for anatomical and other investigations. The study of its structure, internal, external, and structural, that have been devoted to it is a very considerable one of these voluminous articles in Brandt and Reibenburg's *Medicinal Zoologie* may be taken as a type.

Medicinal use. This leech is the *Bædæa* of Herodotus, Theocritus, Nicander, and other Greek authors, and the *Hirudo* and *Sanguisuga* of Plautus, Cicerone, Horace, Pliny, and other Roman writers. Celsus Aretæus mentions its use, and Galen and his successors recommend its application. Apollonius also alludes to the latter, and describes very graphically the process by which it fills itself with blood. It was sufficiently familiar to naturalists both before and after the time of Linnæus, though occasionally there has been considerable ambiguity in regard to species. The use of the leech is mainly for local blood-letting, but in modern times the practice has greatly diminished; indeed, in some cities the druggists chiefly use them with doubtful efficiency in cases of ineffectual gumboil and in facial ecchymosis. They may be applied to any part of the adult skin, and to the mouth, fœces, and other available inlets by the aid of a leech-glass, which consists of a tube with a slightly contracted aperture, and provided (or not) with a glass piston to push the leech onward. In China a piece of bamboo serves the same purpose. For such functions the most active specimens should be chosen (and, as Sir Robert Christison states, these contract firmly when squeezed in the hand) and kept for an hour out of water, and then applied to a perfectly clean surface of skin. They may also be made to bite by smearing the skin with cream or blood, or by immersing the leech for a minute in porter or tepid water. Each fills in about fifteen minutes, and draws from 40 to 85 grains of blood, or, including that afterwards obtained by fomenting the wound, about half an ounce. In young children they should never be placed on parts where firm pressure cannot be applied. It was formerly the practice to prepare the leeches that had been

used for further action by sprinkling a few grains of salt on the snout, and stripping them gently between the fingers so as to cause them to eject the blood. This plan is not now adopted, and rightly so, since various diseases might thus be communicated. They certainly can be applied four and five times in succession by placing them in vinegar and water, and afterwards in a vessel (which the French call a domestic marsh) with turfy earth, but they draw less blood on the fifth occasion. Should the hemorrhage from the wounds (as in certain constitutions) prove severe, it may be stanchied by the application of vinegar, solid nitrate of silver, a hot wire, or a hot solution of alum, or by acupuncture. If a leech by accident be swallowed, a pretty strong solution of common salt, or a glassful or two of wine may be taken. Instead of the actual leech an instrument called an artificial leech is now sometimes used. This consists of a small sharp steel cylinder (worked by a spring) with which a circular incision can be made through the skin, and a glass cylinder capable of being exhausted by a piston worked by a screw. Care must be taken to move the piston at about the same rate as the blood flows, and the edge of the glass cylinder should not press too tightly, else the flow is arrested.

Leeches are imported from France and Hungary, and also through Hamburg from Poland and the Ukraine; they likewise come from Turkey, Wallachia, Russia, Egypt, and Algeria. They are found in Britain—both in Scotland and England, but especially in the latter. In the French trade Bordeaux leeches are preferred, Polish, Swedish, and Hungarian are those most commonly met with in Britain. It is difficult to estimate the number of leeches now used. In 1846 Moquin-Tandon calculated that there were from twenty to thirty millions used in France; and Leuckart mentions in 1863 that in London seven millions, and in the Parisian hospitals five to six millions, were annually employed. At the great American leech-farm the average sale is one thousand per day. There cannot be a doubt, however, that the use of leeches at the present time is greatly restricted—indeed, the younger generation of British medical men seldom or never prescribe them—so that scarcely one will now be employed where one hundred were a quarter of a century ago. This is very well shown in a note from Messrs Duncan, Flockhart, & Co. of Edinburgh, from which it appears that the account for leeches supplied during three months in 1844 to the Royal Infirmary, Edinburgh, was £45. This steadily decreased until about 1868 it amounted for the same period only to 5s. 6d. Sir Robert Christison mentions that the price of the best leeches in 1845 ranged from £4 to £8 per thousand; twenty years ago they were from £10 to £15 per thousand; and at the present time good leeches cost about 10s. per hundred, or £5 per thousand.

They inhabit ditches and ponds, with pure running water, weeds for shelter, and muddy banks and bottom. They are captured by nets after attracting them by bait, or by wading into the water, and then stripping them off the legs on coming to land. Leeches are preserved in loose turf or moss constantly moistened, or in earthenware or glass vessels half full of water, covered with glass or linen-gauze; and some place a rusty nail, others a clean sponge in the vessel, which can be exposed to the light. In transporting them the French "domestic marsh," a vessel with small perforations inferiorly and filled with moist turfy earth or peat made into a stiff mud, is excellent. Sometimes an exterior vessel with a few inches of water is placed round the former. The mouth of the vessel is closed with a coarse linen cloth. Leeches, like many other annelids, live for several years without food in vessels of pure water.

Classification

The group (*Hirudines* or *Dusaphoi*) may be divided into three families, viz., *Rhynchobdellidae*, *Gnathobdellidae*, and *Planorbidae*.

The *Rhynchobdellidae* are those leeches furnished with a protrusible proboscis (which is often everted) if the animal is removed from the water and placed on a dry surface. This family includes the fish-leeches (*Egghydrobia*), which have an anterior and posterior sucker, a simple intestine, and mostly two pairs of eyes. Amongst these are *Piscicola grometta*, L., found on freshwater fishes, *P. appropinquans* on the habitat, and *P. sepium*, in which the body has lateral sacs into which the blood enters. The mentioned (*P. grometta*) is a somewhat beautiful species, and full of activity, waving its body to and fro, and floating by aid of the expanded posterior sucker on the surface of the water. Another well-known genus (*Pontobdella*) is characterized by its thick warty skin, and four rings to each segment. The best-known example is the skate-leech (*P. newmani*, L.), which is olive-colored and dotted with whitish grains. The anterior sucker is furnished with papillae round its edge. It adheres to the skin of the skate, and deposits the curious pedicled hairy capsules, containing a single egg, inside shells. In the same group is the remarkable genus *Branchellion*, which has a narrow anal ring with the sexual orifice at its posterior part, and a series of lateral appendages, the function of which has been supposed to be hanchal. Its stomach is sacculated. One species (*B. torpense*, Sav.) is a mesomate of the torpale or electric ray of the Mediterranean, this has been the subject of very interesting papers by Leydig and De Quatrefages. The next subfamily—the *Olepaninae*—have somewhat broad bodies capable of being everted downwards at the margins so as to form a hollow vaginal groove for the lodgment of the eggs and the young, while the vent is pointed. They have from one to four pairs of eyes, and three rings to each segment. The dorsal blood-vessel is rhythmically contractile, and the median blood-sinus envelope the digestive canal and the ventral nervous. The stomach is bunched, and the anus opens above the posterior sucker. The skin in many is warty and in the *Olepana echinata* of Grube, from Lake Baikal, the dorsal papillae are furnished with soft pointed processes, so that in outline they are spinulose. The oviducts have no common tract or vagina, but open at the fourth pair. The genital apertures occur between the twenty-fifth and twenty-seventh, and between the twenty-seventh and twenty-eighth rings. The ova are in some kept under the body till hatched. Several species abound in the fresh water lakes and ponds of Britain, and their remarkable and beautiful anatomical structure is yet in need of elucidation. Amongst those most commonly met with is *Olepana bosciana*, Sav. (fig. 2), which is about an inch in length, generally

green or pale brown appearance, often with two (sometimes four) interrupted dark brown bands along the middle of the dorsum, in which are pale papillae, four rows of the latter being generally present. The eyes are six in number, in parallel series. The body is firm, and the cutaneous at the sides are brown striated. There are six glands on each side, and in the young the setrum is everted. The proboscis is a cylindrical organ slightly narrowed anteriorly and posteriorly, and banded with transverse striae, a festoon in *O. bosciana* due to the arrangement of the granular nucleated glands on its inner surface. It looks on *Phoronis* and *Lumina* (coel and non-shells). *Olepana heterostyla*, L. (fig. 4), a somewhat smaller form, is characterized by its translucent yellowish aspect. The dorsum is rarely regularly dotted with blue brownish, so as to give it a checkered appearance. The snout is acute, and is furnished with six eyes, the anterior pair being closely approximated, while the two succeeding are separated by an interval from the foregoing, and the eyes in each pair are at a greater distance from each other. The digestive canal are beautiful objects from their regularity and complexity. The ova are carried on the under surface of the body. It is less active than *O. complanata*. Another form very abundant under flat stones in similar lakes and ponds in certain places is *Olepana bosciana*, O. F. Müller (fig. 5), a large



Fig. 2



Fig. 3



Fig. 4

Fig. 2—*Olepana bosciana*, Sav. and young. Dorsal view. Enlarged.
Fig. 3—*Olepana complanata*, Sav. Dorsal view. Enlarged.
Fig. 4—*Olepana heterostyla*, L. Dorsal view. Enlarged.

has a greenish-grey hue, and is much tapered anteriorly. Two closely approximated eyes occur in front. There is a reddish-brown body on the eleventh ring, making an aperture described by O. F. Müller, and a whitish opacity in front of it. It often fixes itself by the posterior sucker, and waves its body to and fro in the water, and it swims actively like a Nematode or horse-leech. The ova and young are carried in groups on the abdominal surface. It contracts itself into a ball on irritation. Its food consists of fluviatile and lacustrine mollusks, especially of *Physa* (bubble-shells). *Olepana complanata*, Sav. (fig. 3), again, is distinguished by its greenish-

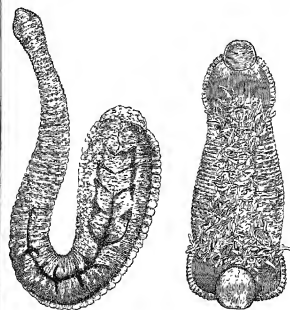


Fig. 5.

Fig. 3.

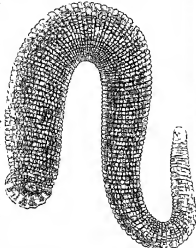
Fig. 5—*Olepana bosciana*, O. F. Müller. Dorsal view. Enlarged.
Fig. 3—*Olepana complanata*, O. F. Müller. With a young adhering to the ventral surface. Slightly enlarged, as adhering to a glass vessel.

and conspicuously tinted form. It reaches the length of 3 inches, and is of various shades of green, brownish, or olive, with six rows of yellowish or whitish spots, the marginal in all cases being the largest, while the four internal occupy papillae. The eyes are eight in number in two series approximated in front. The soft, mobile, and almost gelatinous body is capable of assuming endless shapes, and is sometimes like a cordate leaf. It is gregarious in confinement. When a specimen is detached from its own adjacent mass of ova, it occasionally selects another group and fixes itself to the glass to nurse them. The young are borne on the ventral surface (fig. 4). The genus *Hemidusa* has two eyes, a bifid anterior sucker with the mouth in front, a long pointed proboscis, and five rings in each segment. The species (*H. mexicana* and *H. affinis*) occur in the Mexican lakes and South America, the latter being used medicinally, since it is capable of penetrating the skin with its pointed proboscis.

The second family, *Gnathobdellidae*, includes the medicinal leech, besides *Hirudo intermedia* (M. Tard.) from Algeria, *H. javanica* from Java, *H. sinica* (Blauy) from China, *H. quinquata* (Schim.) from Sydney, and others to be subsequently mentioned. *H. dentata* (Say), the native leech of North America, is used in the same way as *H. medicinalis*. It is bluish, with about twenty-two reddish points on the dorsum and a lateral series of black touches of the same number. The ventral surface is ridged with black points. It also compresses the genus *Bdella*, without dentacles, and *Hemiphaedra*, the best-known example of which is *H. variegata*, a kind of horse-leech which is very troublesome to horses, cattle, and camels, by entering their nostrils when drinking, and the same disagreeable accident occurred to the French soldiers in Egypt. The common horse-leech (*Ambystomum naja*, M. Tard.) with very distinct dorsal

lateral ends of the stomach, but with two long posterior caeca, is abundant in British ponds and lakes, as also is *Nepheleis vulgaris*, L. (fig. 7), a species about 3 inches in length. Its dorsum is brownish-yellow, often with a conspicuously tessellated appearance, while the under surface is pale olive. The eyes are eight—four being placed somewhat in a semicircle, and four a short distance behind, wide apart and at a different angle. It is a voracious test-les, keeping up an undulating motion of its body when attached by the posterior sucker, apparently as in the *Phyllodoceae*, to promote respiration. It also swims on edge through the water like an eel. The skin is exceedingly sensitive to the vapour of chloroform, while the contact of a single drop causes tetanic convulsions, and the animal dies, quite rigid. The digestive canal is nearly simple, and there are no buccal teeth. The dorsal blood-vessel is absent. The ova are deposited in a horny capsule fixed horizontally to sub-aquatic structures, and it is curious that Linnaeus described it as a hemipteron insect under the name of *Coccyx aquaticus*. On

Beignemann's paper in which the enail was corrected the great Swede wrote "*Nepheleis* feeds on earthworms, larvae, mollusks, and other organisms." *Typhlocyba sub-ventralis*, Dufschollet, is a large burrowing form (7 inches in length), which frequents the marshes and ditches of France and Algeria (and also usually, apparently from introduction, in England). It leaves the water to follow the earthworms on which it feeds. There are no buccal teeth, and the alimentary tube is only slightly ciliated. In Ceylon the *Hirudo* *capitata* or *capitata*, a land-leech about an inch



long, is a great annoyance to travellers, especially in the rainy season, attacking men and horses when journeying through the woods and jungles, and causing considerable irritation from its bites. They come in troops out of the grass and dead leaves, and one cannot leave the ground in the garden in some places without being attacked. Leech-garrets, themselves, are worn by many residents for protection. A similar form occurs at an elevation of 4000 feet in the Philippines, and others in Java and Sumatra, and Sir Joseph Hooker found them at a height of 11,000 feet on the Himalayas. Land-leeches also exist in Australia, Japan, and China, where very few occur in the water. They frequent plants, trunks of trees, and shrubs, as well as grass. An eyeless leech, called *Typhlocyba*, inhabits the subterranean waters of the Runda cave in Hungary. An all-but eyeless form, *Cyathobella tumida*, Grube, which was found by Fritz Müller in Brazil, lives in damp earth. It has a slender spindle-shaped outline. The exact position of the gigantic *Monobdella* *maliniana* of Filippi, a South American leech measuring about 24 feet, is uncertain. It is eyeless, and has neither lips nor teeth. It probably lives in damp earth, and feeds on earthworms.

In the third family, Branchiobdellidae, the irregularly annulated body is elongated, somewhat cylindrical, with a bulbous eyesless snout, and a sucker at the posterior end. There is no proboscis, but the pharynx has two flattened ciliated parts (dorsal and ventral). The body is provided with a celom or body-cavity, an unusual feature in the leeches. The alimentary canal is simple. There are only two longitudinal vessels, trunks—a dorsal and a ventral, the former showing a dilatation behind the cephalic branches, sometimes termed a heart. Two pairs of segmental organs are present, the posterior pair of which are modified for the conveyance of the oxygen products to the exterior; for the oves, which are situated far back, discharging their contents into the body-cavity. The best known are *Branchiobdella* *caecata*, Ocher, and *B. parvica*, Haeckel, which occur as ectoparasites—the former (smaller) on the branchiae, the latter under the tail and on the antennae and eyes, of the crayfish. *Myxobdella*, Leidy, and *Ternstrophiella*, Gay, are allied forms. The latter is a curious leech, having five digitate processes attached to its anterior end, and which a pair of eyes and the mouth are situated. A sucker exists posteriorly. In the same family are placed the aberrant types *Acanthobdella* and *Hirudo*. The former is characterized by a somewhat flattened spindle-shaped body resembling a Cephyaean, bluntly pointed in front, furnished with minute hooks near the anterior end, and a posterior sucker.

The *A. pulchella*, Grube, a fish-parasite from Surin, is an example. The latter (*Hirudo* *abdominalis*) are remarkable in the group in being dioecious instead of hermaphrodite, and somewhat resemble in outline grotesque insect-larvae. The peculiar back-like hump fitted for suction, the jointed body, and the pair of posterior suckers are characteristic. They are ectoparasites on marine crustacea, thus *Hirudo* *abdominalis*, Van Beneden, occurs on the lobster, and *Saccobdella* on other decapods.

Formerly *Udonella* and *Entobdella* were included under the leeches, but they seem to be more correctly placed amongst the Trematodes. Until lately *Entobdella* was also considered one of the group, but its ciliated skin, separate re-prods, proloca, and development point it out as an intermediate type allied to the Nematodes.

The following works amongst others may be referred to for more detailed accounts of the order.—Noble, *On the Medical Leech*, 1832; Blandin, *Recherches sur les Verses*, 1839; Miquel-Tenon, *Mémoires de la Société de Médecine*, 2d ed., Paris, 1850; B. Lichten, *Die Natur der Leechen*, vol. 1, 1860; Sir J. D. Doherty, *Parasites of the Crustacea*, 2d ed., 1883; G. Johnston, *Catalogue of Parasites*, British Museum, 1885. Also the various memoirs of Cuvier, M. Thomas, Delle Chimie, Gmelin, H. Rabbat, Van Beneden, F. Leidy, E. Grube, Krieger, Leidy, Villot, Doherty, Konner, Schneider, Hoffmann, Hermann, Whitman, Bousquet, Ray Lankester, and Rando. (W. G. M.)

LEECH, JOHN (1817-1864), the most genial of the humorous dialects of our century, was born in London on the 29th of August 1817. His father, a native of Ireland, was the landlord of the London Coffee House on Ludgate Hill, "a man," on the testimony of those who knew him, "of fine culture, a profound Shakespearean, and a thorough gentleman." His mother was descended from the family of the famous Richard Bentley. It was from his father that Leech inherited his skill with the pencil, which he began to use at a very early age. When he was only three, he was discovered by Flaxman, who had called on his parents, seated on his mother's knee, drawing with much gravity. The sculptor pronounced his sketch to be wonderful, adding, "Do not let him be cramped with lessons in drawing, let his genius follow its own bent, he will astonish the world,"—an advice which was strictly followed. One of his early productions, a mail-coach, done when he was six years old, is already full of surprising vigour and variety in its galloping horses. Leech was educated at Charterhouse, where Thackeray, his lifelong friend, was his schoolfellow, and at the age of sixteen he began to study for the medical profession under Mr Stanley at St Bartholomew's Hospital, where he won praise for the accuracy and beauty of his anatomical drawings. He was then placed under a Mr Whittle, an eccentric practitioner, the original of "Rawkins" in Albert Smith's *Adventures of Mr Ledbury*, and afterwards under Dr John Cockle, but gradually the true bent of the youth's mind asserted itself, and he drifted into the artistic profession. He was eighteen when his first designs were published, a quarto of four pages, entitled *Exchange and Sketchings by A. Pen, Esq.*, comic character studies from the London streets. Then he drew some political lithographs, did rough sketches for *Bell's Life*, produced an exceedingly popular parody on Mulready's postal envelope, and, on the death of Seymour, applied unsuccessfully to illustrate the *Punch* Papers. In 1840 Leech began his contributions to the magazines with a series of etchings in *Bentley's Miscellany*, where Cruikshank had published his splendid plates to *Jack Sheppard* and *Oliver Twist*, and was illustrating *Guy Fawkes* in sadly feeble fashion. In company with the elder master Leech designed for the *Illustrated Legends* and *Stanley Thorn*, and till 1847 produced many independent series of etchings. These, however, cannot be ranked with his best work; their technique is exceedingly imperfect, they are rudely bitten, with the light and shade out of relation; and we never feel that they express the artist's individuality, the *Richard Savage* plates, for instance, being strongly reminiscent of Cruikshank, and "The Dance at Stamford Hall" of Hablot Browne. In 1845 Leech illustrated *St Giles* and *St James* in Douglas Jerrold's newly started *Shilling Magazine*, with plates more vigorous

and accomplished than those in *Bentley*, but it is in subjects of a somewhat later date, and especially in those lightly etched and meant to be printed with colour, that we see the artist's best powers with the needle and the acid. Among such of his designs are four charming plates to Dickens's *Christmas Carol*, 1844, the broadly humorous etchings in the *Comic History of England*, 1847-48, and the still finer illustrations to the *Comic History of Rome*, 1852,—which last, particularly in its minor woodcuts, shows some exquisitely graceful touches, as witness the fair faces that rise from the surging water in "Cicilia and her Companions Escaping from the Etruscan Camp." Among the other etchings which deserve very special reference are those in *Young Master Troublesome* or *Master Jacky's Holidays*, and the frontispiece to *Hints on Life, or How to Rise in Society*, 1845,—a series of minute subjects linked gracefully together by coils of smoke, illustrating the various ranks and conditions of men, one of them—the doctor by his patient's bedside—almost equaling in vivacity and precision the best of Cruikshank's similar scenes. Then in the fifties we have the numerous etchings of sporting scenes, contributed, along with woodcuts, to the *Handley Cross* novels.

Turning to Leech's lithographic work, which succeeded the early political caricatures already mentioned, we have, in 1841, the *Portraits of the Children of the Mobility*, an important series dealing with the humorous and pathetic aspects of London street Arabs, which were afterwards so often and so effectively to employ the artist's pencil. Amid all the aqualor which they depict, they are full of individual beauties in the delicate or touching expression of a face, in the graceful turn of a limb. The book is scarce in its original form, but in 1875 two reproductions of the outline sketches for the designs were published,—a lithographic issue of the whole series, and a finer photographic transcript of six of the subjects, which is more valuable than even the finished illustrations of 1841, in which the added light and shade is frequently spotty and ineffective, and the lining itself has not the freedom which we find in some of Leech's other lithographs, notably in the *Fly Leaves*, published at the *Punch* office, and in the inimitable subject of the nuptial couch of the Caudles, which also appeared, in woodcut form, as a political cartoon, with Mrs Caudle, personated by Brougham, disturbing by untimely loquacity the slumbers of the lord chancellor, whose haggard cheek rests on the wool-sack for pillow.

But it was in work for the wood-engravers that Leech was most prolific and individual. Among the earlier of such designs are the illustrations to the *Comic English* and *Latin Grammar*, 1840, to *Written Caricatures*, 1841, to Hood's *Comic Annual*, 1842, and to Albert Smith's *Wassail Bowl*, 1843, subjects mainly of a small vignette size, transcribed with the best skill of such woodcutters as Orrin Smith, and not, like the larger and later *Punch* illustrations, cut at speed by several engravers working at once on the subdivided block. It was in 1841 that Leech's connexion with *Punch* began, a connexion which subsisted till his death on the 29th of October 1864, and resulted in the production of the best known and most admirable of his designs. His first contribution appeared in the issue of 7th August, a full-page illustration—entitled "Foreign Affairs"—of character studies from the neighbourhood of Leicester Square. His cartoons deal at first mainly with social subjects, and are rough and imperfect in execution, but gradually their method gains in power and their subjects become more distinctly political, and by 1849 the artist is strong enough to produce the splendidly humorous national personification which appears in "Dissociated Measuring the British Lion." About 1845 we have the first of that long series of half-page and quarter-page pictures of

life and manners, executed with a hand as gentle as it was skilful, containing, as Mr Ruskin has said, "admittedly the finest definition and natural history of the classes of our society, the kindest and subtlest analysis of its foibles, the tenderest flattery of its pretty and well-bred ways," which has yet appeared,—a series far too popular and too voluminous to require or admit of particular description here. In addition to his work for the weekly issue of *Punch*, Leech contributed largely to the *Punch* almanacs and pocket-books, to *Once a Week* from 1859 till 1862, to the *Illustrated London News*, where some of his largest and best sporting scenes appeared, and to innumerable novels and miscellaneous volumes besides, of which it is only necessary to specify *A Little Tour in Ireland*, 1859, which is noticeable as showing the artist's treatment of pure landscape, though it also contains some of his daintiest figure-pieces, like that of the wind-blown girl, standing on the summit of a pedestal, with the swifts darting around her, and the breadth of sea beyond.

In 1862 Leech appealed to the public with a very successful exhibition of some of the most remarkable of his *Punch* drawings. These were enlarged by a mechanical process, and coloured in oils by the artist himself, with the assistance and under the direction of his friend Mr J. E. Millsais.

After even such a necessarily incomplete enumeration as we have made of Leech's many designs, it goes without saying that he was a singularly rapid and undisturbable worker. Canon Hole tells us, when he was his guest, "I have known him send off from my house three finished drawings on the wood, designed, traced, and rectified, without much effort as it seemed, between breakfast and dinner. The best technical qualities of Leech's art, his unerring precision, his unflinching vivacity in the use of the line, are seen most clearly in the first sketches for his woodcuts, and in the more finished drawings made on tracing-paper from these first outlines, before the characatures were added and the designs were transcribed by the engraver. Turning to the mental qualities of his art, it would be a mistaken criticism which looked him as a comic draftsman. Like Hogarth he was a true humorist, a student of human life, though he observed humanity mainly in its whimsical aspects,

"Fitting all he saw with shafts
With gentle satire, kin to charity,
That burns not."

The earnestness and gravity of moral purpose which is so constant a note in the work of the last century master is indeed far less characteristic of Leech, but there are touches of pathos and of tragedy in such of the *Punch* designs as the "Poor Man's Friend," 1846, and "General Fervier turned Traitor," 1855, and in "The Queen of the Arena" in the first volume of *Once a Week*, which are sufficient to prove that more solemn powers, for which his daily work afforded no scope, lay dormant in their artist. The purity and manliness of Leech's own character are impressed on his art. We find in it little of the exaggeration and grotesqueness, and none of the fierce political enthusiasm, of which the designs of Gillray are so full. Compared with that of his great contemporary George Cruikshank, his work is restricted both in compass of subject and in artistic dexterity.

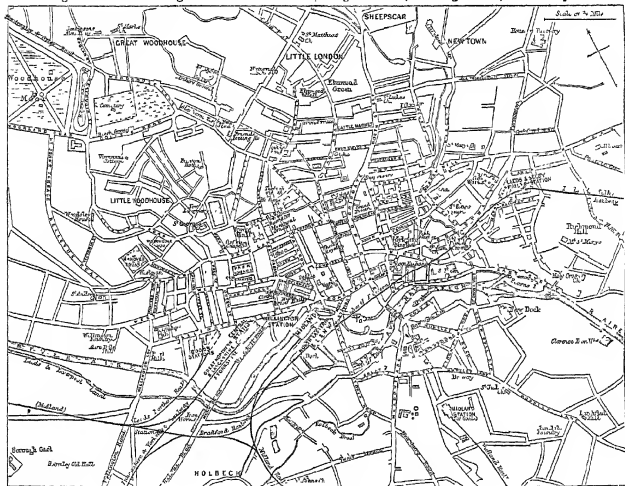
No formal biography of Leech has yet appeared, but interesting particulars regarding his life and works will be found in the following articles:—"John Leech's Pictures of Life and Character," by Thackeray, *Quarterly Review*, December 1854; "John Leech," by Dr John Brown, *North British Review*, March 1865, republished, with additional chapters by Canon Hole, in new edition of Dr Brown's essays (1892); letter by John Ruskin, *Arrows of the Chase*, vol. i. p. 161; *Conrad Massacre*, December 1864; *Scribner's Monthly*, vol. xvi. p. 158; "On Humorous Art," by Ernest Chesnut, *Gaude dei Bonis Arte*, 1875 (J. M. G.).

LEEDS, a town of England, in the West Riding of Yorkshire, the metropolis of the woollen manufacture, and in point of population only exceeded by London, Liverpool, Manchester, and Birmingham. Leeds is situated nearly in the centre of the West Riding, in the wapentake of Skyrack, and in the pleasant and well cultivated valley of the river Aire. The surrounding country possesses much cheerful beauty; and the view from Woodhouse Moor, one of the most elevated parts of the borough, is not excelled in any part of the Riding. For manufacturing and commercial purposes, the situation of Leeds is highly

advantageous. It is distant from London by the Great Northern Railway 185 miles, from Edinburgh 226, from Liverpool 74, from Manchester 42½, and from Birmingham 113, and may be said to occupy a central position in the railway system of England. It has also communication with Liverpool by the Leeds and Liverpool Canal, and with Hull by the Aire and Calder navigation, and through these means of transit has the highest facility for the transmission to the principal seaports of England of its various manufactures, and for receiving raw material at the lowest rate of charge. It is, moreover, the centre of an extensive coal and iron district. All the advantages for the successful working of machinery are therefore within its reach, and hence it has become the seat of several important industries, especially the woollen and linen manufactures, iron working, and machine-making.

Though regarded as the capital of the great manufacturing district of the West Riding, Leeds is not in its centre, but on its border. Eastward and northward the country is wholly agricultural, while to the west and south-west the populous villages resound with the shuttle and the steam-engine. In this district are carried on a woollen manufacture of great extent and of considerable antiquity and a worsted manufacture of extraordinary vigour (a graft on the woollen manufacture), to these have lately been added the iron manufacture and that of machines and steam-engines, and the making of boots and ready-made clothing, besides a manufacture of flax, which now constitutes one of the staple trades of Leeds.

Cloth is the staple trade of the town, although the manufacture itself is not the leading one within the borough, being carried on, to a large extent, in townships out of the



Plan of Leeds.

parish and borough of Leeds. In the town, however, the trade centres, and there the cloth is finally prepared for the market by what is technically termed finishing or dressing—a department quite distinct in Leeds from that of the manufacturer. In this respect the Yorkshire cloth trade differs essentially from that of the west of England, where the manufacturer conducts the two operations of making and finishing the cloth within the same premises. Several Leeds firms conduct their business on the west of England model, but, as the rule, the order of the trade is as follows. The great bulk of the cloths sold in Leeds are produced either in the out-townships of the borough, or in the villages lying west of Leeds, and principally in Pudsey, Farsley, Rawden, Yeadon, Horsforth, and Gumsley, which are all in other parishes, within an extreme radius of 10

miles from Leeds. The cloths so manufactured are sold in the unfinished or *ball* state to the merchants of Leeds, by whom they are put out to the cloth-dressers or finishers, whose special craft it is to raise the pile or nap on the face of the cloth, and to complete it for the purposes of the tailor and the final consumer. In former times a considerable proportion of the business between the manufacturer and the merchant was conducted in the cloth halls, which are two in number. In these the manufacturers formerly took their stand and waited the custom of the merchants, but within the last twenty or thirty years a great change has taken place in the mode of transacting business, and the cloth halls have practically fallen into disuse. The merchant now orders his goods direct from the manufacturer, specifying the weight, colour, and quality

of the articles he wants, and these are delivered to him without passing through the mills. Thus a picturesque and characteristic feature of life in Leeds seems likely at no distant date to become extinct. At one period it seemed probable that the business of the cloth trade would assume the west of England type. Mr William Hirst, a very skilful manufacturer, introduced goods of superior texture and quality, and by his success induced many capitalists to erect mills on a large scale, in which all the processes of the manufacture and finishing were conducted. The change was, however, only temporary. Many of these mills are now occupied for finishing only, and some have been devoted to other branches of the local manufactures. The spinning of flax by machinery was commenced in the township of Holbeck (in the borough of Leeds) more than one hundred years since, by Mr John Marshall, who was one of the first to apply the principle of Sir Richard Arkwright's water frame, invented for the cotton manufacture, to the spinning of linen yarn. The works of Messrs Marshall & Company are very extensive, and one portion of them is an object of attraction to all strangers visiting the town. It is a vast room 400 feet by 220, filled with machinery, all of which is turned by shafting which requires two coupled engines of 350 horse-power to impel it. Light is admitted by glass cupolas. The whole building is held together by a double series of iron ties, uniting the iron pillars which sustain the many-arched roof. The external form is Egyptian.

The spinning of worsted yarn and the weaving of worsted goods were formerly carried on to a considerable extent in Leeds, but have now nearly died out, Bradford, Bingley, and Keighley, with the villages immediately adjoining, having attracted almost the entire trade. Amongst the smaller branches of the textile manufactures carried on in Leeds must be enumerated those of silk and carpeting, neither of them unimportant, though falling short of the flax and woollen trades.

It is probable that the iron trade in its different branches, including the casting of metal, and the manufacture of steam-engines, of steam-ploughs, of machinery of every kind, and of mechanical tools, now gives employment to a larger number of persons within the borough of Leeds than any other branch of industry. The great works founded by the late Sir Peter Fairbairn, as well as those of Messrs Kitson & Co. and of Messrs John Fowler & Co., in the last-named of which the Fowler steam-plough is the staple article of manufacture, occupy places in the front rank of such establishments in the country, while Messrs Greenwood & Batley and other tool-makers give employment to a large number of hands, and export the goods they produce to all parts of the globe.

Leeds was at one time famed for the production of artistic pottery, and very fine specimens of old Leeds ware are still occasionally to be discovered among the residences of the poor in the town. This branch of manufacture, however, became extinct about eighty years ago. Within the last three years it has been revived, and once more attention has been directed to the high artistic merit which the pottery of the town has attained.

In addition to these particular branches of industry, the manufacture of ready-made clothing has become one of great importance. In some of the establishments for this purpose such as that of Messrs John Barrow & Sons, the number of hands employed is so large that from a thousand to twelve hundred suits of clothing can be produced daily. Machinery is now used in all the departments in these places, and the work is conducted with a rapidity and at a price which would have seemed incredible thirty years ago. Leeds has in recent years become famous as the chief seat of the cap manufacture in the United Kingdom.

The leather trade is also one of great importance in the borough, many large tanning establishments being erected on the outskirts, while the wholesale manufacture of boots and shoes for army and other purposes is carried on in workshops which are the largest of their kind in the United Kingdom.

No religious census has been taken in Leeds since that of 1851. There are, however, 181 places of worship in the town, these being divided as follows—Church of England, 10; Wesleyan Methodist, 40; Primitive Methodist, 20; United Methodist Free Church, 12; Congregational, 12; Baptist, 11; Methodist New Connexion, 10; Catholic, 8; Unitarian, 3; Presbyterian, 2; Friends, 2, various, 6. The Leeds school board, which was established immediately after the passing of the Education Act in 1870, has now (1882) 47 schools under its control within the limits of the borough, and these accommodate 80,000 children. In addition to these there are 84 national and parochial schools, 8 Roman Catholic schools, and 6 Wesleyan schools. The educational institutions of a higher order in the town are numerous and important. Of these the principal is the Yorkshire College, established in 1875 for the purpose of supplying instruction in the arts and sciences which are applicable to the manufactures, engineering, mining, and agriculture of the country. It has a staff of 19 professors, instructors, and assistant lecturers, and upwards of 350 day and 160 evening students. The college, which has carried on its operations hitherto in temporary premises, will shortly remove to permanent buildings designed by Mr Waterhouse, A.R.A. These buildings, which when completed will cost upwards of £100,000, will occupy a site of about 8½ acres, and will comprise extensive laboratories and workshops, large lecture theatres, and a college library and museum. The Leeds Public Library, established under the Public Libraries Act, now takes the first place amongst similar institutions in the borough. The reference library contained 26,000 volumes at the close of 1881, and the lending libraries 83,000 volumes, the expenditure for the year being £4160. The issue of volumes during the year reached the large total of 689,618. The Leeds Old Library, a private institution, founded in 1763 by Dr Friesen, who was at that time minister at the Unitarian chapel in the town, contains a very valuable selection of books, numbering about 75,000 volumes, and is in possession of commodious premises in Commercial Street. The Philosophical and Literary Society, established in 1826, possesses a handsome building in Park Row, containing a laboratory, a lecture room, and a museum, with many fine specimens in natural history, geology, and archaeology. The society also possesses a library of upwards of 16,000 volumes, chiefly rare scientific works. During the winter months, lectures on scientific and literary subjects are given in the lecture hall by men of eminence. The Leeds Mechanics' Institute in Cookridge Street is a striking building in the Italian style. It comprises a large circular lecture room, with gallery, capable of seating 1500 persons, besides a library, reading committee, and class rooms. The foundation stone was laid in 1836, and the total cost of the building has been nearly £30,000. Day and evening classes and an art school are carried on within the building, and are largely frequented. The Young Men's Christian Association, another educational institute of importance, occupies the building in South Parade formerly used as a mechanics' institute. The Grammar School, a handsome building, erected at Woodhouse Moor, has endowments producing over £3000 yearly. There are six exhibitions of £50 a year, each tenable for four years at Oxford, Cambridge, and Durham. It provides education for about 280 scholars. There is also a large training college for students proposing to enter the Wesleyan Methodist ministry at Headingley, one of the suburbs of Leeds. The principal charitable institution of the town is the general infirmary in Great George Street, a fine building, built of brick, with stone dressings, from designs by Sir Gilbert Scott. It is arranged upon the pavilion system, each ward being isolated from the rest of the building, and has a highly ornamental exterior, whilst the internal accommodation is suited to the requirements of the patients and the medical staff. The total cost of the erection was more than £100,000. The house of recovery for fever patients, founded in 1802, now occupies a handsome building at Burmantoft. There are also a large building used as a public dispensary in North Street, an institution for the blind, deaf, and dumb in Woodhouse Lane, a School of Medicine and other hospitals and charitable institutions.

The town and borough of Leeds was incorporated by letters patent, 2 Charles I., but this charter was cancelled or surrendered. A new charter was granted, 18 Charles II., under the style of mayor, aldermen, and burgesses of the borough of Leeds. The corporation consisted of a mayor, 12 aldermen, 24 assistants, and a staff of 18 officials. The Municipal Act of 1861 gave a corporation of 16 aldermen and 48 councillors, which has effected great improvements in the management of local matters. In addition to the powers granted to it by the Municipal Reform Act, the town council has secured, through successive Improvement Acts.

complete control over the paving and construction of the streets within the borough, as well as considerable powers for enforcing the consumption of smoke. It has also acquired the whole of the water supply of Leeds, and it controls the public markets, the lighting and watching of the streets, the execution of the Public Health Acts, &c. The supply of water for Leeds is now derived from the valley of the Wharfe, one of the tributaries of the Wharfe, where very extensive reservoirs have been provided, at a cost of £1,400,000. The gas supply of the town is also in the hands of the corporation, which purchased the whole of the gas works from the two companies then in existence in 1879, at the cost of nearly £1,000,000. The entire suite of markets, comprising the corn exchange, the Smithfield cattle market, and the produce markets, have been acquired at different periods, and the corporation has expended upon this property £240,000. The taxable value of the municipal borough is £1,152,000, and the income of the borough derived from the borough rate £28,106. The debt of the town amounted in 1881 to £3,884,000. Of the places of recreation in Leeds, the principal is the Grand Theatre, a handsome building erected from the design of Mr. Conson, in Upper Briggate, in 1879. Large assembly-rooms adjoin this theatre. There is another theatre in King Charles Croft, and there are one or two music halls. Some years ago the corporation acquired, at a large expenditure, Roundhay Park, an estate of great beauty in the neighbourhood of the town. After a portion of the ground had been laid out as building sites, the central part of the estate, comprising splendid lawns, woods of great extent, and a lake covering 40 acres, were reserved as a place of public recreation, and the park is now a favorite resort of the people of Leeds, and also of the inhabitants of the surrounding country. It is under the management of a committee of the corporation, and, though situated at an inconvenient distance from the centre of the town, is largely frequented during the summer months. Woodhouse Moor, a common occupying an elevated position north-west of the town, has been planted with trees and provided with walks within the last ten years, and in other parts of the town the corporation have laid out places of land, which had long been left bare and neglected.

The external appearance of the town has been greatly improved within the last twenty years. The event which had the greatest influence in promoting the erection of more handsome buildings than those of which Leeds was formerly constituted was the opening of the town-hall by the Queen in the year 1853. This is a noble building in the Grecian style. It is 250 feet long and 200 broad, and is crowned by a tower 225 feet high. The principal apartment in it is the Victoria Hall, a richly ornamented chamber 161 feet long, 72 feet wide, and 76 feet high. The building, which cost, including the site and furniture, more than £150,000, is adorned with statues and portraits of local celebrities. The municipal offices, including school board offices and buildings for the public library, are now in course of erection in the immediate neighbourhood of the town-hall, and will cost when completely upwards of £100,000. The other public buildings of importance in the town are the royal exchange, in Penpendicular Gothic, the foundation of which was laid in 1872, the corn exchange, a fine oval edifice, and the bank of Messrs Beckett & Co., one of the best works of Sir Gilbert Scott.

Leeds has long been distinguished for the activity of its political and public life. It has taken a leading part in many of the great questions which have agitated the country during the present century, and among its successive representatives in parliament have been Lord Macaulay, Sir William Molesworth, Mr. Marshall, those members of the Baines family, and other men whose names are familiar in the annals of the liberty party, to which upon the whole the borough has given a consistent support since its enfranchisement in 1832. The newspapers published in the town are the *Leeds Mercury*, daily, Liberal, established in 1718; the *Yorkshire Post and Leeds Intelligencer*, daily, Conservative, established in 1754; the *Leeds Express*, evening paper, Liberal, established in 1840; the *Leeds Conservative*; and the *Leeds Times*, weekly, Liberal. The *Leeds Mercury* for eighty years has been the property of Messrs Edward Baines & Sons, and has long been considered one of the most influential of provincial journals.

The area of the municipal and parliamentary borough is 21,572 acres. In addition to the township of Leeds come out-townships are included in this area. The population (207,105 in 1861 and 269,212 in 1871) in 1881 was 308,126, the number of inhabited houses being 65,084. Leeds is one of the boroughs which under the Reform Act of 1867 elect three members of parliament.

The name of Leeds has been attributed to a chief named Leod. Traces of Roman workmanship have at various times been discovered in the town, and in the parish church several very interesting Anglo-Saxon crosses, discovered when the church was rebuilt in 1588, are preserved. The castle of Leeds occupied a site on Mill Hill, and is supposed to have been built by Albert de Laci at the time of the Conquest, but no traces of it remain.

For the history of Leeds see Ralph Thoresby, *Duettius Ledoniensis*, 1716, 2d ed., 1816, with notes and additions by T. D. Whitaker,

who published the same year a companion volume *Leodis and Elmetis*; Parsons, *History of Leeds, Bradford, and Wakefield*, 1840; Wardell, *The Antiquities of the Borough of Leeds*, 1853. (T. W. R.)

LEEK, the *Allium Porrum* of botanists, a plant which is now considered as a mere variety of *Allium Ampeloprasum* produced by cultivation. It was formerly regarded as being a native of Switzerland, and the year 1582 has been set down as the date of its introduction to England. Both these assumptions are, however, erroneous. The plant is probably of Eastern origin, since it was commonly cultivated in Egypt in the time of the Pharaohs, and is so to the present day; while as regards its first appearance in England both Tusser and Gerard—two of our earliest writers on this class of subjects, the former of whom flourished in the early part and the latter in the later part of the 16th century—speak of it as being then commonly cultivated and used.¹ The Romans, it would appear, made great use of the leek for savouring their dishes, as seems proved by the number of recipes for its use referred to by Celsus. Hence it is more than probable that it was brought to England by the Romans during the period of their occupation. Italy was celebrated for leeks in the time of Pliny (*Z. N.*, xix. c. 8), according to whom they were brought into great notice and esteem through the emperor Nero, derisively surnamed "Porrophagus," who used to eat them for several days in every month to clear his voice. The leek is very generally cultivated in Great Britain as an esculent, but more especially in Scotland and in Wales, being esteemed as an excellent and wholesome vegetable, with properties very similar to those of the onion, but of a milder character. In America it is not much cultivated except by market gardeners in the neighbourhood of large cities. The whole plant, with the exception of the fibrous roots, is used in soups and stews. The sheathing stalks of the leaves lay over each other, and form a thickish stem-like base, which is blanched, and is the part chiefly preferred. These blanched stems are much employed in French cookery. They form an important ingredient in Scotch winter broths, and particularly in the national dish called *cullen-cakes*, and are also largely used boiled, and served with toasted bread and white sauce, as in the case of asparagus. Leeks are sown in the spring, earlier or later according to the soil and the season, and are planted out for the summer, being dropped into holes which are made with a stout dibble and left unfilled in order to allow the stems space to swell. When they are thus planted deeply the holes gradually fill up, and the base of the stem becomes blanched and prepared for use, a process aided by drawing up the earth round about the stems as they elongate. The leek is one of the most useful vegetables the cottager can grow, as it will supply him with a large amount of produce at a season when it will prove very welcome, namely, during the winter and spring. It is extremely hardy, and presents no difficulty in its cultivation, the chief point, as with all succulent esculents, being that it should be grown quickly upon well-enriched soil. The plant is of biennial duration, flowering the second year, and perishing after perfecting its seeds. The leek is the national symbol or badge of the Welsh, who wear it in their hats on St David's Day. The origin of this custom has received various explanations, all of which are probably more or less speculative.

LEEK, a market-town of Staffordshire, England, is situated on a fine eminence above the river Churnet, and on the Churnet Valley branch of the North Staffordshire Railway, 24 miles east-north-east of Stafford. Its streets

¹ Tusser, in his verse for the month of March, writes—

"Now leekes as in a season, for pottage ful good,
And speereth the milke cow, and purreth the blood,
Thene hawking with pession, for pottage in Lent,
Thene speereth both omelet and bread to be spent."

are wide and regular, and its sanitary and water arrangements are very complete. The church, dedicated to Saint Edward the Confessor, is in the Early English style. Much of the old building, erected in 1180, remains, but it has been frequently repaired, and in 1867 and 1875 underwent extensive restoration. In the vicinity of the town are the ruins of the Cistercian abbey De la Croix (known as Dislucra), erected in 1214 by Raoul de Blondeville, sixth earl of Chester. The grammar school was built in the beginning of last century by the earl of Macclesfield. The other principal buildings are the memorial cottage hospital for the county of Stafford, erected in 1870 from a private bequest, and the new town and market hall erected on the site of the old building. There is an important silk manufacture, and also agricultural implement works. The population of the urban sanitary district in 1881 was 12,865.

British and Roman remains have been found in the vicinity of Leek at various periods, and the town itself is of very great antiquity. Not some centuries after the Conquest it was the property of the earls of Chester, but afterwards it was bestowed on the monks of the abbey De la Croix. It received a market from King John On the 31st of December 1246 it was entered by the troops of the Pretender, and again on the 7th of the same month.

LEER, a seaport and the chief town of a circle in the province of Hanover, Prussia, lies on the right bank of the Leda near its confluence with the Ems, 16½ miles south of Aunch in 53° 13' N. lat. and 7° 27' E. long. The aspect of the town is generally pleasing, the streets being broad, well-paved, and adorned with many elegant buildings, among which are Roman Catholic, Lutheran, and Calvinist churches, and several public schools. The principal manufactures are for linen and woollen fabrics, hosiery, paper, cigars, soap, vinegar, and earthenware. There are, moreover, two iron-foundries, several distilleries, tanneries, and shipbuilding yards, besides many large warehouses. The transit trade from the regions traversed by the Westphalian and Oldenburg railways is considerable. The principal exports are cattle, horses, cheese, butter, honey, wax, flour, paper, hardware, and Westphalian coal. Vessels drawing 16 feet of water can approach the quays. The population in 1880 was 10,074.

LEEUWARDEN, or LEUWARDEN (in Frisian *Leeuward*, and Latinized as *Leovardus*), a town of Holland, at the head of the province of Friesland, 17 miles inland from Harlingen and 32 west of Groningen. It is one of the most prosperous of the secondary towns in the country, and, thanks in great measure to the opening of the railway to Harlingen (1868) and Groningen (1866), full of life and enterprise. To the name of the Frisian Hague it is entitled as well by similarity of history as by similarity of appearance. As the Hague grew up round the court of the counts of Holland, so Leeuwarden round the court of the Frisian stadtholders; and, like the Hague, it is an exceptionally clean, tasteful, and attractive town, with parks, pleasure grounds, and drives. The old gates have been somewhat ruthlessly cleared away, and the site of the town walls on the north and west competes with the Prince's Garden as a public pleasure ground. Besides the town-house (dating from 1715, and interesting mainly for the value of the archives admirably arranged by the Dutch antiquarian Eekhoff), the Prince Frederick barracks, capable of containing one thousand men, the corn exchange, and the beautiful weighhouse (dating from 1546), Leeuwarden contains a royal palace, originally the residence of the Frisian stadtholders, the provincial courts, erected in 1850; the so-called chancery (*Kanselarij*), a fine red brick mansion built in 1803 for the chancellor of Dukes George of Saxony, and now used as a house of detention; the penitentiary, rebuilt since 1870, and the largest establishment of the kind in Holland; and, somewhat oddly,

the communal buildings of the neighbouring commune of Leeuwardendam. The church of the Jacobins deserves mention as perhaps the largest monastic church in the country, and as the burial-place of the Frisian stadtholders (Louis of Nassau, Anne of Orange, &c.), whose splendid tombs, however, were destroyed in the revolution of 1795. Unlike the Hague, Leeuwarden is by nature and tradition the centre of an extensive and flourishing trade (in grain, cattle, flax, chicory, &c.). Its present distance from the sea is made up for by abundant means of communication by road, railway, and canal. The canal to Dokkum opens up the rich clay districts of the province, the canal to Harlingen (dating from 1507) furnishes a channel for the trade with England, and other canals give access to the province of Groningen and the Zuyder Zee, and so to Amsterdam and the provinces of Holland. And, though the industrial development is far from keeping pace with the commercial, Leeuwarden possesses large timber and boat-building yards, iron-foundries, copper-works, and lead-works; manufactures sewing machines, sofas, organs, cardboard, oil, and tobacco; and enjoys a wide reputation for its gold and silver wares. The population of the town in 1869 was 24,862; that of the commune increased from 15,686 in 1714 to 27,003 in 1875 (5217 Roman Catholics, 1124 Jews).

Leeuwarden, or that part of it which was called *Nijelove*, appears as early as 1149, and received the rank of a town in 1190. At that time it had free command of the sea, but the entry of the Middlezee on which it stood had already silted up by about 1200. In 1398 we find the town bestowed by Duke Albert of Holland on Gerolt Cammingha, whose family residence is still one of the notable mansions of the place. During the 16th and 18th centuries it plays a considerable part in Frisian history. The year 1499 saw the meeting of a stronghold in the town, which caused Albert of Saxony to bring the country under, and which made Leeuwarden a place of military importance till it was destroyed in 1650. When in 1659 Utrecht was taken by the rank of an archiepiscopal, Leeuwarden was made a bishopric, but only one occupant of the see was actually consecrated before the Reformation got mastery of the town in 1660.

LEEUWENHOEK, or LEUWENHOEK, ANTHONY VAN (1632-1723), a microscopist of remarkable scientific ability, was born at Delft, in Holland, in 1632. He does not seem to have had the advantage of a liberal education, but was probably brought up as a glass-grinder, early acquiring a reputation for the excellent lenses with which he furnished the microscopists who were then turning their attention to the minute structure of organized bodies. He appears soon to have found that simple lenses of very short focus were preferable for this purpose to the compound microscopes then in use; and it is clear from the discoveries he made with these that they must have been of very excellent quality.¹ These discoveries were for the most part originally given to the world in the *Philosophical Transactions* of the Royal Society, to the notice of which learned body he was first introduced by De Graaf in 1673. He was elected a fellow in 1680, and was chosen in 1697 a corresponding member of the Academy of Sciences in Paris. He died at his native place in 1723; and Sir Martin Folkes, then vice-president of the Royal Society, says in the eulogium he pronounced:—"We have seen so many and those of his most surprising discoveries, so perfectly confirmed by great numbers of the most curious and

¹ It is much to be regretted that a cabinet which he bequeathed to the Royal Society of London, containing twenty-six of these single microscopes, each mounted with a suitable object, and accompanied by a magnified drawing of it, the whole being the work of his own hands,—is no longer in its possession. Baker, in his *Treatise on the Microscope*, affirms, from personal and careful examination, that (contrary to the statements of some writers who represented Leeuwenhoek as having worked with globules of glass) "every one of the twenty-six microscopes is a double-convex lens, and not a sphere or globule"; and he states that their magnifying powers range from 40 to 180 diameters.

judicious observers, that there can surely be no reason to distrust his accuracy in those others which have not yet been so frequently or so carefully examined."

His capital discovery was undoubtedly that of the capillary circulation of the blood, first announced in 1690, which afforded the link still wanting for the completion of the doctrine of Harvey, by showing that the blood passes from the arteries into the veins through a network of extremely minute vessels, the tissue of which allow the fluid plasma to transude into the vessels it traverses, so as to serve for their nutrition. He first sought to discern this in the comb of a young cock, then in the ear of a white rabbit, and then in the membrane of a bat's wing; but, though in the last he was able to follow an artery to its ultimate subdivision, he found that, as soon as "it became so small as only to admit one or two globules to pass through it at a time, he then lost sight of it," partly in consequence of "the membrane of the wing being covered with a kind of scale" (epidermis). His first success was obtained with the tail of a newly-hatched tadpole, in which, he says, "I could distinctly perceive the whole circuit of the blood, in its passage to the extremities of the vessels, and in its return towards the heart"—its movement being made apparent by that of the globules carried along in its current. These corpuscles, which had been previously discovered by Malpighi, were correctly described by Leeuwenhoek as flattened circular disks in man, and as oval disks in tadpoles. He afterwards observed the capillary circulation in the tail-fins of small fishes, and recognized the ellipticity of the corpuscles in that class also. He even made out the capillary circulation in the broad thin extremities of the two smallest or hind feet of small crabs about an inch in diameter, and correctly remarked that the corpuscles of their blood were colourless and far fewer than those of fishes or tadpoles, "the globules in red blood being (I am well assured) twenty-five times more in number than those, in the same space, in the blood of a crab." To us it seems not a little surprising that his assertions in regard to the capillary circulation were deemed incredible by some of his scientific contemporaries. It is recorded, however, that Peter the Great, when passing through Delft in 1698, requested Leeuwenhoek to pay him a visit, and to bring his microscope with him, and that the czar was particularly impressed by the spectacle of the circulation in the tail of a small eel.

Among Leeuwenhoek's discoveries in the minute anatomy of man and the higher animals may be specially mentioned the tubules of teeth, the fibrous structure of the crystalline lens, the solidity of the human hair (which had been previously represented as tubular), the structure of the epidermis, and the parallel tubules of the medullary substance of the brain,—which last, however, he supposed to be vessels conveying fluid substance from the highly vascular cortical layers, for the support and nourishment of the spinal marrow and nerves. He was also an independent discoverer of the spermatozoa, although anticipated by a few months by Ludwig Hamn, a student at Leyden.

As might be expected, he made many observations on the anatomy of insects; and among the most interesting of these are his discovery of the composite structure of the eyes (which he recognized also in the eyes of the shrimp), the scales on the wings not only of moths but of the gnat, and the annular (really spiral) structure in the walls of the "vessels" (*tracheæ*) of their wings. He also proved that cochineal, which had been supposed to be "the fruit of some tree," is really the dried body of an insect, which he not unnaturally supposed to be allied to the ladybird. He likewise gave a very good account of the spinnerets and poison-claws of spiders, and of the comb-like

appendages to their feet. He made a special study, also, of the anatomy of the flea,—besides following out its reproduction with great care, as will presently appear.

In examining the stomachs of shrimps, he found in them some minute shells, of which he figured a specimen so exactly that it can be at once recognized as a *Monitina*,—probably the first recent foraminifer that had been distinctly noticed. But one of his most interesting observations is that which he made upon a small *Balanus* attached to a mussel-shell; for he not only gives a good figure of the animal, but describes the way in which it retorts into its shell, and closes its orifice by two shelly valves. His figure most distinctly shows its *articulate* character, which has only in modern times caused its removal from the molluscae to the annulose sub-kingdom.

Not less admirable were his observations on the structure of plants. He made very careful sections of stems of the oak, elm, beech, willow, fir, and other trees, in different directions, of which he gave careful figures and descriptions,—especially noting the horizontal arrangement of the cells in the "medullary rays," and the peculiar "pitting" of the woody fibre of the fir, as well as the absence of large vessels in the latter. He also examined the structure of various germinating seeds, and gave accurate descriptions of the relation of the embryo to the cotyledons.

Although, when he ventured into physiological speculation, Leeuwenhoek's ideas (like those of the best physiologists of his time) were often very crude, his reasonings upon the facts actually observed by him are often remarkably cogent and sagacious. Thus, to estimate the insensible perspiration, he placed his hand within a dry glass jar, closed the space between its neck and his wrist by stuffing his handkerchief into it, and carefully collected and weighed the moisture which accumulated in its interior during a given time, and by a computation based on the ratio of the surface of the hand to that of the entire body he concluded that about 28 oz. of fluid are daily lost by transpiration, which is not far from the truth. So, again, he triumphantly refuted the chemical theories which then reigned in medicine, and which assumed that the blood undergoes a fermentation like that of wine or beer, by the statement that he had never seen in the blood-vessels the bubbles of gas which must be generated in them if this doctrine were correct. In one important point, however, he allowed his imagination to supplement the necessary imperfection of his observations, maintaining that each blood-disk is made up of six coherent particles, an idea probably suggested by the crenated appearance which the blood-disks often present.

It is to Leeuwenhoek that we owe the refutation of the then current heliogenic doctrine that animals of high organization can be "produced spontaneously, or bred from corruption." This doctrine had been previously attacked by Redi, who showed that the putrefaction of meat will not engender maggots, if the access of blow-flies be prevented. But even Redi, while upholding the doctrine "*Omne vivum ex vivo*," believed that the insects found within the galls of plants, and the parasitic worms by which the human body is sometimes infested, are generated by a peculiar modification of the living vegetable or animal substance. It was Leeuwenhoek who first explicitly took up the position that every living organism reproduces its like, no type originating in any other way than by the ordinary generation of its kind; "*Omne vivum ex ovo*." Thus he established by careful and prolonged observation, in a great variety of cases in which "spontaneous generation" had been reputed to take place, and he further continually adduced the great complexity of organization which his microscopic researches had revealed in what had been previously regarded as creatures of the lowest grade, as an argument against the doctrine that they are "bred from corruption." Thus he followed out the whole history of oak-galls, and showed that they are a product of a peculiar vegetable growth, excited by the insertion of an egg by the winged insect, and supplying the maggot, when hatched, with food. So, again, he showed that the warts of granaries, then commonly supposed to be bred from wheat, as well as in it, are nothing else than grubs hatched from eggs deposited by winged insects; and he practically applied this conclusion, by recommending that granaries thus infested should be repeatedly fumigated with sulphur at the time when these insects come forth, so as to kill them before they deposit eggs. His chapter on the flea, in which he not only describes its structure, but traces out the whole history of its metamorphoses from its first emergence from the egg, is full of interest,—not so much for the exactness of his observations, as for the evidence of revelation of the extraordinary ignorance then prevalent in regard to the

origin and propagation of "this minute and despicable creature," which some asserted to be produced from sand, others from dust, others from the dung of pugs, and others from urine, but which he showed to be "endowed with as great perfection in its kind as any large animal," and proved to breed in the regular way of winged insects. He often noted the fact that the pupa of the flea is sometimes attached and fed upon by a mite,—an observation which suggested the well-known lines of Swift.

Although Bonnet is usually credited with the discovery of the viviparous propagation of the *Aphides*, this had been really made by Leeuwenhoek half a century previously. For, his attention having been drawn to the lighting of the young shoots of fruit-trees, which was commonly attributed to the ants found upon them, he was the first to find the *Aphides* that really do the mischief, and, upon searching, after his wont, into the history of their generation, he observed the young within the bodies of their parents. He carefully studied also the history of the wit, and was the first to show that what had been commonly reputed to be "ant eggs" are really their pupae, containing the perfect insect nearly ready for emission, whilst the true eggs are far smaller, and give origin to "maggots" or larvae.

Of the sea-mussel, again, and other shell-fish, he argued (in reply to a then recent defence of Aristotle's doctrine by Bonnet, a learned Jesuit of Italy) that they are not generated out of the mud or sand which is found on the sea-shore or the beds of rivers at low water, but from spawn, by the regular course of generation. "For my part," he says, "I hold it equally impossible for a small shell fish to be produced without generation as for a whale to have its origin in the mud." And he maintained the same to be true of the fresh-water mussel (*Unio*), whose ova he examined so carefully that he saw in them the rotation of the embryo, a phenomenon supposed to have been first discovered long afterwards. "This uncommonly pleasing spectacle," he says, "is enjoyed by myself, my daughter, and the engraver for three whole hours, and we thought it one of the most delightful that could be exhibited." Not only was he the first discoverer of the rotifers, but he showed "how wonderfully nature has provided for the preservation of their species," by their tolerance of the drying-up of the water they inhabit, and the resistance afforded to the rupture of the fluid which their bodies by the impermeability of the casing in which they then become enclosed. "We can now easily conceive," he says, "that in all rain-water which is collected from gutters in cities, and in all waters exposed to the air, animalcules may be found, for they may be carried thither by the particles of dirt blown about by the winds." Although Hakea is usually credited with the first careful study of the "wheel-animalcule," yet he really added very little to the account long previously given of it by Leeuwenhoek. In the same spirit he investigated the generation of sels, which were at that time exposed, not only by the ignorant vulgar, but by "respectable and learned men," to be produced from dew (!) without the ordinary process of generation. He was rewarded by the discovery of their viviparous propagation,—his careful and prolonged observations on which point, though since called in question, have never been refuted. The spectacle of the minute sels lying together in a transparent liquid within the body of the female gave him, he says, great pleasure,—affording a complete answer to those who said, behind his back, "Since Mr. Leeuwenhoek is endeavouring to establish the regular generation of all animals, let him show us in what manner sels are bred."

Altogether it does not seem too much to affirm that Leeuwenhoek is well entitled to be considered, not only as "the father of scientific microscopy," but as having contributed more than any other naturalist to the overthrow of the doctrine of "spontaneous generation," and as having set a most admirable example of scientific method in the prosecution of biological research.

Leeuwenhoek's contributions to the *Philosophical Transactions* amounted to one hundred and twelve. He also published twenty-six papers in the *Memoirs of the Paris Academy of Sciences*. Two collections of his works appeared during his life, one in Dutch, and the other in Latin; the most complete edition having been published at Leyden shortly before his death in 4 vols. (1719-22). A selection from this, translated into English by S. Hoole, was published in London (1798-81), 2 vols. 4to. (W. B. G.)

LEEWARD ISLANDS. See WEST INDIES.

LEFFREY D'ETAPLES. See FABRE, JACQUES.

LEGATE, one of the special names of a messenger or ambassador of the pope. The first four centuries present us with no actual recorded instances of recognized delegation of the papal authority; for that Hosius acted as papal legate at the council of Nice is nothing more than an

assertion of Gelasius of Cyzicus, who wrote about the end of the 5th century, and no Western prelate took any part, either personally or otherwise, in the first council of Constantinople. The fifth (sometimes called the seventh) canon of the council of Sardica, in 343, however, shows that the possibility of such delegation had already begun to be discussed, and suggests that it may actually have been exemplified before that date. This canon provides that, in case of an appeal by a deposed bishop to Rome, if the pope is inclined to grant a new trial, it shall be competent for him to write to the bishops of the neighbouring province, but if the appellant wishes the pope to send priests from his own side ("ut de latere suo presbyteros mittat"), it shall be free to the pope to do so, and give them due rank and dignity in the court thus constituted (Hefele, *Conc.*, i. 568). Instances of delegation of the papal authority in various degrees become numerous in the course of the 5th century, especially during the pontificate of Leo I. Thus Leo writes in 444 (Ep. 6) to Anastasius of Thessalonica, appointing him his vicar for the province of Illyria; the same arrangement, he informs us, had been made by Pope Siricius in favour of Anysius, the predecessor of Anastasius. Similar vicarial or legatine powers had been conferred in 418 by Zosimus upon Patroclus, bishop of Arles. In 449 Leo was represented at the "Robber Synod" from which his legates hardly escaped with life; at Chalcedon in 451, they were treated with singular honour. Again, in 453 the same pope writes to the empress Pulcheria, naming Julianus of Coe as his representative in the defence of the interests of orthodoxy and ecclesiastical discipline at Constantinople (Ep. 112); the instructions to Julianus are given in Ep. 113 ("hanc specialem curam vices meae functionis assumas"). The designation of Anastasius as vicar apostolic over Illyria may be said to mark the beginning of the custom of conferring, *ex officio*, the title of *legatus* upon the holders of important sees, who ultimately came to be known as *legati nati*, with the rank of primate, the appointment of Julianus at Constantinople gradually developed into the long permanent office of *apocrisarius* or *respondens*. Another sort of delegation is exemplified in Leo's letter to the African bishops (Ep. 12), in which he sends Potentius, with instructions to inquire in his name, and to report (*vicem curae nostrae fratri et consacerdoti nostro Potentio delegantes qui de episcopis, quorum culpabilis ferebatur electio, quid veritas haberet inquireret, nobiscum omnia fideliter indicaret*). Passing on to the time of Gregory the Great, we find Augustine of Canterbury sometimes spoken of as *legatus*, but it does not appear that in his case this title was used in any strictly technical sense, although the archbishop of Canterbury afterwards attained the permanent dignity of a *legatus natus*. Boniface, the apostle of Germany, was in like manner constituted, according to Hincmar (Ep. 30), a *legatus* of the apostolic see by Popes Gregory II. and Gregory III. According to Hefele (*Conc.*, iv. 239), Rodolph of Porto and Zacharias of Anagni, who were sent by Pope Nicolas to Constantinople in 860, were the first who are actually called *legati a latere*. The policy of Gregory VII. naturally led to a great development of the legatine as distinguished from the ordinary episcopal function. According to the *Nova Compilatio Decretalium* of Gregory IX., under the title "De officio legati" the canon law recognizes two sorts of legats, the *legatus natus* and the *legatus datus* or *missus*. The *legatus datus* (*missus*) may be either (1) *delegatus*, or (2) *nuncios apostolicus*, or (3) *legatus a latere* (*lateralis, collateralis*). The rights of the *legatus natus*, which included concurrent jurisdiction with that of all the bishops within his province, have been much curtailed since the 16th century; they were altogether suspended in presence of the higher claims of a *legatus a*

¹ Leeuwenhoek's argument in this instance was partly based on false premises. For he imagined the *Legyris* with which mussel-shells are often encrusted to be the eggs of the mussel, and the centipeded *Polysma*, whose sixteen tentacles he figures, to be the young mussel.

latere, and the title is now almost quite honorary. It still attaches to the sees of Seville, Toledo, Arles, Rheims, Lyons, Gran, Prague, Gnesen-Posen, Cologne, Salzburg, among others. The commission of the *legatus delegatus* (generally a member of the local clergy) is of a limited nature, and relates only to some definite piece of work. The *nuncios apostolici* (who has the privilege of red apparel, a white horse, and golden spurs) possesses ordinary jurisdiction within the province to which he has been sent, but his powers otherwise are restricted by the terms of his mandate. The *legatus a latere* (almost invariably a cardinal, though the power can be conferred on other prelates) is in the fullest sense the plenipotentiary representative of the pope, and possesses the high prerogative implied in the words of Gregory VII., "*nostra vice quae corrigenda sunt corrigit, quae statuenda, constituit*." He has the power of suspending all the bishops in his province, and no judicial cases are reserved from his judgment. Without special mandate, however, he cannot depose bishops or unite or separate bishoprics. At present *legati a latere* are not sent by the holy see, but diplomatic relations, where they exist, are maintained by means of nuncios, internuncios, and other agents. According to the congress of Vienna, the diplomatic rank of a papal nuncio corresponds to that of an ambassador. The pope at present has nuncios at the courts of Bavaria, Austria-Hungary, Belgium, Chili, Spain, France, and Portugal. Inferior in rank and less numerous are the internuncios (Holland, Brazil).

LEGENDRE, ADRIEN MARIE (1752-1833), French mathematician, a contemporary of Laplace and Lagrange, with whom he deserves to be ranked,¹ was born at Paris (or, according to some accounts, at Toulouse) in 1752. He was brought up at Paris, where he completed his studies at the Collège Mazarin. His first published writings consist of some articles forming part of the *Traité de Mécanique* (1774) of the Abbé Marie, who was his professor. Legendre's name, however, is not mentioned. Soon afterwards he was appointed professor of mathematics in the École Militaire at Paris, and he was afterwards professor in the École Normale. In 1782 he received the prize from the Berlin Academy for his "Dissertation sur la question de balistique," a memoir relating to the paths of projectiles in resisting media. He also, about this time, wrote his "*Recherches sur la figure des planètes*," published in the *Mémoires* of the French Academy, of which he was elected a member in succession to D'Alembert in 1783. He was also appointed a commissioner for connecting geodetically Paris and Greenwich, his colleagues being Méchain and Cassini; General Roy conducted the operations on behalf of England. The French observations were published in 1792 (*Exposé des opérations faites en France en 1787 pour la jonction des observations de Paris et de Greenwich*). During the Revolution, when the decimal system had been decreed, he was one of the three members of the council established to introduce the new system, and he was also a member of the commission appointed to determine the length of the metre, for which purpose the calculations, &c., connected with the arc of the meridian from Barcelona to Dunkirk were revised. He was also associated with Prony in the formation of the great French table of logarithms of numbers, sines, and tangents, and natural sines, called the *Tables du Cadastre*, in which the quadrant was divided centesimally; these tables have never been published (see LOGARITHMS). He also served on other public commissions. He was examiner in the École Polytechnique, but held few important state offices, and he

seems never to have been much noticed by the different Governments; it has indeed been generally remarked that the offices he held were not such as his reputation entitled him to. Not many facts with regard to his personal life seem to have been published, but in a letter to Jacobi of June 30, 1833, he writes—"Je me suis marié à la suite d'une révolution sanglante qui avait détruit ma petite fortune; nous avons eu de grands embarras et des moments bien difficiles à passer, mais ma femme m'a aidé puissamment à restaurer progressivement mes affaires et à me donner cette tranquillité d'esprit nécessaire pour me livrer à mes travaux accoutumés et pour composer de nouveaux ouvrages qui ont ajouté de plus en plus à ma réputation, de manière à me procurer bientôt une existence honorable et une petite fortune dont les débris, après de nouvelles révolutions qui m'ont causé de grandes pertes, suffisent encore pour pourvoir aux besoins de ma vieillesse, et suffiront pour pourvoir à ceux de ma femme bien-aimée quand je n'y serai plus."

He died at Paris on January 10, 1833, in his eighty-first year, and the discourse at his grave was pronounced by Poisson. He was engaged in mathematical investigations almost up to the time of his death. The last of the three supplements to his *Traité des Fonctions Elliptiques* was published in 1832, and Poisson in his funeral oration remarked—"M. Legendre a eu cela de commun avec la plupart des géomètres qui l'ont précédé, que ses travaux n'ont fini qu'avec sa vie. Le dernier volume de nos *Mémoires* renferme encore un mémoire de lui, sur une question difficile de la théorie des nombres; et peu de temps avant la maladie qui l'a conduit au tombeau, il se procura les observations les plus récentes des comètes à courtes périodes, dont il allait se servir pour appliquer et perfectionner ses méthodes."

Legendre was the author of separate works on elliptic functions, the integral calculus, the theory of numbers, and the elements of geometry, besides numerous papers which were published chiefly in the *Mémoires* of the French Academy; and it will be convenient, in giving an account of his writings, to consider them under the different subjects which are especially associated with his name.

Elliptic Functions.—This is the subject with which Legendre's name will always be most closely connected, and his researches upon it extend over a period of more than forty years. His first published writings upon the subject consist of two papers in the *Mémoires* of the French Academy for 1786 upon elliptic arcs. In 1792 he presented to the Academy a memoir on elliptic transcendents. The contents of these memoirs are included in the first volume of his *Exercices de Calcul Intégral* (1811). The third volume (1816) contains the very elaborate and now well-known tables of the elliptic integrals which were calculated by Legendre himself, with an account of the mode of their construction. In 1827 appeared the *Théorie des fonctions elliptiques* (2 vols., the first dated 1825, the second 1826); a great part of the first volume agrees very closely with the contents of the *Exercices*, the tables, &c., are given in the second volume. Three supplements, relating to the researches of Abel and Jacobi, were published in 1828-32, and form a third volume. Legendre had pursued the subject which would now be called elliptic integrals alone from 1786 to 1827, the results of his labours having been almost entirely neglected by his contemporaries, but his work had scarcely appeared in 1827 when the discoveries which were independently made by the two young and as yet unknown mathematicians Abel and Jacobi placed the subject on a new basis, and revolutionized it completely. The readiness with which Legendre, who was then seventy-six years of age, welcomed these important researches, that quite overshadowed his own, and included them in successive supplements to his work, does the highest honour to him. The sudden occurrence, near the close of his long life, of these great discoveries relating to a subject which Legendre had so completely made his own and apparently exhausted, and their ready acceptance by him, form one of the most striking episodes in the history of mathematics. A very full account of the contents of Legendre's work and of the results obtained by Abel and Jacobi has been given in the article *INDEFINITE ANALYSIS*, vol. xii. pp. 62-72. (See also Louis KILLIE's report "On the Recent Progress of Analysis," in the *Report of the British Association for 1846* (pp. 44-9).

Berlinian Integrals and Integral Calculus.—The *Exercices de Calcul Intégral* consist of three volumes, a great portion of the first and the whole of the third being devoted to elliptic functions. The

¹ Besides Laplace and Lagrange, with whom it is most natural to associate Legendre, the names of Poisson, Cauchy, Fourier, and Monge should be mentioned as contemporaries. The number of French mathematicians of the highest rank who were living at the same time, at the beginning of the century, has often been the subject of remark.

remainder of the first volume relates to the Eulerian integrals and to quadratures. The second volume (1817) relates to the Eulerian integrals, and to various integrals and series, developments, mechanical problems, &c., connected with the integral calculus; this volume contains also a numerical table of the values of the gamma function. The latter part of the second volume of the *Œuvres des Fonctions Elliptiques* (1828) is also devoted to the Eulerian integrals, the table being reproduced. Legendre's researches connected with the gamma function are of importance, and are well known; the subject was also treated by Gauss in his memoir *Disquisitiones arithmeticae et de arithmetica* (1801), but in a very different manner. The results given in the second volume of the *Œuvres* are of too miscellaneous a character to admit of being briefly described. In 1788 Legendre published a memoir on double integrals, and in 1809 one on definite integrals.

Theory of Numbers.—Legendre's *Théorie des Nombres* and Gauss's *Disquisitiones Arithmeticae* (1801) are still the standard works upon this subject. The first edition of the former appeared in 1788 under the title *Essai sur la Théorie des Nombres*; there was a second edition in 1808; a first supplement was published in 1816, and a second in 1835. The third edition, under the title *Théorie des Nombres*, appeared in 1880 in two volumes. To Legendre is due the discovery known as the law of quadratic reciprocity, the most important general result in the science of numbers which has been discovered since the time of Fermat, and which was called by Gauss the "gem of arithmetic." It was first given by Legendre in the *Mémoires* of the Academy for 1786, but the demonstration that accompanied it was incomplete. The symbol $\left(\frac{a}{p}\right)$ which is known as Legendre's sym-

bol, and denotes the product on negative unit which is the remainder when a^{p-1} is divided by a prime number p , does not appear in this memoir, but was first used in the *Essai sur la Théorie des Nombres*. Legendre's formula $x(\log x - 1.08869)$ for the approximate number of forms inferior to a given number x was first given by him also in this work (3d ed., p. 394).

Attractions of Ellipsoids.—Legendre was the author of four important memoirs on this subject. In the first of these, entitled "Recherches sur l'attraction des sphéroïdes homogènes," published in the *Mémoires* of the Academy for 1786, but communicated to it at an earlier period, Legendre introduces the celebrated expressions which, though frequently used by Laplace, are more correctly named after Legendre. The definition of the coefficients is that if $(1 - 2h \cos \theta + h^2)^{-1}$ be expanded in ascending powers of h , and if the sum of the n th order term is denoted by P_n , then P_n is of the Legendrian coefficient of the n th order. In this memoir also the function which is now called the potential was, at the suggestion of Laplace, first introduced. Legendre also treated elliptic coefficients, with respect to confocal ellipsoids is true for any position of the external point when the ellipsoids are solids of revolution. Of this memoir Todhunter writes—"We may affirm that no single memoir in the history of our subject can rival this in interest and importance. During forty years the resources of analysis, even in the hands of D'Alembert, Lagrange, and Laplace, had not carried the theory of the attraction of ellipsoids beyond the point which the geometry of Maclaurin had reached. The introduction of the coefficients now called Laplace's, and their application, commences a new era in mathematical physics. Legendre's second memoir was communicated to the Academy in 1786, and relates to the conditions of equilibrium of a mass of rotating fluid in the form of a figure of revolution which does not deviate much from a sphere. The third memoir relates to Laplace's theorem respecting confocal ellipsoids. Of the fourth memoir Todhunter writes, "It occupies an important position in the history of our subject. The more striking solution which we here meet in previous researches consists in the treatment of a planet supposed entirely fluid; the general equation for the form of a stratum is given for the first time and discussed. For the first time we have a correct and convenient expression for Laplace's n th coefficient." See Todhunter's *History of the Mathematical Theories of Attraction* and the *Figure of the Earth* (1873), the twentieth, twenty-second, twenty-fourth, and twenty-fifth chapters of which contain a full and complete account of Legendre's four memoirs. For the theory of the Legendrian coefficients and the analysis connected with them, the reader is referred to Hesse's *Handbuch der Kugelfunctionen* (Berlin, 1876), to Trautmann's *Traité de Laplace's Fonctions, Lamé's Fonctions, et Bessel's Fonctions* (1876), or to Ferrers's *Spherical Harmonics* (1877). It should be mentioned that Legendre's coefficients have been recently termed zonal harmonics by some writers.

Geodesy.—Besides the work upon the geodesical operations connecting Paris and Greenwich referred to above, and of which Legendre was one of the authors, he published in the *Mémoires* of the Academy for 1787 two papers on trigonometrical operations depending upon the figure of the earth, concerning many theorems relating to this subject. The best known of these, which is called Legendre's theorem in treatises on spherical trigonometry, by means of it a small spherical triangle may be treated

as a plane triangle, certain corrections being applied to the angles. Legendre was also the author of a memoir upon triangles drawn upon a spheroid. Legendre's theorem is a fundamental one in geodesy, and his contributions to the subject are of the greatest importance.

Method of Least Squares.—In 1805 appeared Legendre's *Nouvelles Méthodes pour la détermination des courbes*, which is memorable as containing the first published suggestion of the method of least squares. In the preface Legendre remarks, "La méthode qui me parait la plus simple et la plus générale consiste à rendre minimum la somme des carrés des erreurs, . . . et que j'appelle méthode des moindres carrés"; and in an appendix in which the application of the method is explained his words are, "De tous les principes qu'on peut proposer pour cet objet, je pense qu'il n'est pas de plus général, de plus exact, ni d'une application plus facile que celui dont nous avons fait usage dans les recherches précédentes, et qui consiste à rendre minimum la somme des carrés des erreurs." The method was proposed by Legendre only as a convenient process for testing observations, without reference to the theory of probability. It had, however, been applied by Gauss as early as 1796, and the method was fully explained, and the law of facility for the first time given by him in 1805. Laplace also justified the method by means of the principles of the theory of probability, and thus led Legendre to republish the part of his *Nouvelles Méthodes* which related to it in the *Mémoires* of the Academy for 1810. Thus, although the method of least squares was first formally proposed by Legendre, the theory and algorithm and mathematical foundation of the process are due to Gauss and Laplace. Legendre published two supplements to his *Nouvelles Méthodes* in 1805 and 1820.

The Elements of Geometry.—Legendre's name is most widely known on account of his *Éléments de géométrie*, the most successful of the numerous attempts that have been made to supersede Euclid as a text-book on geometry. It first appeared in 1794, and went through very many editions, and has been translated into almost all languages. An English translation, by Sir David Brewster, from the eleventh French edition, was published in 1823, and is well known in England. The earlier editions did not contain the trigonometry. In one of the notes Legendre gives a proof of the rationality of π . This had been first proved by Lambert in the *Berlin Memoirs* for 1768. Legendre's proof is similar in principle to Lambert's, but much simpler. On account of the objections urged against the treatment of parallels in this work, Legendre was induced to publish in 1803 his *Nouvelle Théorie des parallèles*. His *Géométrie* gave rise in England also to a lengthened discussion on the difficult question of the treatment of the theory of parallels.

It will thus be seen that Legendre's works have placed him in the very foremost rank in the widely distinct subjects of elliptic functions, theory of numbers, attractions, and geodesy, and have given him a conspicuous position in connexion with the integral calculus and other branches of mathematics. He ranked high in the integration of partial differential equations and a few others which have not been noticed above, but they relate to subjects with which his name is not especially associated. A good account of the principal works of Legendre is given in the *Bibliothèque Universelle de Genève* for 1855, pp. 45-52. (J. W. L. G.)

LEGERDEMAIN, PRESTIDIGITATION, or SLEIGHT OF HAND, as it is variously called, is the art of deceiving the eye of the spectator by adroit movements of the hand of the operator so as apparently to cause an object either to be changed, produced, or made to disappear. The term "legerdemain" is extended in meaning to include all sorts of "conjuring" by means of mechanical and other contrivances, although it properly applies to tricks performed with the hand alone. Even in ancient times two distinct branches of magic existed—the impostures of divination and necromancy, and the amusing exhibition of jugglery and sleight of hand. Judging from the accounts which history has handed down to us, the marvels performed by the thaumaturgists of antiquity were very skillfully produced, and must have required a considerable practical knowledge of the art. The Romans were in the habit of giving conjuring exhibitions, the most favourite feat being that of the "cups and balls," the performers of which were called *actabularii*, and the cups themselves *actabula*. The balls used, however, instead of being the convenient light cork ones employed by modern conjurers, were simply round white pebbles which must have added greatly to the difficulty of performing the trick. The art survived the barbarism and ignorance of the Middle Ages; and the earliest professors of the modern school were Italians such as Jonas, Androletti, and Antonio Carlotti. In England

legerdemain has always found professors and patrons; Chaucer, in describing a motley assemblage, says:—

"There I saw playenge jougelaurs,
Magiciens, tregotours,
Pietonysse, charmeresses,
Olii wiches, sovercesses,"

and in another place (*House of Fame*, bk. iii.) he records a startling feat of prestidigitation:—

"There I saw Coll Tregetour
Upon a table of aycomour
Play an uncouth thyng to tell;
I saw him cary a wyndemell
Under a walnut shale."

But there is no reason for supposing that the ancient magicians were more proficient in the art than their modern successors, and, as Robert-Houdin, the greatest of modern conjurers, has pithily observed, "if antiquity was the cradle of magic, it is because the art was yet in its infancy." Towards the close of the reign of Elizabeth the profession had fallen very low in England, and the performers were classed with "ruffians, blasphemers, thieves, vagabonds, Jews, Turks, heretics, pagans, and sorcerers." In 1840 a German physicist named Dobler devised an entertainment which gave an entirely new development to the science, and was in effect the same as the conjuring entertainments which have since become so popular and familiar. The most eminent conjurers of the modern school have been Robert-Houdin, Wiljalba Frickell, Hermann, and Boatié de Kolta.

The secrets of legerdemain were for a long time jealously guarded by its professors, but in 1793 a work appeared in Paris entitled *Testament de Jérôme Sharpe, Professeur de Physique Amusante*, which gives a very fair account of the methods then in vogue. Its author was M. Decremps. In 1856 a still more important and accurate book was published—*Sorcellerie ancienne et moderne expliquée*, by J. N. Ponsin; and ten years later J. E. Robert-Houdin issued his *Secrets de la Prestidigitation et de la Magie*, which is a masterly exposition of the entire art and mystery of conjuring. The last-mentioned book has been translated into English by "Professor Hoffman," the author of *Modern Magic*, the best English treatise on the subject. Modern magic calls to its aid all the appliances of modern science,—electricity, magnetism, optics, and mechanics; but the most successful adepts in the art look down upon all such succedaneous aids and rely upon address and sleight of hand alone. Confederacy is never resorted to except by the merest tyros. The prestidigitator's motto is "The quickness of the hand deceives the eye"; but this very phrase, which is always in a performer's mouth, is in itself one of the innocent frauds which the conjuror employs as part and parcel of his exhibition. The truth is that it is not so much upon the quickness with which a feat is performed as upon the adroitness with which the time and means of performing it are concealed that its success depends. "A prestidigitator," says Robert-Houdin, "is not a juggler, he is an actor playing the part of a magician, an artist whose fingers should be more clever than nimble. I would even add that, in the practice of legerdemain, the calmer the movements are the more easy it is to produce an illusion on the spectators." Professor Hoffman corroborates this statement, and says, "The effects of magic are produced by successive adroit substitutions, and the whole magic of the trick consists in the concealment of the particular moment at which each substitution is effected." The right opportunity for executing the required movement is technically called a *temps*. This is defined to be any act or movement which distracts the attention of the audience while something is being "vanished" or "produced." Experiment will readily convince any one that it is absolutely impos-

sible to move the hand so quickly as to abstract or replace any object without being perceived, so long as the eyes of the audience are upon the performer. But it is very easy to do so unnoticed, provided the audience are looking another way at the time, and the faculty of thus diverting their attention is at once the most difficult and the most necessary accomplishment for a conjuror to acquire. It does not suffice to point, or ask them to look in another direction, because they will obviously suspect the truth and look with all the more persistence. The great requisite is to "have a good eye"—in French conjuring parlance *avoir de l'œil*, an earnest, convinced look of the performer in a particular direction will carry every one's glances with it, while a furtive glance at the hand which is performing some function that should be kept secret will run all

Robert-Houdin may be considered the actual founder of the modern school of legerdemain. This celebrated conjuror, who was originally a watchmaker and mechanician, possessed a remarkably inventive genius, and, having early turned his attention to legerdemain, he concentrated all his efforts upon the development and improvement of that art. Discarding the clumsy tricks of what he calls the "false-bottomed school," as well as the gaudy paraphernalia with which his predecessors used to encumber their stage, he produced in 1845, at a little theatre in the Palais Royal, a number of entirely new illusions, in which all the resources of mechanical and electrical science were combined with manual dexterity and personal address. His entertainments, which he called *Soirées Fantastiques*, made a great sensation in Paris, and placed him at once at the head of his profession. His skill and success were so great that the French Government sent him on a sort of roving commission to Algeria, in order that he might, by his exhibitions of natural magic, destroy the prestige of the *marabouts*—wonder-workers who had obtained a great and dangerous influence over the Arabs by their pretended miracles. The motto prefixed by Robert-Houdin to his chapter on the "Art of Conjuring" is—"to succeed as a conjuror, three things are essential: first, dexterity, second, dexterity, and third, dexterity"; and this is not a mere trick of language, for triple dexterity is required, not only to train the hand to the needful adroitness, but to acquire the requisite command of eye and tongue.

Besides the legitimate application of legerdemain to the purpose of amusement, it serves another and less innocent purpose, being employed by card sharps in their nefarious profession. The successful card sharper must have qualities which, if applied in a legitimate direction, would ensure distinction in almost any profession. He must be observant, dexterous, cool; but above all he must have impudence. If it requires a considerable share of this quality to perform an ordinary feat of legerdemain with all the advantages of scenic effects and stage arrangements, how much more must it need to effect a trick under the very eyes of a vigilant adversary, and when the consequences of failure are so extremely unpleasant! As in legitimate conjuring, too, it is not so much that actual dexterity or the quickness of the hand deceives the eye as that the attention is diverted by some ingenious but unperceived device at the moment when the operation is performed.

Legerdemain as applied to cheating at cards may be divided into the following branches:—(1) marking the cards; (2) abstracting certain cards during the game for clandestine use; (3) previously concealing cards about the person; (4) packing the cards; (5) substituting marked or prepared packs; (6) confederacy; (7) false shuffles. All these methods are thoroughly exposed in Robert-Houdin's work *Les tricheries des Grés*.

In addition to the works on conjuring already mentioned, reference may be made to *Sleights of Hand*, by Edwin Sachs. (E. H. F.)

LEGHORN (Italian, *Livorno*), a city of Italy, the chief town of the province of Leghorn (which includes the island of Elba), the see of a bishop, and next to Genoa and Naples the greatest commercial port in the kingdom, is situated on the coast of the Ligurian Sea, in $43^{\circ} 33' N$ lat and $10^{\circ} 10' E$ long, 15 miles south-west of Pisa, with which it is connected by a branch from the main west coast line. It is built on low-lying ground backed by a ridge of hills, of which the most striking though not the highest is Monte Nero, with its ancient monastery. In some respects one of the least Italian of Italian cities, Leghorn owes its



Plan of Leghorn

- | | |
|---------------------------------|------------------------------|
| 1 Duomo (S. Francesco d'Assisi) | 4 Jewish Synagogue |
| 2 S. Maria del Soccorso | 5 Monument to Ferdinand I. |
| 3 English Church | 6 Monument to Ferdinand III. |
| | 7 Monument to Leopold II. |

prosperity as a port not so much to any special advantages of situation as to wise legislation and labour. Broad and well-kept streets, spacious squares, and large substantial houses are the general characteristics of the city, which has room enough within the circuit of its walls (built 1835-37), though it has scattered its villas on the neighbouring hills and coast. Of note among the buildings are the old cathedral (a Latin cross with a single nave—the facade designed by Inigo Jones), the town-hall, the great oil warehouses erected by Cosmo III in 1705, the reservoir (a subterranean structure dating from the time of Ferdinand II.), and the Jewish synagogue, which ranks next to that of Amsterdam. Near the port stands the statue of Ferdinand I by Giovanni dell'Opera, with four slaves in bronze, by Pietro Tacca, chained to the pedestal; and the Piazza Carlo Alberto is adorned with statues of the grand dukes Ferdinand III. and Leopold II. The old English cemetery (closed 1839), which was up to the present century the only Protestant burial-place in Italy, contains the tombs of Smollett and Francis Horner. The Torre del Marzocco, or "Tower of the Sculptured Lion," is one of the

leading landmarks of the city from the sea, and almost the only relic of the republican period. Among the public institutions are the "Chambers of Public Payments," similar to the London clearing-house, a large naval academy opened in 1881, a chamber of commerce dating from 1801, a public library of 40,000 volumes, and a technical and nautical institute. Great changes have been effected in the port of Leghorn since the middle of the century. The "new port" is formed by a breakwater finished in 1863, which extends north and south for 3300 feet, at a distance of 6 furlongs from the shore. It has a general depth of from 24 to 32 feet. Vessels moored to the breakwater are sheltered from all winds, but those in the open part of the basin are exposed to the southerly gales. The inner or old port, formed by a pier projecting half a mile in a north-north-west direction from the shore, measures 1800 by 1500 feet, and is perfectly secure on all sides. To the south and east he a number of docks, which in turn are connected with a system of canals complex enough to justify the name Little Venice applied to part of the city. The Canale dei Navicelli extends north to the Arno. Dredging operations for deepening the harbour having been carried on between 1868 and 1878 with little permanent result, a much more extensive and effective series of improvements (including the construction of a new breakwater from the shore south of the town to the old lighthouse, and the lengthening of the dry dock so as to take in the largest ships now obliged to dock at Marseilles), received the Government sanction in 1881. Shipbuilding is the principal local industry, and even ironclads have been sent out from the dockyards. The following table shows the foreign trade of the port to have declined since 1860, but a counterbalancing increase to have taken place in the coasting trade —

Foreign Trade				Coasting Trade					
Ships	Tonnage	Ships	Tonnage	Ships	Tonnage	Ships	Tonnage		
1861	1,147	986,457	10,108	562,652	1871	1,064	621,312	7,053	1,215,937
1862	5,271	1,046,254	9,929	693,478	1872	1,891	669,584	8,070	1,214,276
1863	4,477	1,013,849	11,307	1,125,179	1873	1,912	656,362	8,338	1,207,907
1864	3,775	837,561	8,562	1,041,054	1874	1,545	562,384	9,218	1,188,313
1867	9,689	881,268	5,016	1,111,531	1875	1,429	575,845	10,105	1,190,411
1868	3,299	696,066	5,085	1,185,601	1876	1,118	488,391	7,797	1,247,918
1869	2,217	612,185	7,799	937,055	1877	1,111	465,071	7,770	1,869,828
1869	2,248	687,471	7,867	938,652	1878	1,372	586,210	7,152	1,920,187
1869	2,838	746,915	7,120	952,120	1879	1,181	469,884	7,508	1,901,496
1870	2,151	644,937	7,449	1,070,648	1880	1,301	466,113	7,074	1,901,188

In the early part of the century Leghorn became a great depot of British commerce with the Levant, and about twenty British firms were settled in the town. It was a free port, and had an excellent bonding system. But about 1833 the increase of direct intercourse between Britain and her customers began to tell on the trade, and it gradually disappeared altogether. At present the activity of the port is due to exportation of Italian produce (especially from Tuscany), and the importation of iron, coal, fish, and general goods. Marseilles, Cardiff, and Newcastle are the three ports with which the dealings are most extensive. A considerable trade is also maintained with the United States. The population of Leghorn city increased from 33,000 in 1807 to 83,543 in 1861; but in 1871 it was 80,948, and in 1881 only 77,781, a decrease due mainly to the distribution of the population beyond the city limits, especially along the coast. The communal population was 97,096 in 1871, and 97,615 in 1881. Between the city and the village of Aidenza are many seaside residences, occupied mostly by foreign visitors during the bathing season.

The earliest mention of Leghorn occurs in a document of the year 891 relating to the first church, in 1017 it is called a castle. In the 13th century the Pisans tried to attract a population to the spot, but it was not till the 14th that Leghorn began to be the rival of Porto Pisano, which was destined

ultimately to supplant. It was at Leghorn that Urban V. and Gregory XI. landed on their return from Avignon. When in 1405 the king of France sold Pisa to the Florentines he kept possession of Leghorn, but he afterwards (1407) sold it for 26,000 ducats to the Genoese, and from the Genoese the Florentines purchased it in 1421. In 1498 the city showed its devotion to its new masters by a successful defence against Maximilian and his allies. With the rise of the Medici came a rapid increase of prosperity; Cosmo, Francis, and Ferdinand erected fortifications and harbour works, warehouses and churches, with equal liberality, and the last especially gave a stimulus to trade by inviting "men of the East and the West, Spanish and Portuguese, Greeks, Germans, Italians, Hebrews, Turks, Moors, Armenians, Persians, and others," to settle and traffic in the city. Declared free and neutral in 1691, Leghorn was permanently invested with these privileges by the Quadruple Alliance in 1718; but in 1799 Napoleon seized all the hostile vessels in its port. It ceased to be a free city by law of 1867.

LEGION OF HONOUR, **ORDER OF THE**. This order of merit was instituted by Napoleon in 1802, all previously existing French military or religious orders—those of St Michael, the Holy Ghost, St Louis, and Military Merit, as well as the united orders of St Lazarus and Our Lady of Mount Carmel—having been abolished at the Revolution. All soldiers on whom claims of honour had been already conferred were forthwith declared to be members, and all citizens of sufficient merit were declared to be eligible for admission, whatever their birth, rank, religion, or social position might be. At their reception they were required to swear upon their honour to employ all just, reasonable, and lawful means for the service of the republic, the maintenance of its territory, the support of the government, the law, and the public property, and to withstand every effort towards the restoration of the feudal system and its various accompaniments—in short, to co-operate as much as in them lay for the assertion of the principles of freedom and equality. The grand master was Napoleon himself; under him were 105 grand officers, 300 commanders, 450 officers, and 3665 chevaliers. To the members of the various classes yearly allowances, ranging from 5000 francs in the case of a grand officer to 200 in that of a chevalier, were assigned. Some unimportant modifications in details were made when the empire was introduced. Between 1805 and 1814 about 43,000 nominations were made, 1400 only being in favour of civilians. Shortly after the accession of Louis XVIII. considerable changes took place. The old military and religious orders were restored, and that of the Legion of Honour reduced to the last place; the king was of course its grand master; the membership was divided into five grades—80 grand crosses, 160 grand officers, 400 commanders, 2000 officers, and an indefinite number of chevaliers. These fixed numbers were to be exclusive of members of the royal family, princes of the blood, and foreigners. Admission (the reward of at least twenty-five years of distinguished service) in ordinary cases was to be made to the grade of chevalier only; and only chevaliers of more than four years' standing, officers of two years' standing, and commanders of three years were to be eligible for promotion. The admissions were in every case to be made on parade in the case of military persons, and at a public sitting of a court of first instance in the case of civilians. The terms of the oath required, were of course, somewhat modified, and the arrangements about yearly allowances could not be continued. After the revolution of July, the "Ordre royal de la légion d'honneur" again resumed the unique place and special character which had belonged to it under Bonaparte in 1802. But its constitution was again remodelled in 1852; the numbers of grand crosses, grand officers, commanders, and officers were fixed respectively at 80, 200, 1000, and 2000, the number of chevaliers being still left vague, while the system of annual allowances was restored. Since 1870 the maximum number of chevaliers has been fixed at 25,000, the remaining four classes having 70, 200, 1000, and 4000

assigned to them respectively. In each grade three-fifths must be military persons, the rest civilians. The yearly pension of a military chevalier is 250 francs, of an officer 500, of a commander 1000, of a grand officer 2000, and of a grand cross 3000. The order may be conferred upon foreigners, but these do not count. It has occasionally been conferred upon women (e.g., Rosa Bonheur). In connection with the order there is an army medal, which may be distributed to the number of 40,000, and which entitles the bearer to a pension of 100 francs. On January 1, 1874, the military members of the legion, in point of fact, numbered 39,793, drawing 12,718,050 francs annually, and there were 51,460 holders of military medals, drawing 5,146,000 francs, besides not less than 15,000 civil members drawing no pension. By economy in making new appointments, these numbers have subsequently been reduced. Since 1805 there has existed an institution for the education of daughters, sisters, and nieces of members of the legion; in 1809 the numbers were fixed at 600, the place being the "Maison d'éducation de Saint Denis." The arrangements have subsequently been considerably extended. The decoration under the first empire consisted of a white enamelled five-rayed star, bearing the portrait of Napoleon, and a wreath of oak and laurel, with the words "Napoléon, empereur des Français"; on the reverse was the French eagle grasping a thunderbolt, and the legend "Honneur et patrie." The ribbon was of watered scarlet silk. At present the obverse of the star bears the emblem of the republic and the words "République Française," the reverse two tricolor flags with the original legend.

LEH, or Lâ. See **LADIA**.

LEIAH, a town in Derâ Ismail Khan district, Punjab, India, is situated near the east bank of the Indus, in 30° 57' 30" N. lat., 70° 58' 30" E. long. The population in 1868 was 17,093 (13,151 Mohammedans, 3756 Hindus, 30 Sikhs, and 126 "others"). There is a considerable trade in local produce as well as through traffic between the districts of upper India and the countries to the west.

LEIBNITZ, or **LEHNIZ**, **GOTTFRIED WILHELM** (1646–1716), almost equally distinguished as philosopher, mathematician, and man of affairs, was born on the 21st June (o.s.) 1646, at Leipsic, where his father was professor of moral philosophy. The name Leibniz, Leibnitz, or Lubebeck was originally Slavonic, but his family was German, and for three generations his ancestors had been in the employment of the Saxon Government. Young Leibnitz was sent to the Nicolai school at Leipsic, but from the time of his father's death, which took place when he was only six years old, seems to have been for the most part his own teacher. From his father he had acquired a love of historical study that bore remarkable fruit in after life. The German books at his command were soon all read through, and with the help of two Latin books which fell in his way—the *Theophrastus Chronologicus* of Calvisius and an illustrated edition of Livy—he learned Latin for himself at the age of eight. By the advice of a neighbouring gentleman his father's library was now thrown open to him with the permission "Tolle, lege." At this his joy knew no bounds. "For," he says, "I burned to get sight of the ancients, most of them known to me only by name, Cicero and Seneca, Pliny, Herodotus, Xenophon, Plato, and the historical writers, and many church fathers, Latin and Greek." Thus before he was twelve he could read Latin easily and had begun Greek; and his facility in writing Latin verses made his instructors fear that he would be seduced by poetry from more serious pursuits. Next he took with avidity to the study of logic, attempting already to reform its doctrines, and reading the scholastics and some of the Protestant theologians with such zeal that his

friends now began to fear that he would never leave scholastic subtleties, "not knowing," as he said, "that my mind could not be satisfied with one kind of things."

In the autumn of 1681, at the age of fifteen, he entered the university of Leipzig as a student of law. His first two years were devoted to philosophy under Scherzer, a follower of the scholastics, and Jacob Thomasius, a Neo-Aristotelian, who is looked upon as having founded the scientific study of the history of philosophy in Germany. It was at this time probably that he first made acquaintance with the modern thinkers who had already revolutionized science and philosophy, Francis Bacon, Cardan, and Campanella, Kepler, Galileo, and Descartes; and he began to discuss with himself the difference between the old and new ways of regarding nature. "I remember," he says, "walking alone, at the age of fifteen, in a wood near Leipze called the Rosenthal, to deliberate whether I should retain the doctrine of substantial forms. At last mechanism triumphed and induced me to apply myself to mathematics." It was not, however, till the summer of 1683, which he spent at Jena under Weigel, that he obtained the instructions of a mathematician of repute, nor was the deeper study of mathematics entered upon till his visit to Paris and acquaintance with Huygens many years later.

The three years following his return from Jena were devoted to legal studies, and in 1686 Leibnitz became a candidate for the degree of doctor of law. The doctorate was a pathway to the post of assessor which he coveted, but through the opposition of older candidates for the same office his youth was made an excuse for refusing him the degree. Upon this he left his native town for ever. The doctor's degree refused him there was at once (November 5, 1686) conferred on him at Altdorf, — the university town of the free city of Nuremberg, — where his brilliant dissertation procured him the immediate offer of a professor's chair. This, however, he declined, having, as he said, "very different things in view."

Leibnitz, not yet twenty-one years of age, was already the author of several remarkable essays. In his bachelor's dissertation *De principio individui* (1683), he defended the nominalistic doctrine that individuality is constituted by the whole entity or essence of a thing; his arithmetical tract *De complexionebus*, published in an extended form under the title *De arte combinatoria* (1666), is an essay towards his life-long project of a reformed symbolism and method of thought; and besides these there are four juridical essays, including the *Novus methodus docendi descendique juris*, written in the intervals of his journey from Leipzig to Altdorf. This last essay is remarkable, not only for the reconstruction it attempted of the *Corpus Juris*, but as containing the first clear recognition of the importance of the historical method in law.

Rejecting the professional career, but without any definite plan for the future, Leibnitz turned his steps to Nuremberg. That city was a centre of the Rosicrucians, and Leibnitz, busying himself with writings of the alchemists, soon gained such a knowledge of their tenets that he was supposed to be one of the secret brotherhood, and was even elected their secretary. A more important result of his visit to Nuremberg was his acquaintance with Johann Christian von Bönneburg, formerly first minister to the elector of Mainz, and one of the most distinguished statesmen of the day. By his advice Leibnitz printed his *Novus methodus* in 1687, dedicated it to the elector, and, going to Mainz, presented it to him in person. It was thus that Leibnitz entered the service of the elector of Mainz, at first as an assistant in the revision of the statute-book, afterwards on more important work.

The policy of the elector, which the pen of Leibnitz was now called upon to promote, was to maintain the security

of the German empire, threatened on the west by the aggressive power of France, on the east by Turkey and Russia. Thus when in 1669 the crown of Poland became vacant, it fell to Leibnitz to support the claims of the German candidate, which he did in his first political writing, *Specimen demonstrationum politicarum*, attempting, under the guise of a Catholic Polish nobleman, to show by mathematical demonstration that it was necessary in the interest of Poland that it should have the count palatine of Neuburg as its king. But neither the diplomatic skill of Bönneburg, who had been sent as plenipotentiary to the election at Warsaw, nor the arguments of Leibnitz were successful, and a Polish prince was elected to fill the vacant throne.

A greater danger threatened Germany in the aggressions of Louis XIV. and the wars of conquest on which he was entering. Though Holland was in most immediate danger from his arms, the seizure of Lorraine in 1670 showed that Germany too was threatened. It was in this year that Leibnitz wrote his *Thoughts on Public Safety*,¹ in which he urged the formation of a new "Reimbund" for the protection of Germany, and contended that the states of Europe should employ their power, not against one another, but in the conquest of the non-Christian world, in which Egypt, "one of the best situated lands in the world," would fall to the share of France. The plan thus proposed of averting the threatened attack on Germany by a French expedition to Egypt was discussed with Bönneburg, and obtained the approval of the elector. French relations with Turkey were at the time so strained as to make a breach imminent, and at the close of 1671, about the time when the war with Holland broke out, Louis himself was approached by a letter from Bönneburg and a short memorial from the pen of Leibnitz, who attempted to show that Holland itself, as a mercantile power trading with the East, might be best attacked through Egypt, while nothing would be easier for France or would more largely increase her power than the conquest of Egypt. On February 12, 1672, a request came from the French secretary of state, Pomponne, that the author of the memorial should further explain himself, and on the 18th of next month Leibnitz started for Paris. Louis seems still to have kept the matter in view, but never granted Leibnitz the personal interview he desired, while Pomponne wrote from the camp before Dossburg, "I have nothing against the plan of a holy war, but such plans, you know, since the days of St Louis, have ceased to be the fashion." Not yet discouraged, Leibnitz wrote a full account of his project for the king,² and a summary of the same³ evidently intended for Bönneburg. But Bönneburg died in December 1672, before the latter could be sent to him. Nor did the former ever reach its destination. The French quarrel with the Porte was made up, and the plan of a French expedition to Egypt disappeared from practical politics till Napoleon menaced the power of England by the same means as those by which Louis had been invited to cripple Holland. The history of this scheme, and the reason of Leibnitz's journey to Paris, long remained hidden in the archives of the Hanoverian library. It was on his taking possession of Hanover in 1803 that Napoleon learned, through the *Consilium Aegyptiacum*, that the idea of a French conquest of Egypt had been first put forward by a German philosopher. In the same year there was published in London an account of the *Iusta dissertatio*⁴ of which the British Government had procured a copy in 1799.

¹ *Bedanken, welchergestaltt securitas publicæ interna et externa und status præsentis germaniæ Umständten nach auf Jsten Fasse zu stellen.*

² *De ægyptiaca regni Franciæ proponenda iusta dissertatio.*

³ *Consilium Aegyptiacum.*
⁴ *A Summary Account of Leibnitz's Memoir addressed to Louis the Fourteenth, &c.* [edited by Granville Foss], London, 1808.

But it is only since the appearance of the edition of Leibnitz's works begun by Otto Kloppe in 1864 that the full history of the scheme has been made known.

Leibnitz had other than political ends in view in his visit to France. It was at the centre of literature and science that Paris chiefly attracted him. Political duties never made him lose sight of his philosophical and scientific interests. At Mainz he was still busied with the question of the relation between the old and new methods in philosophy. In a letter to Jacob Thomaeus (1669) he contends that the mechanical explanation of nature by magnitude, figure, and motion alone is not inconsistent with the doctrines of Aristotle's *Physica*, in which he finds more truth than in the *Meditations* of Descartes. Yet these qualities of bodies, he argues in 1668 (in an essay published without his knowledge under the title *Confessio naturæ contra atheistas*), require an incorporeal principle, or God, for their ultimate explanation. He also wrote at this time a defence of the doctrine of the Trinity against Wissovavius (1669), and an essay on philosophic style, introductory to an edition of the *Antibarbarus* of Nizolius (1670). Clearness and distinctness alone, he says, are what makes a philosophic style, and no language is better suited for this popular exposition than the German. In 1671 he issued a *Hypothesis physica nova*, in which, agreeing with Descartes that corporeal phenomena should be explained from motion, he carried out the mechanical explanation of nature by contending that the original of this motion is a fine æther, similar to light, or rather constituting it, which, penetrating all bodies in the direction of the earth's axis, produces the phenomena of gravity, elasticity, &c. The first part of the essay, on concrete motion, was dedicated to the Royal Society of London, the second, on abstract motion, to the French Academy.

Leibnitz thus came to Paris, not merely as a young diplomatist on an important if not very hopeful mission, but also as an author who had already made his debut in the world of science and philosophy. At Paris he met with Arnould, Malebranche, and, more important still, with Christian Huygens. This was pre-eminently the period of his mathematical and physical activity. Before leaving Mainz he was able to announce¹ an imposing list of discoveries, and plans for discoveries, arrived at by means of his new logical art, in natural philosophy, mathematics, mechanics, optics, hydrostatics, pneumatics, and nautical science, not to speak of new ideas in law, theology, and politics. Chief among these discoveries was that of a calculating machine for performing more complicated operations than that of Pascal—multiplying, dividing, and extracting roots, as well as adding and subtracting. This machine was exhibited to the Academy of Paris and to the Royal Society of London, and Leibnitz was elected a fellow of the latter society in April 1673.² In January of this year he had gone to London as an attaché on a political mission from the elector of Mainz, returning in March to Paris, and while in London had become personally acquainted with Oldenburg, the secretary of the Royal Society, with whom he had already corresponded, with Boyle the chemist, and Pell the mathematician. It is from this period that we must date the impulse that directed him anew to mathematics. By Pell he had been referred to Mercator's *Logarithmo-technica* as already containing some numerical observations which Leibnitz had thought original on his own part; and, on his return to Paris, he devoted himself to the study of higher geometry under Huygens, entering almost at once upon the series of investigations which culminated in his discovery of the

differential and integral calculus. For the history of this discovery and of the controversies to which it gave rise, see vol. xiii. p. 8 sq.

Shortly after his return to Paris in 1673, Leibnitz ceased to be in the Mainz service any more than in name, but in the same year entered the employment of Duke John Frederick of Brunswick-Lüneburg, with whom he had corresponded for some time. In 1676 he removed at the duke's request to Hanover, travelling thither by way of London and Amsterdam. At the latter place he saw and conversed with Spinoza, now in the last year of his life.

For the next forty years, and under three successive princes, Leibnitz was in the service of the Brunswick family, and his headquarters were at Hanover, where he had charge of the ducal library. In leaving the electorate of Mainz for the dukedom of Brunswick, Leibnitz passed into a political atmosphere formed by the dynastic aims of the typical German state. The recognition of the rights of the dukedom amongst the states of Europe, the consolidation and permanence of the reigning house, the union of the two branches of the Brunswick family, and lastly, —the aim to which all the others led up—the attainment of the electoral list, were the ends of its political action. Leibnitz had thus to support by his pen the claim of Hanover to appoint an ambassador at the congress of Nimègue (1678)³ to defend the establishment of primogeniture in the Lüneburg branch of the Brunswick family; and, when the proposal was made to raise the duke of Hanover to the electorate, with the charge of the imperial banner, he had to show that this did not interfere with the rights of the duke of Württemberg, who was the hereditary custodian of the imperial colours. It was in 1692 that the duke of Hanover was made elector. Before, and with a view to this, Leibnitz had been employed by him to write the history of the Brunswick-Lüneburg family, and, to collect material for his history, had undertaken a journey through Germany and Italy in 1687–90, visiting and examining the records in Marburg, Frankfurt-on-the-Main, Munich, Vienna (where he remained nine months), Venice, Modena, and Rome. At Rome he was offered the custodianship of the Vatican library on condition of his joining the Catholic Church.

About this time too his thoughts and energies were partly taken up with the scheme for the reunion of the Catholic and Protestant Churches. While at Mainz he had joined in an attempt made by the elector and Boineburg to bring about a reconciliation, and now, chiefly through the energy and skill of the Catholic Royas de Spinoia, and from the spirit of moderation which prevailed among the theologians he met with at Hanover in 1683 it almost seemed as if some agreement might be arrived at. It was in these circumstances that, in 1686, Leibnitz wrote his *Systema theologicum*,⁴ in which he strove to find common standing-ground for Protestants and Catholics in the details of their creeds. But the English Revolution of 1688, and the establishment of the Protestant succession, became a political obstacle to the prosecution of the scheme in Hanover, while it was soon found that the religious difficulties were greater than had at one time appeared. Spinoia's practical and conciliatory tone did not make full allowance for the ecclesiastical and dogmatical claims of Rome, and the moderation of the Hanover theologians was not fairly representative of the spirit of the Protestant Churches. In the letters to Leibnitz from Bossuet, the

¹ *Cusanus Furstenberg tractatus de fidei suprematus ac legationis principum Germaniae, Amsterdam, 1677; Enchiridion de Philartio et d'Epinoia sur le droit d'ambassade, Duisl., 1677.*

² Not published till 1816. It is on this work that the assertion has been founded that Leibnitz was at heart a Catholic—a supposition clearly disproved by his correspondence.

³ In a letter to the duke of Brunswick-Lüneburg (autumn 1671), *Werke*, ed. Kloppe, iii. 258 sq.

⁴ He was made a foreign member of the French Academy in 1700.

landgrave of Hessen-Rheinfels, and Madame de Brion, the aim is obviously to make converts to Catholicism, not to arrive at a compromise with Protestantism, and when it was found that Leibnitz refused to be converted the correspondence ceased. A further scheme of church union in which Leibnitz was engaged, that between the Reformed and Lutheran Churches, met with no better success.

Returning from Italy in 1690, Leibnitz was appointed librarian at Wolfenbützel by Duke Anton of Brunswick-Wolfenbützel. Some years afterwards began his connexion with Berlin through his friendship with the electress Sophie Charlotte of Brandenburg and her mother the princess Sophie of Hanover. He was invited to Berlin in 1700, and on the 11th July of that year the academy he had planned was founded, with himself as its president for life. In the same year he was made a privy councillor of justice by the elector of Brandenburg. Four years before he had received a like honour from the elector of Hanover, and twelve years afterwards the same distinction was conferred upon him by Peter the Great, to whom he gave a plan for an academy at St Petersburg, carried out after the czar's death. At Berlin, in the pleasant suburb of Charlottenburg, Leibnitz read and philosophized with his royal pupil, whose death in 1705 was the greatest loss he ever suffered. After this event his visits to Berlin became less frequent and less welcome, and in 1711 he was there for the last time. In the following year he undertook his fifth and last journey to Vienna, where he stayed till 1714. An attempt to found an academy of sciences there was defeated by the opposition of the Jesuits, but he now attained the honour he had coveted of an imperial privy councillorship (1713), and either at this time or on a previous occasion, was made a baron of the empire (*Reichsfreiherr*). Leibnitz returned to Hanover in September 1714, but found the elector George Louis had already gone to assume the crown of England. Leibnitz would gladly have followed him to London, but was bidden remain at Hanover and finish his history of Brunswick.

During the last thirty years Leibnitz's pen had been busy with many matters. Mathematics, natural science,¹ philosophy, theology, history, jurisprudence, politics (particularly the French war with Germany, and the question of the Spanish succession), economics, and philology, all gained a share of his attention; almost all of them he enriched with original observations.

His genealogical researches in Italy—through which he established the common origin of the families of Brunswick and Este—were not only preceded by an immense collection of historical sources, but enabled him to publish materials for a code of international law.² The history of Brunswick itself was the last work of his life, and had covered the period from 788 to 1005 when death ended his labours. But the Government, in whose service and at whose order the work had been carried out, left it to him unhindered in the archives of the Hanover library, till it was published by Pertz in 1843.

It was in the years between 1690 and 1716 that Leibnitz's chief philosophical works were composed, and during the first ten of these years the accounts of his system were, for the most part, preliminary sketches. Indeed, he never gave a full and systematic account of his doctrines. His views have to be gathered from letters to friends, from occasional articles in the *Acta Eruditorum*, the *Journal des Savants*, and other journals, and from one or two more extensive works. It is evident, however, that philosophy

had not been entirely neglected in the years in which his pen was almost solely occupied with other matters. A letter to the duke of Brunswick, and another to Arnauld, in 1671, show that he had already reached his new notion of substance; and it seems to have been the want of leisure and opportunity alone that prevented the systematic expression of his views. In a letter to Arnauld, of date March 23, 1690, the leading peculiarities of his system are clearly stated. The appearance of Locke's *Essay* in 1690 induced him (1696) to note down his objections to it, and his own ideas on the same subjects. In 1703-4 these were worked out in detail and ready for publication, when the death of the author whom they criticized prevented their appearance (first published by Raspe, 1765). In 1710 appeared the only complete and systematic philosophical work of his life-time, *Essais de Théodicée sur la bonté de Dieu, la liberté de l'homme, et l'origine du mal*, originally undertaken at the request of the late queen of Prussia, who had wished a reply to Bayle's opposition of faith and reason. In 1714 he wrote, for Prince Eugene of Savoy, a sketch of his system under the title of *La Monadologie*, and in the same year appeared his *Principes de la nature et de la grace*. The last few years of his life were perhaps more occupied with correspondence than any others, and, in a philosophical regard, were chiefly notable for the letters which, through the desire of the new queen of England, he interchanged with Clarke, *sur Dieu, l'âme, l'espace, la durée*.

Leibnitz died on the 14th November 1716, his closing years enfeebled by disease, harassed by controversy, embittered by neglect, darkened by the loss of his dearest friend; but to the last he preserved the indomitable energy and power of work to which is largely due the position he holds as, more perhaps than any one in modern times, a man of almost universal attainments and almost universal genius. Neither at Berlin, in the academy which he had founded, nor in London, whither his sovereign had gone to rule, was any notice taken of his death. At Hanover, Eckhart, his secretary, was his only mourner, no courtiers, no clergyman followed him to the grave, not till 1787 was the simple monument that marks the place erected; "he was buried," says an eye-witness, "more like a robber than what he really was, the ornament of his country."³ Only in the French Academy was the loss that had been sustained recognized, and a worthy eulogium devoted to his memory (November 13, 1717).

Accustomed from his boyhood to a studious life, Leibnitz possessed a wonderful power of rapid and continuous work, and for days together would hardly leave his chair. Even in travelling his time was employed in solving mathematical problems. He is further described as moderate in his desires and habits, quick of temper but easily appeased, charitable in his judgments of others, and tolerant of differences of opinion, though impatient of contradiction on small matters. He is also said to have been fond of money to the point of covetousness; he was certainly desirous of honour, and felt keenly the neglect in which his last years were passed.

Leibnitz's Philosophy. The central point in the philosophy of Leibnitz was only arrived at after many advances and corrections in his opinions. This point is his new doctrine of substance ("708"), and it is through it that unity is given to the succession of occasional writings, scattered over fifty years, in which he explained his views. More inclined to agree than to differ with what he read (p. 426), and borrowing from almost every philosophical system, his own standpoint is yet most closely related to that of Descartes, partly as consequence, partly by way of opposition. Cartesianism, Leibnitz often asserted, is the ante-room of truth, but the ante-room only. Descartes's separation of things into two heterogeneous substances only connected by the omnipotence of God, and the more logical

¹ In his *Prolegomena* (1681) he developed the notion of the historical genesis of the present condition of this earth's surface. Cf. O. Peschel, *Geogr. u. Erdkunde*, Munich, 1895, pp. 618 sq.

² *Codex juris gentium diplomatice*, pp. 618 sq., *Monita codici juris gentium diplomatice*, 1700.

³ *Memoirs of John Ker of Roxburgh*, by himself, 1726, i. 118.

⁴ When not otherwise stated, the references are to Erdmann's edition of the *Opera philosophica*.

absorption of both by Spinoza into the one divine substance, followed from an erroneous conception of what the true nature of substance is. Substance, the ultimate reality, can only be conceived as force. Hence Leibniz's metaphysical view of the monads as simple, percipient, self-active beings, the constituent elements of all things, his physical doctrine of the reality and constancy of force at the same time that space, matter, and motion are merely phenomenal, and his psychological conception of the continuity and development of consciousness. In the closest connexion with the same stand his logical principles of consistency and sufficient reason, and the method he developed from them, his ethical end of perfection, and his crowning theological conception of the universe as the best possible world, and of God both as its efficient cause and its final harmony.

The ultimate elements of the universe are, according to Leibniz, individual centres of force or monads. Why they should be individual, and not manifestations of one world-force, he never clearly proves.¹ His doctrine of individuality seems to have been arrived at, not by strict deduction from the nature of force, but rather from the empirical observation that it is by the manifestation of its activity that the separate existence of the individual becomes evident, for his system individuality is as fundamental as activity. "The monads," he says, "are the very atoms of nature—in a word, the elements of things," but, as centres of force, they have neither parts, extension, nor figure (p. 705). Hence their distinction from the atoms of Democritus and the materialists. They are metaphysical points or rather spiritual beings whose very nature it is to act. As the bent bow springs back of itself, so the monads naturally pass and are always passing into action without any aid and but the absence of opposition (p. 123). Nor do they, like the atoms, act upon one another (p. 680); the action of each excludes that of every other. The activity of each is the result of its own past state, the determiner of its own future (pp. 703, 723). "The monads have no windows by which anything may go in or out" (p. 705).

Further, since all substances are of the nature of force, it follows that—"in imitation of the notion which we have of souls"—they must contain something analogous to feeling and appetite. It is the nature of the monad to represent the universe, and this is perception, by which external events are mirrored internally (p. 433). Through their own activity the monads mirror the universe (p. 725), but such in its own way and from its own point of view, that is, with a more or less perfect perception (p. 127); for the Cartesian view was wrong in assuming that the monad is not conscious, and identifying it with the reflex cognition of it which may be called apperception. Every monad is thus a microcosm, the universe in little,² and according to the degree of its activity is the distinctness of its representation of the universe (p. 709). Thus Leibniz, borrowing the Aristotelian term, calls the monads *enteliches*, because they have a certain perfection (*perfectionem*) and sufficiency (*abundantiam*) which make them sources of their internal actions and, so to speak, incorporeal antonets (p. 705). That the monads are not pure enteliches is shown by the differences amongst them. Excluding all external limitation, they are yet limited by their own nature. All created monads contain a passive element or *matéria prima* (pp. 440, 687, 726), in virtue of which their perceptions are more or less confused. As the activity of the monad consists in perception, this is inhibited by the passive principle, so that there arises in the monad an appetite or tendency to overcome the inhibition and become more percipient, which allows the change from one perception to another (pp. 708, 714). By the proportion of activity to passivity in it one monad is differentiated from another. The greater the amount of activity or of distinct perceptions the more perfect is the monad; the stronger the element of passivity, the more confused its perceptions, the less perfect is it (p. 709). This could be a divinity had it nothing but distinct perceptions (p. 620).

The monad is never without a perception; but, when it has a number of little perceptions with no means of distinction, a state similar to that of being stunned ensues, the monad *vis* being perpetually in this state (p. 707). Between this and the most distinct perception there is room for an infinite diversity of nature among the monads themselves. Thus no one monad is exactly the same as another; for, were it possible that there should be two identical, there would be no sufficient reason why God, who brings them into actual existence, should put one of them at one definite time and place, the other at a different time and place. This is Leibniz's principle of the *identity of indiscernibles* (pp. 277, 755); by it his early problem as to the principle of individuation is solved by the distinction between *res* and individual being abolished, and every individual made *res generis*. The principle thus established is formulated in Leibniz's law of continuity, founded, he says, on the doctrine of the infinite, essential to geometry, and of the utmost importance in physics (pp. 104, 105), in accordance with which

there is neither vacuum nor break in nature, but "everything takes place by degrees" (p. 823), the different species of creatures rising by measurable steps from the lowest to the most perfect form (p. 812).

As in every monad each succeeding state is the consequence of the preceding, and as it is of the nature of every monad to mirror or represent the universe, it follows (p. 774) that the percipient content of each monad is in "accord" or correspondence with that of every other (cf. p. 127), though this content is represented with infinitely varying degrees of perfection. This is Leibniz's famous doctrine of pre-established harmony, in virtue of which the infinitely numerous independent substances of which the world is composed are related to each other and form one universe. It is essential to notice that it proceeds from the very nature of the monads as percipient, self-acting beings, and not from an arbitrary determination of the Deity.

From the harmony of self-determining percipient units Leibniz has to explain the world of matter and mind. As everything that really exists is of the nature of spiritual or metaphysical points (p. 126), it follows that space and matter in the ordinary sense can only have a phenomenal existence (p. 745), being dependent not on the nature of the monads themselves but on the way in which they are perceived. Considering that several things exist at the same time and in a certain order of coexistence, and mistaking this constant relation for something that exists outside of them, the mind forms the confused perception of space (p. 758). But space and time are merely relative, the former an order of coexistence, the latter of succession (pp. 682, 752). Hence not only the secondary qualities of Descartes and Locke, but their so-called primary qualities as well, are merely phenomenal (p. 445). The monads are really without position or distance from each other, but, as we perceive several simple substances, there is for us an aggregate or extended body. Body is thus actual extension (pp. 110, 115). The unity of the aggregate depends entirely on our perceiving the monads composing it together. There is no such thing as an absolute vacuum or empty space, any more than there are indivisible material atoms or atoms from which all things are built up (pp. 126, 188, 377). Body, corporeal mass, or, as Leibniz calls it, to distinguish it from the material *prima* of which every monad is composed, is *matéria secunda*, is thus only a "phenomenon *hinc fundatum*" (p. 438). It is not a *substantia* but *substantia* or *substantiam* (p. 745). While thus, however, is the only view consistent with Leibniz's fundamental principles, and is often clearly stated by himself, he has another aspect of the matter, namely, that of matter as a real substance, and of a real metaphysical bond between soul and body. But these expressions occur chiefly in the letters to Des Bosses, in which Leibniz is trying to reconcile his views with the doctrines of the Roman Catholic Church, especially with that of the real presence in the Eucharist, and are usually referred to by him as doctrines of faith or as hypothetical (see especially p. 850). The true *essentia substantialis* is not the *matéria secunda*, which is a consistent development of Leibniz's principles can only regard as phenomenal, but the *matéria prima*, through which the monads are individualized and distinguished and their connexion rendered possible. And Leibniz seems to recognize that the opposite assumption is inconsistent with his cardinal metaphysical view of the monads as the only realities.

From Leibniz's doctrine of force as the ultimate reality it follows that his view of nature must be throughout dynamical. And though he rejects as a *systeme* or theory of natural philosophy what we regard as the outlines of his own theory and his criticism of the mechanical physics of Descartes are known to us. The whole distinction between the two lies in the difference between the mechanical and the dynamical views of nature. Descartes started from the reality of extension as constituting the nature of material substance, and found in magnitude, figure, and motion the explanation of the material universe. Leibniz too admitted the mechanical view of nature as giving the laws of corporeal phenomena (p. 438), applying also to everything that takes place in animal organisms,³ even the human body (p. 777). But, as phenomenal, these laws must find their explanation in metaphysics, and thus in final causes (p. 155). All things, he says (in his *Opuscula Dynamica*), can be explained either by efficient or by final causes. But the latter method is not appropriate to individual occurrences,⁴ though it must be applied when the laws of mechanism themselves need explanation (p. 678). For Descartes's doctrine of the constancy of the quantity of motion (*q. incommutabilis*) in the world Leibniz substitutes the principle of the conservation of *vis viva*, and contends that the Cartesian position that motion is measured by velocity should be superseded by the law that moving force (*vis motrix*) is measured by the square of the velocity (pp. 182, 193). The long controversy raised by this contention was really caused by the technical use of the term employed. The principles held by Descartes and Leibniz were both correct, though different, and their conflict only apparent. Descartes's

¹ See *Considérations sur la doctrine d'un esprit universel*, 1702.

² Cf. *Opera*, ed. Dutrue, II. p. 10.

³ The difference between an organic and an inorganic body consists, he says, in this, that the former is a machine *en son* in its smallest parts.

⁴ *Opera*, ed. Dutrue, III. p. 251.

principle is now enunciated as the conservation of momentum, that of Leibnitz as the conservation of energy. Leibnitz further criticizes the Cartesian view that the mind can alter the direction of motion though it cannot initiate it, and contends that the quantity of "ess directed," estimated between the same parts, is constant (p. 108)—a position developed in a statistical theorem for determining geometrically the resultant of any number of forces acting at a point.

Lake the monad, body, which is its analogue, has a passive and an active element. The former is the capacity of resistance, and includes impenetrability and inertia; the latter is active force (p. 255, 637). Bodies, then, like the monads, are self-contained activities, receiving no impulse from without—its only by an accommodation to ordinary language that we speak of them as doing so—without moving themselves in harmony with each other (p. 260).

The psychology of Leibnitz is chiefly developed in the *Nouveaux Essais sur l'entendement humain*, written in answer to Locke's famous *Essay*, and criticizing it chapter by chapter. In these essays he worked out a theory of the origin and development of knowledge in harmony with his metaphysical views, and thus without Locke's implied assumption of the mutual influence of soul and body. When one monad in an aggregate perceives the others so clearly that they are in comparison with it mere monads (*monades enus*), it is said to be the ruling monad of the aggregate, not because it actually does exert an influence over the rest, but because, being in close correspondence with them, and yet having so much clearer perception, it seems to do so (p. 683). This monad is called the entelechy or soul of the aggregate or body, and as such mirrors the aggregate in the first place and the universe through it (p. 710). Each soul or entelechy is surrounded by an infinite number of monads forming its body (p. 714); soul and body together make a living being, and, as their laws are in perfect harmony—a harmony established between the whole realm of final causes and that of efficient causes (p. 714)—we have the same result as if one influenced the other. This is further explained by Leibnitz in his well-known illustration of the different ways in which two clocks may keep exactly the same time. The machinery of the one may actually move that of the other, or whenever one moves the mechanism may make a similar alteration in the other, or they may have been so perfectly constructed at first as to continue to correspond at every instant without any further influence (pp. 133, 134). The first way represents the common (Locke's) theory of mutual influence, the second the method of the occasionalists, the third that of pre-established harmony. Thus the body does not act on the soul in the production of cognition, nor is it continued to correspond at every instant without any further influence (pp. 133, 134). The body just as it had no soul, the soul as if it had no body (p. 711). Instead, therefore, of all knowledge coming to us directly or indirectly through the bodily senses, it is all developed by the soul's own activity, and sensuous perception is itself but a confused kind of cognition. The body is the instrument of the soul only (cf. Descartes' field), but all our ideas are innate, though only worked up into actual cognition in the development of knowledge (p. 212). To the aphorism made use of by Locke, "Nihil est in intellectu quod non prius fuerit in sensu," must be added the clause, "mai intellectus ipse" (p. 228). The soul at birth is not comparable to a *tabula rasa*, but rather to an unworked block of marble, the hidden veins of which already determine the form it is to assume in the hands of the sculptor (p. 108). Nor, again, can the soul ever be without perception; for it has no other nature than that of a perpetual active being (p. 248). Apparently dreamless sleep is to be accounted for by unconscious perception (p. 228) and it is by such unmeaning perceptions that Leibnitz explains his doctrine of pre-established harmony (p. 197).

In the human soul perception is developed into thought, and there is thus an infinite though gradual difference between it and the mere monad (p. 464). As all knowledge is innate in our mind, it follows that its perfection depends on the efficiency of the instrument by which it is developed. Hence the importance, in Leibnitz's system, of the logical principles and method the consideration of which occupied him at intervals throughout his whole career.

There are two kinds of truth—(1) truths of reasoning, and (2) truths of fact (pp. 83, 98, 707). The former rest on the principles of identity (or contradiction) or of possibility, in virtue of which that is false which contains a contradiction, and that true which is contradictory to the false. The latter rest on the principle of sufficient reason or of reality (*compossibilité*), according to which no fact is true unless there is a sufficient reason why it should be as it is and not otherwise (agreeing thus with the *principium veritatis* or final cause). God alone, the purely active monad, has an *a priori* knowledge of the latter class of truths, they have their source in the human mind only in so far as it mirrors the outer world, i. e., in 39 positively, whereas the truths of reason have their source in our mind in itself or in its activity.

Both kinds of truths fall into two classes, primitive and derivative. The primitive truths of fact are, as Descartes held, those of internal experience, and the derivative truths are inferred from them in accordance with the principle of sufficient reason, by their agreement with our perception of the world as a whole. They are thus

reached by probable arguments—a department of logic which Leibnitz was the first to bring into prominence (pp. 84, 164, 168, 169, 248). The primitive truths of reasoning are identical (in later terminology, analytical) propositions, the derivative truths being deduced from them by the principle of contradiction. The part of his logic on which Leibnitz laid the greatest stress was the separation of these rational cognitions into their simplest elements—for he held that the root-notions (*conceptiones primae*) would be found to be few in number (pp. 92, 93)—and the designation of them by universal characters or symbols,¹ composite notions being denoted by the formulae formed by the union of several definite characters, and judgments by the relation of acquiescence among these formulae, so as to reduce the syllogism to a calculus. This is the main idea of Leibnitz's "universal characteristic," never fully worked out by him, which he regarded as one of the greatest discoveries of the age. An incidental result of its adoption would be the introduction of a universal symbolism of thought comparable to the symbolism of mathematics and intelligible in all languages (cf. p. 356). But the great revolution it would effect would chiefly consist in this, that truth and falsehood would be no longer matters of opinion but of correctness or error in calculation² (pp. 88, 84, 89, 83). What Adam Smith says is not to be superadded, but it is to be supplemented by this new method, for of itself it is but the ABC of logic.

But the logic of Leibnitz is an art of discovery (p. 85) as well as of proof, and, as such, applies both to the sphere of reasoning and to that of fact. In the former it has by attention to render explicit what is otherwise only implicit, and by the intellect to introduce order into the *a priori* truths of reason, so that one may follow from another and they may constitute together a *monade intellectuelle*. To this art of orderly combination Leibnitz attached the greatest importance, and to it one of his earliest writings was devoted. Similarly, in the sphere of experience, it is the art of discovery, by which we find out and classify the primitive facts of fact, referring every other fact to them as its sufficient reason, so that new truths of experience may be brought to light.

As the perception of the monad when clarified becomes thought, so the aspects of which all monads partake is raised to will, their spontaneity is freedom in man (p. 699). The will is an affect or tendency to that which one finds good (p. 251), and is free only in the sense of being exempt from external control³ (pp. 252, 513, 521), for it must always have a sufficient reason for its action determined by what seems good to it. The end determining the will is pleasure (p. 259), and pleasure is the sense of an increase of freedom (p. 670).

A man guided by reason will sacrifice transitory and pursue constant pleasures or happiness, and in this weighing of pleasures consists true wisdom. Leibnitz, like Spinoza, says that freedom consists in following reason, servitude in following the passions (p. 669), and that the passions proceed from confused perceptions (pp. 188, 299). In love one finds joy in the happiness of another; and from love follow justice and law.⁴ Our reason," says Leibnitz, "is illumined by the spirit of God, reveals the law of nature," and with its positive law must not conflict. Natural law rises from the strict command to avoid offence, through the maxim of equity which gives to each his due, to that of piety or piety (*bonitas verus*),—the highest ethical perfection,—which presupposes a belief in God, providence and a future life.⁵ Moral immortality—not merely the simple continuity which belongs to every monad—comes from God having provided that the changes of matter will not make man lose his individuality (pp. 126, 496).

Leibnitz thus makes the existence of God a postulate of morality as well as necessary for the realization of the monads. It is in the *Theodicee* that his theology is worked out and his view of the universe as the best possible world defended. In it he contends that faith and reason are essentially harmonious (pp. 402, 479), and that nothing can be received as an article of faith which contradicts an eternal truth, though the ordinary physical order may be superseded by a higher.⁶

The ordinary arguments for the being of God are retained by Leibnitz in a modified form (p. 875). Descartes' ontological proof is supplemented by the clause that God as the *ens* as such must either exist or be impossible (pp. 90, 177, 708). The cosmological proof⁷ he passes from the infinite series of finite causes to their sufficient reason which contains all changes in the series necessarily in itself (pp. 147, 708); and he argues teleologically from the existence of harmony among the monads without any mutual influence to God as the author of this harmony (p. 430).

¹ Different symbolic systems were proposed by Leibnitz at different periods of his life. Leibnitz's *Logic*, 1687, p. 37.

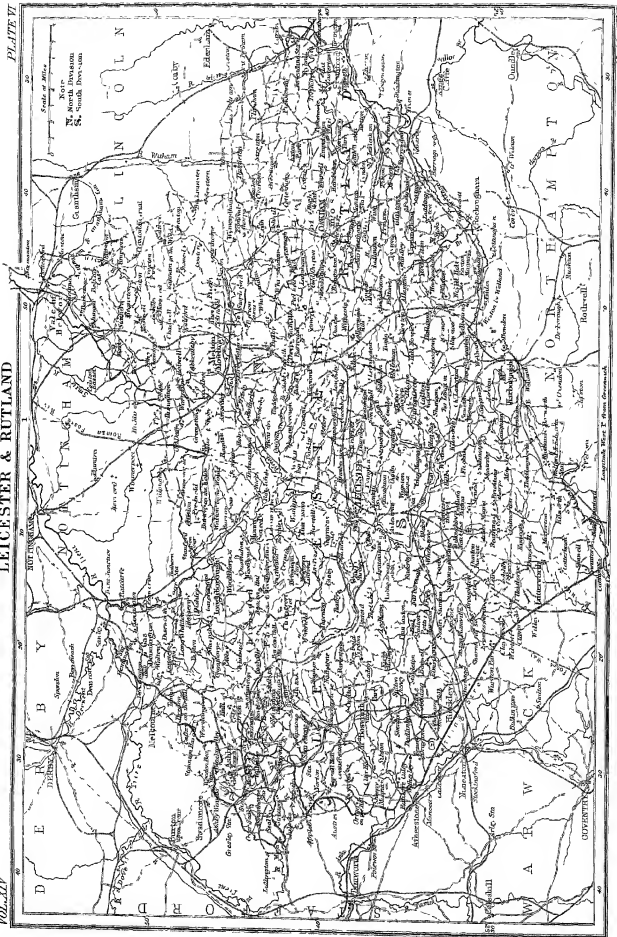
² The ideas of which Leibnitz anticipated the modern theory of logic mainly due to Boole are collected out in St. Yves's *Symbolica Logica*, 1881.

³ Hence the difference of the determinism from that of Spinoza, though Leibnitz too says "in one place that 'in his opinion the cosmological proof of the existence of God from those of the creature' (Werke, ed. Furtz, 3d ser., p. 100).

⁴ *Opera omnia*, ed. Dufrenoy, IV, 181, 285.

⁵ *Phil. IV*, III, 286. Cf. Blumenthal, *Geist*, d. altg. *Blasphemie* u. *Philosophie*, 1894, pp. 143 ff.

⁶ P. 489; cf. Werke, ed. Furtz, 2d ser., p. 1, 186, 160.



miles. The available coal in the Moira district is estimated at over 450,000,000 tons, and in the Coleorton district at over 350,000,000 tons. In 1870 the amount of coal produced was 599,450 tons, but for some years it has exceeded 1,000,000 tons, the number of collieries being about thirty. At a depth of 593 feet in the Moira coal-field there is a spring of salt-water, the brine of which is brought to Ashby-de-la-Zouch for use in scorbatic and rheumatic affections. Limestone is worked in various portions of the county, freestone is plentiful, gypsum is found, and a kind of granite, which is

extensively used for paving purposes, is obtained at Charnwood forest, Mount-Sorrel, Sapcote, and Stoney-Stanton.

Agriculture.—The climate is mild, and on account of the inland position of the county, and the absence of any very high elevations, the rainfall is very moderate. The soil is of a loamy character, the richest district being that to the east of the Soar, which is occupied by pasture, while the corn crops are grown chiefly on a lighter soil resting above the Red Sandstone formation. The following table gives a classification of holdings according to size, with the area under each class of holding.—

	60 Acres and under		From 60 to 100 Acres.		From 100 to 300 Acres		From 300 to 600 Acres.		From 600 to 1000 Acres		Above 1000 Acres.		Total.	
	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.	No.	Acres.
1874	5,974	77,381	958	69,044	1,466	248,036	105	69,090	25	16,815	2	2,800	470,006	
1880	5,832	74,464	990	65,469	1,407	244,180	139	66,483	26	21,776	2	2,605	473,956	

A large number of the holdings between 100 and 300 acres are possessed by owners who farm their own land. In 1881 the total area of arable land was 473,998 acres, of which 91,952 were under corn crop, 22,033 under green crop, 25,302 rotation grasses, 317,869 permanent pasture, and 16,842 fallow; 740 acres were under orchards, 345 market gardens, 125 nursery grounds, and 11,262 woods. It will be observed that the proportion of pasture is very great. The pasture land is especially rich along the banks of the rivers. Of corn crops 33,675 acres were under wheat, 27,724 barley, and 23,330 oats. The number of cows in 1881 was 33,863, the total number of cattle being 123,681, an average of 26 to every 100 acres under cultivation, the average for England being 16.9. There are many dairy farms for the manufacture of cheese, the famous Stilton cheese being made near Melton Mowbray. Horses numbered 18,085, the number used for agricultural purposes being 12,243. The breed was much improved by the importation by the well-known agriculturist Bakewell of mares from Flanders. As the county is famed for fox-hunting, there are many excellent riding horses. The number of sheep in 1881 was 263,383, an average of 51 to every 100 acres under cultivation, the average for England being 62.4. The famous New Leicesters, introduced by Bakewell, are the most common, but the Old Leicesters are still bred, and there is also a race of sheep peculiar to Charnwood forest. Pigs in 1881 numbered 21,765. According to the return of 1874, the land in 1872-73 was divided among 13,848 proprietors, possessing 519,524 acres, with an annual rental of £1,493,378, 10s. Of the owners only 35 per cent. possessed more than 1 acre, and the average value per acre all over was £2, 16s. Among the principal proprietors are the duke of Rutland, possessing 30,109 acres; Lord Donington, 10,174; Earl Hossa, 9755; the earl of Stamford and Warrington, 9012; and the earl of Dysart, 8420.

Manufactures.—The staple manufacture of the county is hosiery, for which the wool is obtained chiefly from home-bred sheep. Its principal seats are Leicester, Hinckley, and Loughborough. Cotton hose are likewise made, and the other industries include the manufacture of boots and shoes, elastic webbing, silk plush for hats and lace, agricultural implements, bricks and pottery, and artificial manures.

Administration and Population.—Leicestershire comprises six "hundreds," the municipal and parliamentary borough of Leicester (123,351), and five other towns with a population of over 5000, viz., Loughborough (14,783), Hinckley, partly in Warwickshire (7673), Ashby-de-la-Zouch (7465), Melton Mowbray (5766), and Market Harborough (5350). The population of the county, which in 1801 was only 130,030, was 215,867 in 1841, 269,311 in 1871, and 321,018 (165,429 males and 165,689 females) in 1881, the increase within the last ten years being 19.2 per cent

The county returns six members to Parliament,—two for North and two for South Leicestershire, and two for the borough of Leicester. It has one court of quarter sessions, and is separated into nine petty sessional divisions, with which the police divisions are nearly identical. The borough of Leicester has a commission of the peace, a separate court of quarter sessions, and also its own police. The county is almost wholly in the diocese of Peterborough, and contains 381 civil parishes, townships, or places, as well as parts of other parishes. It is included in the Midland circuit, and assizes and quarter sessions are held at Leicester.

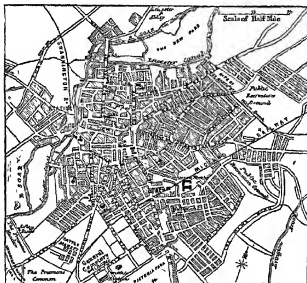
History and Antiquities.—Before the Roman invasion Leicestershire was inhabited by the Coritani, and under the Romans it formed part of the province of *Flavia Caesariensis*. The principal Roman roads are the Watling Street, which forms for 20 miles the south-west boundary of the county from Deveredale near the Avon to near Atherstone, where it enters Warwickshire; the Fosse road from Lincolnshire, which enters the county at Six Hills, and passes by Leicester to Watling Street, the *Via Devana* from Colchester, which enters the county near Melton, and joins the Fosse at Leicester on its way to Chester. The principal Roman stations were *Ratae* (Leicester), *Veromastum* (supposed to have been Borough Hill), *Mandunessum* (Mancetter), and *Bemona* (Highcross). Roman coins, urns, tessellated pavements, military weapons, and domestic utensils and other remains have been found in several places, especially at Leicester, Rothley, Wapley, Eatherby, Bottesford, Hinckley, Sapcote, and Melton Mowbray. Two miles from Leicester a Roman milestone of the time of the emperor Hadrian was discovered in 1771. Under the Heptarchy Leicester was included in the kingdom of Mercia. Afterwards it was overrun by the Danes, from whom it was recovered by Ethelfield. The most noteworthy event connected with the county was the battle of Bosworth Field, where Richard III. was slain 22d August 1485; but it was frequently the scene of contests in the reigns of John and of Henry II and during the Revolution period.

The principal monastic foundations in Leicester were priories of Black Canons at St Mary Friar near Leicester, founded in 1143, and at Brecon founded in 1144, priories of Benedictines at Hinckley in 1173 and of Benedictine nuns at Langley near Brecon in the time of Henry I, a collegiate church at Leicester founded in the reign of William I, a priory of canons of St Augustine at Launde in the reign of Henry I. (Now changed into a mansion), houses of the Knights Hospitallars at Dalby and Heather, a priory of St Austin at Bradley, a preceptory of Knights Templars at Rothley in 1280, a house of Franciscans at Leicester founded by Simon de Montfort, a friary of St Augustine called St Catherine's, also at Leicester, and a convent of canons regular of St Augustine at Kirkby, founded in 1369. The principal old castles are those of Ashby-de-la-Zouch and Kirkby-Muxton.

The principal histories of Leicestershire are those of Nicolson, 1790, 4th edition 1798-1809; Threlby, 1749, and Currie, 1851. See also *Compendious Book of Leicester*, 1692; Watson, *Chambers of Leicester*, 1814; Hall, *Geology of the Leicester Coal-field*, 1860; Aveline, *Geology of part of Leicester*, 1860; Judd, *Geology of part of Leicester*, 1876; Hamilton, *Geology of Leicestershire and Rutland*, 1876. For a full list see see Anderson, *Supplement of the Gazetteer of the United Kingdom*, 1881.

LEICESTER, a municipal and parliamentary borough and market-town of England, and the chief town of the county of Leicester, is situated at the intersection of several railway lines, in a gentle hollow on the river Soar, 97 miles north-north-west of London, and 27 south of Nottingham. The town is well built, the streets are spacious

and regular, and the sanitary and water arrangements are very satisfactory. The most important of the churches are St Martin's, near the site of an old Franciscan convent, restored in 1881 at a cost of £80,000; St Mary's, Early English and Norman, originally built in the 13th century, and restored in 1861 at a cost of £10,000; All Saints, an ancient structure in the Early English style, restored in 1875; St Margaret's, a beautiful and spacious building erected in 1444, Early English and Decorated, recently restored at a cost of £6000; and St Nicholas's, in the Early Norman style. Of the old castle two gateways are still standing, and also a portion of the Norman Hall. The other principal buildings are the old town-hall, formerly the guild-hall of Corpus Christi, the new town-hall erected in 1875, the town museum, the school of art, and the public baths, erected in 1879 at a cost of £11,000. One



Plan of Leicester

of the ornaments of the town is the memorial clock-tower erected in 1868 in honour of Simon de Montfort and three other less known persons connected with the district. In the neighbourhood of the town are the remains of the abbey of Black Canons, founded in 1143. On the site of St Margaret's church was the old Saxon cathedral, and in the adjoining abbey Cardinal Wolsey was buried. Besides Trinity Hospital, founded in 1331 by Henry Plantagenet, earl of Leicester, and Wyggeston's Hospital, founded in 1513, there are a large number of minor charities. There is a fine promenade from the town to the Victoria park and raccourse, in addition to which the Abbey park of 40 acres has lately been opened. The staple trade of Leicester is hosiery, including stockings and all kinds of fancy goods. There are also iron-foundries, and manufactures of boots and shoes, elastic web, and sewing cotton. The population of the municipal and parliamentary borough, 17,005 in 1801, had increased in 1871 to 95,220, and in 1881 to 122,351.

Leicester was an ancient British town, and under the name of *Eborac* or *Eboracorum* an important Roman station. It was also one of the five old Danish boroughs, and until 874 it was an ecclesiastical see. Its charter of incorporation was obtained from King John, and from the 23d of Edward I. it returned two members to parliament. Parliaments were held in the town by Henry V. in 1414 and by Henry VI. in 1426. Richard III., who passed a night in it on his way to the fatal battle of Bosworth, was buried in the Franciscan convent. The town was stormed by Charles I., May 31, 1646, and recovered by Fairfax in the June following. See the *History of Thoresby* (1777), Robinson (1791), and Thompson (1871).

LEICESTER, SIMON DE MONTFORT, EARL OF See MONTFORT.

LEICESTER, ROBERT DUDLEY, EARL OF (c. 1531-1588). This favourite of Queen Elizabeth came of an ambitious family. They were not, indeed, such mere upstarts as their enemies loved to represent them, for Leicester's grandfather—the notorious Edmund Dudley who was one of the chief instruments of Henry VII.'s extortions—was descended from a younger branch of the barons of Dudley. But the love of power was a passion which seems to have increased in them with each succeeding generation, and though the grandfather was beheaded by Henry VIII. for his too devoted services in the preceding reign, the father grew powerful enough in the days of Edward VI. to trouble the succession to the crown. This was that John Dudley, duke of Northumberland, who contrived the marriage of Lady Jane Grey with his own son Guildford Dudley, and involved both her and her husband in a common ruin with himself. Robert Dudley, the subject of this article, was an elder brother of Guildford, and shared at that time in the misfortunes of the whole family. Having taken up arms with them against Queen Mary, he was sent to the Tower, and was actually sentenced to death, but the queen afterwards not only pardoned and restored him to liberty, but appointed him master of the ordnance. On the accession of Elizabeth he was also made master of the horse. He was then, perhaps, about seven and twenty, and was evidently rising rapidly in the queen's favour. A few early ages he had been married to Amy, daughter of Sir John Robsart. The match had been arranged by his father, who was very studious to provide in this way for the future fortunes of his children, and the wedding was graced by the presence of King Edward. But it was not a happy marriage. The lady lived alone at Cumnor Hall in Berkshire, the house of one Anthony Forster, and there in the year 1560 she died under circumstances which certainly aroused some suspicions of foul play. The scandal was the more serious as it was insinuated that Dudley stood so high in the queen's favour that he might reasonably hope to marry her, and that a murder had been deliberately planned to remove an obstacle to his advancement. The point, it must be owned, is not free from obscurity, and recent revelations from the archives of Simancas prove that even before the unhappy lady's death it was said there was a design to poison her. After the event, however, the story was that she had broken her neck by a fall down stairs, and, suspicious as the case may appear, there is much to be said in favour of Dudley's innocence, which cannot be discussed within our limits. Certain it is that he continued to rise in the queen's favour. She made him a Knight of the Garter, and bestowed on him the castle of Kenilworth, the lordship of Denbigh, and other lands of very great value in Warwickshire and in Wales. In September 1564 she created him baron of Denbigh, and immediately afterwards earl of Leicester. In the preceding month, when she visited Cambridge, she at his request addressed the university in Latin. The honours shown him naturally excited jealousy, especially as it was well known that his entertainments still more ambitious hopes, which the queen apparently did not altogether discourage. The earl of Sussex, in opposition to him, strongly favoured a match with the archduke Charles of Austria. The court was divided, and, while arguments were set forth on the one side against the queen's marrying a subject, the other party insisted strongly on the disadvantages of a foreign alliance. The queen, however, was so far from being foolishly in love with him that in 1564 she recommended him as a husband for Mary Queen of Scots. But even this, it was believed, was only a blind, and indeed it may be doubted how far this proposal was serious. After his creation as earl of Leicester great attention was paid to him both at home and abroad. The

university of Oxford made him their chancellor, and Charles IX. of France sent him the order of St Michael. A few years later he formed an ambiguous connexion with the baroness dowager of Sheffield, which was maintained by the lady, with great appearance of truth, to have been a valid marriage, though it was concealed from the queen. Long afterwards, in the days of James I., their son, Sir Robert Dudley, a man of extraordinary talents, sought to establish his legitimacy, but his suit was suddenly brought to a stop, and the documents connected with it sealed up by an order of the Star Chamber, without any reasons being assigned.

In 1575 Queen Elizabeth visited the earl at Kenilworth, where she was entertained for some days with great magnificence. The picturesque account of the event given by Sir Walter Scott has made every one familiar with the general character of the scene. Next year Walter, earl of Essex, with whom Leicester had had some differences, died in Ireland, not without suspicion of poison, and Leicester's subsequent marriage with his widow again gave rise to very serious imputations against him. This marriage, like the former, was kept secret at first; but it was revealed to the queen in 1579 by Simier, an emissary of the duke of Alençon, to whose projected match with Elizabeth the earl seemed to be the principal obstacle. The queen showed great displeasure at the news, and had some thought, it is said, of committing Leicester to the Tower, but was dissuaded from doing so by his rival the earl of Sussex. In February 1582 Leicester, along with a number of other noblemen and gentlemen, escorted the duke of Alençon on his return to Antwerp to be invested with the government of the Low Countries. In 1584 he inaugurated an association for the protection of Queen Elizabeth against conspirators. About this time there issued from the press the famous pamphlet, believed to have been the work of Parsons the Jesuit, entitled *Leicester's Commonwealth*, which was intended to suggest to the people that the English constitution was subverted and the government handed over to one who was at heart an atheist and a traitor, besides being a man of infamous life and morals. The book was ordered to be suppressed by letters from the privy council, in which it was declared that the charges against the earl were to the queen's certain knowledge untrue; nevertheless they produced a very strong impression, and were believed in by some who had no sympathy with Jesuits long after Leicester's death. In 1585 he was appointed commander of an expedition to the Low Countries in aid of the revolted provinces, and sailed with a fleet of fifty ships to Flushing, where he was received with great enthusiasm. In January following he was invested with the government of the provinces, but immediately received a strong reprimand from the queen for taking upon himself a function which she had not authorized. Both he and the States General were obliged to apologize; but the latter protested that they had no intention of giving him absolute control of their affairs, and that it would be extremely dangerous to them to revoke the appointment. Leicester accordingly was allowed to retain his dignity; but the incident was inauspicious, nor did affairs prosper greatly under his management. His nephew Sir Philip Sidney was slain at the unsuccessful siege of Zutphen, and complaints were made by the States General of the conduct of the whole campaign. He returned to England for a time, and went back in 1587, when he made an abortive effort to raise the siege of Silya. Disagreements increasing between him and the States, he was recalled by the queen, from whom, contrary to the expectation of his enemies, he met with a very good reception; and he continued in such favour that in the following summer (the year being that of the Armada,

1588) he was appointed lieutenant-general of the army mustered at Tilbury to resist Spanish invasion. After the crisis was past he was returning homewards from the court to Kenilworth, when he was attacked by a sudden illness and died at his house at Cornbury in Oxfordshire, on the 4th September.

Such are the bare facts of Leicester's life. Of his character it is more difficult to speak with confidence, but some features of it are indisputable. Being in person tall and remarkably handsome, he improved these advantages by a very ingratiating manner. A man of no small ability and still more ambition, he was nevertheless vain, and presumed at times upon his influence with the queen to a degree that brought upon him a sharp rebuff. On the other hand, Elizabeth stood by him, as we have seen, against efforts to supplant him. That she was ever really in love with him, as modern writers have supposed, is extremely questionable; but she saw in him some valuable qualities which marked him as the fitting recipient of high favours. He was a man of princely tastes, especially in architecture. At court he became latterly the leader of the Puritan party, and his letters were pervaded by expressions of religious feeling which it is hard to believe were insincere. Of the darker suspicions against him it is enough to say that much was certainly reported beyond the truth; but there remain some facts sufficiently mysterious to make a just estimate of the man a rather perplexing problem.

(J. G.)

LEIGH, a market and manufacturing town of Lancashire, England, is situated on several branch railway lines, $7\frac{1}{2}$ miles south-west of Bolton. The ancient parish church was, with the exception of the old tower, rebuilt in 1873 in the Perpendicular style, at a cost of over £10,000. The grammar school, the date of whose foundation is unknown, received its principal endowments in 1555, 1562, and 1681. A union workhouse was erected in 1851 at a cost of £10,000. The staple manufactures of the town are silk and cotton, but there are also glass-works, foundries, breweries, and flour-mills, with extensive collieries. The local government board was formed in 1875 by the amalgamation of those previously existing for the townships of West Leigh, Bedford, and Pennington. The population of the district was 17,623 in 1871, and 21,733 in 1881. The town includes also a portion of the township of Atherton.

LEIGH, EDWARD (1602-1671), Puritan linguist and theologian, was born in 1602 at Shawell, Leicestershire, was educated at Magdalen Hall, Oxford, from 1618, and subsequently became a member of the Middle Temple. In 1636 he entered parliament as member for Stafford, and during the civil war he held a colonelcy in the parliamentary army. He has sometimes been confounded with John Ley, and so represented as having sat in the Westminster Assembly. The public career of Leigh terminated with his expulsion from parliament along with the rest of the Presbyterian party in 1648. From an early period in his life he devoted much of his time to the study of theology and to the preparation for the press of numerous compilations, the most important of these being the *Critica Sacra*, containing observations on all the *Radices* of the Hebrew Words of the Old and the Greek of the New Testament (1639-44; new ed., with supplement, 1662), for which the author received the thanks of the Westminster Assembly, to whom it was dedicated. It has frequently been reprinted abroad, and in the opinion of Leigh's contemporary Fuller, it, "with many other worthy works, will make his judicious industry known to posterity." It is now, however, but little used. Leigh died in Staffordshire in June 1671.

His remaining works include *A Treatise of Divinity* (1646-51), *A Bely of Dromsdy* (1654), *Annotations upon the New Testament*

(1656), of which a Latin translation by Arnold was published at Leipzig in 1732. *Annotations on the First Printed Books of the Old Testament* (1657), *A Treatise of Religion and Learning* (1656), *Selected and Choice Observations concerning the First Twelve Chapters* (1655).

LEIGHTON, ROBERT (1611–1684), bishop of Dunblane, and afterwards archbishop of Glasgow, was the eldest son of Dr Alexander Leighton, the author of *Zion's Plea against the Prelacie*, whose terrible sufferings for having dared to question the divine right of Episcopacy, under the persecution of Laud, form one of the most disgraceful incidents of the reign of Charles I. Dr Leighton is said to have been of the old family of Ullishaven in Forfarshire, and his illustrious son was born in the year 1611. From his earliest childhood, according to Burnet, he was distinguished for his sauntly temper and disposition, and in his sixteenth year (1627) he was sent to complete his education at the university of Edinburgh, where, after studying with distinguished success for four years, he took his degree of M.A. in 1631.¹

After leaving college his father sent him to travel abroad, and he is understood to have spent several years in France, where he acquired a complete mastery of the French language. While there he passed a good deal of time with some relations at Douay who had become Roman Catholics, and with whom he would seem to have formed a strict friendship, as he kept up a correspondence with them for many years afterwards. Either at this time or on some subsequent visit to the Continent he had also a good deal of intercourse with some members of the Jansenist party. And no doubt what he then saw among these excellent persons of the piety which was possible even in a communion which he believed to be corrupt contributed not a little to the charity towards those who differed from him in religious opinions, which ever afterwards formed so remarkable a feature in his character. The exact period of his return to Scotland has not been ascertained; but in 1641 he was ordained Presbyterian minister of Newbattle in Midlothian, where he continued for about ten years. At the end of that period he resigned his charge, and went to reside in Edinburgh (1652). What the precise circumstances were which led him to take this step does not distinctly appear. But the account given is that the fiery zeal of his brother clergymen on certain political questions found little sympathy with him, and that this led to severe censures on their part, which were too much for his gentle nature to bear.

Early in the following year (1653) he was appointed principal of the university of Edinburgh, and primarius professor of divinity. In this post he continued for seven or eight years, and, according to Burnet, "he was a great blessing in it, for he talked so to all the youth of any capacity or distinction that it had a great effect on many of them." A considerable number of his Latin prelections and other addresses to the students were published after his death, and are singularly remarkable for the purity and

elegance of their Latinity, and their subdued and meditative eloquence. The reader will be disappointed if he expects to find in them any subtle exposition of a metaphysical system of theology. In this respect they present a curious contrast to any thing that is known of the theology taught at that time in the Presbyterian Church of Scotland. They are rather to be regarded as valuable instructions in the art of living a holy life than as a body of scientific divinity. Throughout, however, they bear the marks of a deeply learned and accomplished mind, fully saturated with both classical and patristic reading, and like all his works they breathe the spirit of one who lived very much above the world. It would be interesting to ascertain how far he succeeded in instilling something of his own spirit into the minds of those who listened to his teaching. We certainly meet with very little indication of its having taken any deep root in the hearts of either the Presbyterians or the Episcopalian clergy of the twenty or thirty years which succeeded the period of his principalship. The only writer of the time who has spoken with true appreciation of his character is Bishop Burnet, both in his *History of his Own Times* and in his *Pastoral Care* he has referred to Leighton in language of unbounded affection and admiration. This, however, was founded upon knowledge of him obtained in the course of a friendship formed after he had demitted his office of principal, and not upon his university teaching.

In 1661, when Charles II. had resolved to force Episcopacy once more upon Scotland, he fixed upon Leighton for one of his bishops. Looking at the matter, as we are apt to do, in the light of what followed in the history of Scotland during the next twenty-seven years, it seems almost unaccountable how such a man as Leighton could have submitted as he did to the degradation of being associated with condutors like Sharp and some of his companion bishops. The only explanations which can be given perhaps are that Leighton, living very much out of the world, and being somewhat deficient in what may be called the political sense, had no idea of the deadly hatred entertained toward Episcopacy by the great mass of the religious people of Scotland, and so of its utter unfitness to become the established church polity of the country, and that his soft and gentle nature rendered him too open to the persuasions which were used to induce him to enter a sphere for which he instinctively felt he was ill qualified. Every one will give him credit too for having no conception that the only object of the Government in establishing Episcopacy in Scotland was to make it subservient to despotism and persecution. The Episcopacy which he contemplated was that modified form which had been suggested by Archbishop Usher, and to which Baxter and many of the best of the English Nonconformists would have readily given their adherence. It is significant on this head that he always refused to be addressed as "my lord," and it is stated that when dining with his clergymen on one occasion he was so far from arrogating any right of superiority or precedence that he wished to seat himself at the foot of the table.²

If Leighton did not know before, he soon began to discover the sort of men with whom he was to be associated in the episcopate. He travelled with them in the same coach from London towards Scotland, but having become, as he told Burnet, very weary of their company (as he doubted not they were of his), and having found that they intended to make a kind of triumphal entrance into Edinburgh, he left them at Morpeth and retired to the earl of

¹ One has difficulty in thinking of even the youthful Leighton as capable of humour or sarcasm. But it so happens that the only anecdote of his college career which has been preserved to us indicates the presence of some trace of these in his character. The provost of Edinburgh at the time was a certain David Aikenhead, who had probably made himself offensive in some way to the young colleagues, and Leighton, it appears, was tempted to perpetrate the following little epigram upon him:—

"That quibble his name friends in falsely said,
To wit that of one whose his head is made,
For it that had been compassed on,
His byre nose had stained his long space."

To "blaspheme the bullies" (much more the provost) was at that time a somewhat serious offence, and we are told that he was "extruded" from the college for his attack upon the provost's nose. It would seem, however, that the offence was speedily condoned, as he is found soon afterwards to have been restored to his position.

² For an interesting and characteristic indication of the purity of his motives in accepting a bishopric, reference may be made to his letter to the earl of Lothian, dated December 28, 1661, which is still preserved among the Lothian papers.

it is capable of in the heart of man. It was a common reproach against Leighton, as we have seen, that he had leanings towards Roman Catholicism, and perhaps this is so far true that he had formed himself in some degree upon the model of some of those saintly persons of that faith, such as Pascal and Thomas à Kempis, who had entered the spiritual life to more ethereal heights than appear to be as yet attained within the lines of Protestantism.

Editorial—It is matter of regret that no perfectly satisfactory edition of Leighton's works has as yet appeared. After his death his *Commentary on Peter* and several of his other works were published under the editorship of his friend Dr Fall, and on the whole these only editions may be said to be with some drawbacks, by far the best. All his later editors have unfortunately been possessed by the tasteless mania of reducing his good antique and nervous language to the bald feebleness of modern phraseology, dealing with him like literary matrons correcting a schoolboy's themes. It is unfortunately impossible to exempt from this custom even the edition, in other respects very valuable and meritorious, lately published under the superintendence of the Rev W West (London, 1875). (J T BR)

LEIGHTON-BUZZARD, a market-town of Bedfordshire, is situated on the river Ouse, which there divides Bedford from Bucks, and on the North-Western Railway, 40 miles north of London. The town, which is generally well built, contains a spacious market-place, and of late great improvement has taken place in the appearance of the shops. The church of All Saints, in the Early English style of architecture, possesses a tower and spire 193 feet in height. In the market-place are the town-hall, rebuilt in 1852, and containing portions of a very ancient structure, the coin exchange erected in 1863, and the fine old market cross, in the Perpendicular style, erected in 1330. National school premises were built in 1872. There are also several charities. The manufacture of straw plait gives employment to a considerable number of females, but the town is chiefly dependent on agriculture. The population of the registration sub-district in 1871 was 9942, and in 1881 it was 10,384.

Some identify Leighton-Buzzard with the *Lyppanburgh* mentioned in the Saxon Chronicle as having been taken in 871 by Canulf, brother of Cædric, king of Wessex. The addition *Buzzard* has been conjectured to be a corruption of *Zawodort*, but others also derive it from *Bozzard* or *Borot*, the name of an ancient family, one of whom was knight of the shire in the time of Edward III.

LEINSTER See **IRELAND**.

LEIPZIG (in German, *Leipzig*), the second town of the kingdom of Saxony in size, and the first in commercial importance, is situated in a large and fertile plain, in 51° 20' 6" N. lat and 12° 23' 37" E. long., about 65 miles north-west of Dresden and 6 miles from the Prussian frontier. It stands just above the junction of three small rivers, the Pleisse, the Parthe, and the Elster, which flow in various branches through or round the town, and afterwards, under the name of Elster, discharge themselves into the Saale. Though of unimposing exterior, Leipzig is one of the most prosperous and enterprising of German towns. Besides being the most important commercial city in Germany next to Hamburg, it possesses the second largest German university, is the headquarters of the supreme courts of the empire, and forms one of the most prominent literary and musical centres in Europe. It consists of the old or inner city, surrounded by a wide and pleasant promenade laid out on the site of the old fortifications, and of the very much more extensive inner and outer suburbs. Beyond the last is a fringe of thriving suburban villages, such as Raudnitz, Volkmarndorf, Gohlis, Eutritzsch, Plagwitz, and Lindenau, which are gradually becoming absorbed by the growth of the town. On the north-west the town is bordered by the fine public park and woods of the Rosenthal.

The old town, with its narrow streets and numerous houses of the 16th and 17th centuries, still preserves much of its quaint medieval aspect. The most interesting of its buildings are the Rathaus, a Gothic edifice

built by Hieronymus Lotter in 1556 (now doomed to demolition), and the Fürstenthum, with its curious projecting balconies. The Pleissenburg, or citadel, now used for barracks and public offices, also dates from the middle of the 16th century. Anerbach's Keller, a curious old wine-vault, is interesting for the use made of it by Goethe in his *Faust*; it contains a series of mural paintings of the 16th century, representing the legend on which the play is based. The business of Leipzig is chiefly concentrated in the inner city, but the headquarters of the book trade lie in the east suburb. The streets of the suburbs are mostly broad and well built. The most notable modern buildings are the new theatre, an imposing Renaissance structure designed by Langhans, and the museum, which stand facing each other at opposite ends of the spacious Augustus-Platz. Most of the west side of the same square



Plan of Leipzig

is occupied by the Augusteum, or main building of the university, which, however, also possesses several special institutes in another part of the town. The new district law courts are contained in a large and substantial though not specially imposing building, and the municipal hospital and the hospital of St John are also handsome edifices. The so-called Roman House, with loggias and frescoes in the Italian style, is the only private dwelling demanding remark. The churches of Leipzig are comparatively uninteresting. The oldest, in its present form, is the Paulinerkirche or university church, built in 1229-40, and the largest is the Thomaskirche, dating from 1496. The university of Leipzig, founded in 1409 by a secession of two thousand German students from Prague, has long ranked among the most important in Germany. A few years ago it was also the most numerously attended, but it is now outstripped by Berlin, which has about four thousand students as compared with thirty five hundred at Leipzig (1882). The professors and "Privatdozenten," or lecturers, number about one hundred and seventy. The university library contains 350,000 volumes and 4000 manuscripts; it occupies the Paulinum, a characteristic specimen of old monastic architecture, dating in part from

1229-1240. The other educational institutions of Leipzig include three gymnasia, two "Realschulen," a commercial academy (*Handelschule*), a high school for girls, another for boys, and a large number of admirable public and private schools of a lower grade.

The number of literary, scientific, and artistic institutions in Leipzig is unusually large for the size of the town. One of the most important is the museum, which contains about four hundred modern paintings, a large number of casts, a few pieces of original sculpture, and a well-arranged collection of drawings and engravings. The art-industrial museum, the collection of the historical society, and the ethnographical museum are also of considerable interest, and will be still more useful when they are united in the large building to be erected for them with part of the munificent bequest made to the town by Herr Grassi in 1881. As a musical centre Leipzig is known all over the world for its excellent conservatorium, founded in 1843 by Mendelssohn-Bartholdy. The series of concerts given annually in the old Gewandhaus, or Drapers' Hall, as also of world-wide reputation, and the operatic stage of Leipzig is deservedly ranked among the finest in Germany. A further stimulus to the musical taste of the inhabitants is afforded by the numerous vocal and orchestral societies, some of which have brought their art to a very high pitch of perfection. The prominence of the publishing interest (more fully noticed below) has attracted to Leipzig a large number of gifted authors, and made it a literary centre of considerable importance. About two hundred and seventy newspapers and periodicals are published here, including several of the most widely circulated in Germany.

The outstanding importance of Leipzig as a commercial town is mainly derived from its three great fairs, which annually attract a concourse of about forty thousand merchants from all parts of Europe, and from Persia, Armenia, and other Asiatic countries. The most important fairs are held at Easter and Michaelmas, and are said to have been founded as markets about 1170. The smaller New Year's fair was established in 1458. In 1268 Margrave Dietrich granted a safe-conduct to all frequenters of the fairs, and in 1497 and 1507 the emperor Maximilian greatly increased their importance by prohibiting the holding of annual markets at any town within a wide radius of Leipzig. During the Thirty Years' War, the Seven Years' War, and the troubles consequent upon the French Revolution, the trade of the Leipzig fairs considerably decreased, but it recovered itself after the accession of Saxony to the German Customs Union (*Zollverein*) in 1833, and for the next twenty years rapidly and steadily increased. Since then, owing to the greater facilities of communication and consequent alterations in the mode of conducting business, the transactions at the fairs may be said to have diminished in relative though they have increased in actual value. Wares that can be safely purchased by sample appear at the fairs in steadily diminishing quantities, while others, such as hides, furs, and leather, which require to be actually examined, show as marked an increase. It is impossible to give accurate statistics of the business done at the fair, but the value of the sales considerably exceeds £10,000,000 sterling per annum. The principal commodity is furs (chiefly American and Russian), of which about one and a quarter million pounds worth are annually disposed of; next in order come leather, hides, wool, cloth, linen, and glass. The Leipzig wool-market, held for two days in June, is also important.

In the trades of bookselling and publishing Leipzig occupies a unique position, not only taking the first place in Germany, but even surpassing London and Paris in the number and total value of its sales (*Hasse, Leipzig und ihre Umgebung*, p. 236). There are upwards of three hundred

publishers and booksellers in the town, and about five thousand firms in other parts of Europe are represented here by commissionaires. About 2500 books, or one-sixth of the total production of Germany, are published in Leipzig annually. Several hundred booksellers assemble in Leipzig every year at Jubilate, and settle their accounts at their own exchange (*Buchhändler-Börse*). Leipzig also contains seventy printing-works, some of great extent, and a corresponding number of type-foundries, bindings-shops, and other kindred industries. The so-called "polygraphic" industries give employment to nearly ten thousand hands.

As a manufacturing town Leipzig is important rather for the variety than for the magnitude of its industries. The great manufacturing staples, such as iron and the textile fabrics, are scarcely represented at all, but in certain specialties, such as etheric oils, artificial flowers, and perfumes, it ranks before any other town in Germany. In absolute value the most important articles of manufacture are pianos and other musical instruments, tobacco and cigars, spirits, chemicals, scientific instruments, and waxcloth. Wool-combing has also of late years been extensively carried on. Upwards of fifty thousand workpeople are employed in the factories in and around Leipzig.

The population of Leipzig has been quantified within the present century, rising from 31,337 in 1801 to 163,688 in 1881, and has of late increased at the rate of between 3 and 4 per cent. per annum. With the suburban villages the population amounts to 220,000. While the dwelling-houses in the suburbs have been multiplied sixfold in the last two hundred years, the number in the inner town has remained almost stationary for the same period, the business part of Leipzig thus exhibiting the same phenomenon as in other large cities. The vast majority of the population (upwards of 90 per cent.) belongs to the Lutheran Church, while the religious bodies next in numerical order are the Roman Catholics (4268), the Reformed (3958), and the Jews (3176). The annual death-rate is 28 to 24 per 1000, in which Leipzig, thanks in part to its excellent system of drainage, compares favourably with other German towns. It is remarkable that the proportion of suicides to population is larger in Leipzig than in any other European town. In the five years 1876-80 no fewer than 332 persons voluntarily put an end to their lives, being at the rate of 62 per annum, or 1 suicide to every 80 deaths of adults.

History.—Though recent discoveries point to the conclusion that the site of Leipzig was inhabited even during the Stone Age, the history of the present town begins with the foundation of a Saxon fishing village at the junction of the Pleisse and the Parthe, which derived its name of *Lipik* from the Slavonic *lip* or *lipo*, a lime-tree. This settlement was probably already in existence when the emperor Henry I. built a castle here about 930. The Slavonic language long continued to be spoken in Leipzig, and was legal in the courts of law down to 1327. The first historical mention of Leipzig occurs in a writ of the beginning of the 11th century, when it is spoken of as an "urbs," or fortified place. In 1134 it came into the possession of Conrad of Wettin, margrave of Meissen, and under Margrave Otto the Rich (1156-86) it received many important privileges, and became a flourishing town of 5000 to 6000 inhabitants. Its favourable situation, almost equidistant from the Baltic Sea and the Alps, the Rhine and the Oder, in this midst of a fertile plain intersected by the principal highways of central Europe from north to south and east to west, co-operated with the fostering care of the margaves in raising it in the 15th century to the position of one of the most important commercial towns in Germany. The growth of its fairs, which of course were mainly instrumental in producing this result, has been above described. The famous conference between Luther and Dr. Eck, held in the Leipzig Pleisensburg in 1519, did much for the spread of the Reformation, but it was not till twenty years later that Luther formally espoused the Protestant cause. In 1547, in the war of the Smalkaldean League, the town was besieged and the suburbs reduced to ashes, and during the Thirty Years' War it suffered six sieges and was four times occupied by hostile troops. Its commerce was also greatly interrupted by the Seven Years' War. The publishing trade of Leipzig began to grow important towards the end of the 17th century, when the severity of the censorship at Frankfurt-on-the-Main caused many of its booksellers to emigrate to Leipzig. The preliminary years of the French Revolutionary war were not unfavourable to the commerce of Leipzig, but in 1813 and 1814 the town suffered greatly. Its accession to the Zollverein in 1833 and the establishment of the German system of railways (of which Leipzig is an important centre) inaugurated a period of great prosperity, which has continued to the

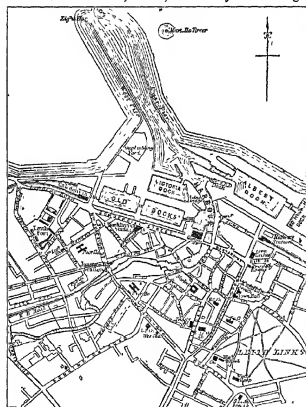
present day. The revolutionary riots of 1848-49 and the Prussian occupation in 1866-67 were merely passing shadows. In 1870 Leipzig acquired a new importance by becoming the seat of the supreme courts of the German empire.

The immediate neighbourhood of Leipzig has been the scene of numerous battles, two of which are of more than ordinary importance, viz. the battle of Breitenfeld in 1631 (vol. xi. p. 334), and the great battle of Leipzig, known in Germany as the *Völkerschlacht*, fought in 1813 between Napoleon and the allied forces of Russia, Germany, and Austria.

Towards the middle of last century Leipzig was the seat of the most influential body of literary men in Germany, even when Goethe and Schiller (q.v.) like his contemporary Samuel Johnson in England, exercised a kind of literary dictatorship. Then, if ever, Leipzig deserved the epithet of a "Paris in miniature" (*Klein-Paris*), assigned to it by Goethe in his *Feust*. The young Lessing produced his first play in the Leipzig theatre, and the university count Goethe, Klopstock, Jean Paul Richter, the Schlegels, Fichte, Schelling, and numerous other eminent writers and thinkers among its quondam alumni. Schiller also resided for a time in Leipzig, and Sebastian Bach, Hiller, and Mendelssohn all filled musical posts there. Among the famous natives of the town are the philosopher Leibnitz and the composer Wagner.

See the *Erkenntnis des Stadt Leipzig*, 1870 v. G. Grosse, *Geschichte des Stadt Leipzig*, 1887-88, *Stadtfeld, Chronik der Stadt Leipzig*, 2d ed. 1891, *Geschichte der Universität Leipzig*, 1891. Also, *Leipziger Handel und Gewerbe*, 1860, *Fluss der Stadt Leipzig und ihre Umgebungen*, 1860, and *Leipziger Nachrichten*, 1878, the *Mittheilungen* of the Historical Bureau of Leipzig, and the *Abhandlungen* of the Leipzig Historical Society.

LEITH, a municipal and parliamentary burgh of Midlothian, the chief seaport of the east coast of Scotland, 1½ miles north by east of Edinburgh, with which it is connected by Leith Walk and other lines of street. It is built on the southern shore of the Firth of Forth, at the mouth of the Water of Leith, which, crossed by seven bridges,



Plan of Leith

divides it into North and South Leith. Stretching along the coast for about 3½ miles from Seaford on the east to Granton on the west, the burgh includes the fishing village of Newhaven, the suburb of Trinity, and part of Wardie, and extends to an area of 1978 acres. It figures as Inverleith ("mouth of the Leith") in the foundation charter of Holyrood Abbey (1128); and many of its houses, in narrow wynds and along the eastern water-side, have an

antique and decayed appearance. The earliest date on any is 1573, but one, at the Coalhill, is thought to be the "handsome and spacious edifice" built for her privy council by the queen regent, Mary of Guise. Nothing remains of D'Essé's fortifications (1549) or of Cromwell's "fair citadel" (1650), but it was Cromwell's troops that razed the battery mounds upon the Links, a grassy expanse of 1140 by 400 yards, bought for a public park in 1857. Leith Fort, the headquarters of the royal artillery in Scotland, dates from 1779, the quaint old Tolbooth, where Maitland of Lethington poisoned himself (1573), was demolished in 1819, and the public buildings one and all are modern, most of them classical structures. They comprise the town hall (1828), the custom-house (1812), Trinity house (1817), with David Scott's Vasco da Gama and other paintings, the exchange buildings, the corn exchange (1862), the markets (1818), the slaughter-house (1862), the post-office (1876), the public institute (1867), the poor-house (1862), the hospital (1872-76), John Watt's hospital (1862), the high school (1806), and Dr Bell's school (1839). In December 1881 eight board schools had 4839 children on the roll, and an average attendance of 3932.

Of twenty-seven churches, belonging to nine different denominations, the only ancient one is that of South Leith parish, which, founded in 1483, and dedicated to St Mary, was originally cruciform, but now, as "restored" in 1852, consists of merely an aisled nave and square north-western tower. David Lindsay preached in it before James VI. a thanksgiving sermon on the Gowrie conspiracy (1600), and in its graveyard lies the Rev. John Home (1722-1808), author of *Douglas*, and a native of Leith. Other places of worship are North Leith parish church (1814-16), with Grecian spire of 158 feet, North Leith Free church (1859), in Germanized Gothic, with spire of 160 feet; and St James's Episcopal church (1862-69), a cruciform structure, designed in Early English style by the late Sir G. G. Scott, with apsidal chancel, a spire of 160 feet, and a peal of bells.

So early as 1313 Leith possessed its ships, they in that year being burnt by the English. But in a wide flat foreshore and drifting sands the port has had great difficulties to contend with, and Tucker in 1656 describes it merely as "a convenient dry harbour into which the fifth ebbs and flows every tide, with a convenient quay on the one side thereof, of a good length for lading of goods." The earliest dock was commenced in 1720, and the custom-house quay constructed in 1777; but little of the existing works is older than the present century. These, with date, cost, and area, comprise the Old docks (1801-17: £285,108; 10½ acres), the Victoria dock (1852: £135,000; 5 acres), the Albert dock (1868-69: £224,500, 10½ acres), and the Edinburgh dock (1874-81: £400,000, 10½ acres); in connexion with the last two 62 and 108 acres were reclaimed from the east sands. The largest of seven graving docks, the Prince of Wales dock (1858), measures 370 by 60 feet, and cost £100,000; the east and west piers, extended or formed during 1826-52, and respectively 3530 and 3123 feet long, leave an entrance to the harbour 280 feet broad, with a depth at high water of 20 to 25 feet. The aggregate tonnage registered as belonging to the port was 1702 in 1692, 6935 in 1752, 25,427 in 1844, 28,303 (3946 steam) in 1854, 33,303 in 1860, 44,892 in 1867, 65,692 in 1873, 74,713 in 1878, and 86,509 on 31st December 1881, viz. 64 sailing vessels of 16,371 tons, and 125 steam-vessels of 70,138 tons, the largest of the latter being one of 2144 tons. This shows marked progress, as likewise does the following table, giving the aggregate tonnage of British and foreign vessels that entered and cleared from and to foreign ports and coast-

wise, in cargoes and ballast, during the years ending 15th May:—

Year	Entered			Cleared		
	Sailing	Steam	Total.	Sailing	Steam	Total.
1854			309,498			304,022
1857	235,065	321,035	556,100	97,969	304,806	402,775
1860	304,301	534,479	838,880	291,344	536,458	827,797
1870	309,751	652,694	962,475	312,621	654,427	967,048
1878	320,348	695,258	1,015,606	265,062	598,751	863,813
1880	261,407	678,771	940,178	269,927	631,803	901,730
1881	262,871	711,582	974,453	259,143	712,056	971,199

Of 8838 vessels of 552,580 tons that entered in the twelvemonth ending 31st December 1880, 851 of 215,268 tons were foreign, 464 of 51,514 tons were in ballast, and 2341 of 843,005 tons were coasters; whilst of 3786 of 935,007 tons that cleared in the same year, 837 of 212,550 tons were foreign, 1093 of 235,655 tons were in ballast, and 2611 of 471,055 tons were coasters. The total value of foreign and colonial imports was £7,887,066 in 1876, £9,777,370 in 1877, £8,614,869 in 1878, £7,361,548 in 1879, and £9,475,080 in 1880. The total value of exports again was £3,145,820 in 1876, £2,861,992 in 1877, £3,804,919 in 1878, £3,086,780 in 1879, and £3,612,111 in 1880. Lastly, the customs revenue has fluctuated between £207,264 in 1867 and £280,570 in 1880,—the amount for the year ended March 31, 1882, being £498,018, and the port's revenue and expenditure amounted to £1,990,509 and £1,953,947 from July 1880 to May 1876, and to £255,582 and £266,306 from 15th May 1876 to 15th May 1881.

In 1511 James IV. here "buildit the 'Michael,' ane verrie monstrous great ship, whilk tuk as meikle timber that aches waited all the woods in Fife, except Falkland wood, besides the timber that can be cut in the Firth of Forth. It was a ship of 2000 tons, and was the first of a new class of ships. During the six years 1875-80 10 sailing vessels of 982 tons and 34 steam-vessels of 11,217 tons were built at Leith, of which those built in 1880 were all steamships—11 of 8555 tons being of iron, and 5 of 191 tons of wood. Glass-making dates from 1689, sugar-refining from 1757, rope-preserving, 1759, and other manufactures are flour-grinding, canvas-weaving, soap-boling, rope-making, engineering, tanning, and the manufacture of artificial manure. Leith is an important centre of trade in grain, timber, and wool, and in wine from Spain, Portugal, and France. It is also head of one of the twenty-five factory districts of Scotland. Granted to the city of Edinburgh in 1829, it first became an independent parliamentary and municipal burgh in 1832-33, with Portobello and Musselburgh returning one member to parliament, and being governed by a provost, four bailies, a treasurer, and ten councillors. The annual value of real property amounted in 1852 to £266,895, against £150,042 in 1850, and £252,819 in 1878. Population (1811) 80,383, (1841) 26,808, (1851) 80,910, (1861) 80,628, (1871) 44,277, (1881) 58,193.

The history of Leith is closely connected with that of Edinburgh, episodes being the burning of its shipping by the English in 1513 and 1510, its sack by them in 1544 and 1647, its seizure by Mary of Guise as stronghold of the Catholic party from 1548 to 1560 and unsuccessful siege in the latter year by the Scotch and English allies, the sailing from it of the first Danish expedition in 1698, and the seizure of its arsenal by Brigadier Mackintosh of Portmarnock and 1800 Highland Jacobites in 1719, to which may be added the arrival, departure, or visit of James II. (1437), Mary Queen of Scots (1561), James VI. and his queen Anne of Denmark (1590), Charles I., who is said to have first got tidings of the Irish rebellion (1641) when playing golf upon the Links, Cromwell and Charles II. (1650), George IV. (1822), Queen Victoria (1842), the King of Denmark (1874), and the duke of Edinburgh (1881).

See A. Campbell's *History of Leith* (Leith, 1827). (F. H. G.)

LEITMERITZ (Boh., *Litoměřice*), an episcopal see and chief town of Leitmeritz district, Bohemia, is situated on the right bank of the Elbe, crossed there by an iron bridge 1700 feet in length, and on the Austrian North-Western Railway, about 35 miles north-north-west of Prague, in 50° 33' N. lat., 14° 10' E. long. Leitmeritz is the seat of the judicial, fiscal, and military authorities for the district, and has a fine cathedral (founded 1057) and several other Roman Catholic churches and ecclesiastical establishments, also a training institute for teachers, classical, mercantile, and industrial schools, two hospitals, and an old-fashioned town-hall dating from the 16th century. The town is noted for its breweries, producing, according to the latest returns, 1,056,420 gallons of beer

annually; it also possesses glass-works, tile-kilns, potteries, and metallic ware factories. The principal agricultural products of the surrounding country, which on account of its fertility has been called the "Bohemian Paradise," are corn, fruit, hops, and wine. Population in 1880, 10,854.

At a very early date Leitmeritz enjoyed special privileges, which were extended and confirmed in 1825 by King John of Luxemburg. In 1421 the town was ineffectually besieged by Ziska. Royal diets were held there in 1494 and 1547, but subsequently the commune was deprived of several of its ancient rights, and its importance declined. In 1631, during the Thirty Years' War, Leitmeritz was captured and forcibly occupied by Saxon troops, who were, however, obliged to relinquish it in 1632 to the imperialists. In 1639 it was taken by the Swedes, who did irretrievable damage to the town. In 1742 the suburbs were burnt by the French.

LEITRIM, a maritime county of Ireland in the province of Connaught, is bounded on the N.W. by Donegal Bay, N.E. by Fermanagh, E. by Cavan, S.E. by Longford, and S.W. by Roscommon and Sligo. Its shape resembles that of an hour-glass. From about 20 miles at the extremities it narrows in the centre to a breadth of only 7 miles, and its greatest length from south-east to north-west is 52 miles. The total area is 376,212 acres, or about 588 square miles.

The northern portion of the county consists of an elevated tableland, of which the highest summits are Luganquilla 1485 feet; Benbo, 1365; and Lacka, 1315. In the southern part the country is comparatively level, and is generally richly wooded. The extent of coast-line is only about 3 miles. The principal river is the Shannon, which, issuing from Lough Allen, forms the south-western boundary of the county with Roscommon. The Bonnet rises in the north-west and flows to Lough Gill, and the streams of Bundrows and Bunduff separate Leitrim from Donegal and Sligo. Besides Lough Allen, which has an area of 8900 acres, the other principal lakes in the county are Lough Macnean, Lough Saur, Lough Gill, and Lough Melvin. A canal from Carrick-on-Shannon passes through the county to Lough Erne.

Geology and Minerals.—The central part of the county round Lough Allen is included in the Connaught coal-field, which both north and south is bounded by carboniferous limestone interspersed with millstone grit and Yoredale beds. In the southern districts there is a considerable extent of bog resting on marl or blue clay. The coal-fields consist of a series of eminences ranging from 1000 to 1377 feet, the most important beds being those to the west of Lough Allen near the Arigna. Only the lower measures remain, and they contain marine fossils. The coal is bituminous, and is well suited for manufacturing purposes; but it is not extensively wrought. In the Yoredale series of the Coal-measures clay ironstone of a very rich quality is found, and was formerly smelted at the Arigna iron-works on Lough Allen. Lead has been found near Lurganboy, and copper in Benbo mountain. Manganese is obtained in considerable quantities, and also yellow ochre and various kinds of clays and chalks. The most important sulphureous spring is that of Drumana; and the chalybeate springs of Cavan on the borders of the county, and of Oakfield adjoining the sea-coast, are also much visited.

Climate and Agriculture.—The climate is very moist and unsuitable for grain crops. On the higher districts the soil is stiff and cold, and, though abounding in stones, very retentive of moisture, but in the valleys there are some very fertile districts resting upon limestone. In the higher regions the chief implement of culture is the spade. Lime, marl, and similar manures are abundant, and on the coast seaweed is plentiful. The total number of holdings in 1880 was 14,812, of which only 624 were less than one acre. More than two-thirds of the holdings are included

in those between 5 and 15 acres and between 15 and 30 acres, which numbered respectively 5439 and 5350. The following table shows the number of acres under the various crops in 1855 and 1881:—

	Wheat	Oats	Other Cereals	Peas	Turnips	Other Crops	Flax	Total under Crops	Manure	Grass	Total
1855	281	28,750	687	23,237	1,078	1,183	719	55,161	26,890	66,770	
1881	338	12,748	108	19,310	942	1,239	177	36,313	40,888	82,583	

The acreage under peas is thus less than one-fourth of the whole area. In 1880 there were 212,374 acres under pasture, and 78,330 waste. The number of horses in 1881 was 3983, of which 2627 were used for agricultural purposes. Between 1855 and 1881 cattle diminished from 91,061 to 84,814. The number of milch cows in the latter year was 35,732, the production of butter being one of the principal industries of the small farmer. Sheep diminished from 20,878 in 1855 to 11,347 in 1881, and pigs from 20,790 to 19,302. Poultry 1881 numbered 81,920.

According to the corrected return of 1878 the land was divided among 451 owners possessing 371,371 acres, with a total annual valuation of £135,946. Of the owners about 70 per cent. possessed more than one acre, and the average value per acre was 7s. 3d. The average size of the estates is 823 acres; and the largest owners are Lord Massy, 24,751; Earl of Leitrim, 25,038; George Lane Fox, 18,850; Owen Wynne, 15,436; and Arthur L. Tottenham, 14,561.

Manufactures.—These are confined chiefly to coarse linen for domestic purposes, but coarse pottery is also made. In 1880 there were three scutching mills in the county, all driven by water.

Railways.—The Longford and Sligo branch of the Midland Great Western Railway passes through the southern part of the county, and in the northern part there is a branch between Sligo and Bundoran.

Administration and Population.—The county is divided into 5 baronies, and contains 17 parishes, with 1489 townlands. It is within the Connaught circuit, and seizures are held at Carrick-on-Shannon, and quarter sessions at Ballinamore, Carrick-on-Shannon, and Manorhamilton. There are two poor-law unions in the county and portions of other three. The county is within the Dublin military district, and there are barracks at Carrick-on-Shannon. It is in the diocese of Kilmore and Ardagh. In the Irish House of Commons two members were returned for the county and two for the boroughs of Carrick-on-Shannon and Jamestown, but at the union the boroughs were disfranchised. In 1780 the population was 26,149, which in 1821 had increased to 124,785 and in 1841 to 156,309, but in 1861 had diminished to 104,744, in 1871 to 95,562, and in 1881 to 89,795, of whom 44,777 were males and 45,018 were females. The total number of emigrants from the county between 1st May 1851 and 31st December 1880 was 43,186, a percentage of 41·2 to the population in 1861. In 1880 the rate of marriages per 1000 of estimated population was 2·6, of births 22·4, and of deaths 15·9. The population is almost entirely rural, the only town being Carrick-on-Shannon, with a population in 1871 of 1442.

History and Antiquities.—Anciently the entire county bordering on Lough Erne, including Fermanagh and Cavan, was, according to Ptolemy, occupied by the Eboraci. Afterwards, along with Cavan, Leitrim formed part of the territory of Breffny or Brenny, which was divided into two parishes, of which Leitrim under the name of Hy Brein-Breiffny or Brenny formed the western. From the fact that for a long time it was possessed by the O'Rourke descendants of Roderick, king of Ireland, it was also called Breffny O'Rourke. In the 12th century Thomas O'Rourke was expelled from the government by the princes of Leinster and Connaught, but he was afterwards reinstated by Turlogh, king of Ireland,

and, although after the arrival of the English it was united to Roscommon, the O'Rourkes remained practically independent in the reign of Elizabeth. Large consecrations took place in the reigns of Elizabeth and James I., in the Cromwellian period, and after the Revolution of 1688-89.

"There was a 'drumshill' remains near Fenagh and at Letterfyan, and important monastic ruins at Creevelea near the Bonnet, with several antiquary monuments, and at Frysall in the parish of Fenagh. There was an important Franciscan friary at Jamestown. The abbey of Mohill, Annaduff, and Drumlish have been converted into parish churches. Among the more notable old castles are O'Rourke's Hall at Drumlish, now in ruins, Manorhamilton Castle, originally very extensive, but now also in ruins, and Castle John on an island in Lough Seun.

LELAND, LEYLAND, or LAYLONDE, JOHN (c. 1606-1652), a famous English antiquary, was born in London towards the close of the reign of Henry VII. From St Paul's School, where he was brought up under Laly, the famous grammarian, he passed to Christ's College, Cambridge, and thence to All Soul's College, Oxford. After residing for some time in Paris, he returned to England, and became chaplain to Henry VIII., who appointed him, in 1530, to the rectory of Popeling in the marches of Calais, made him his librarian, and in 1533 commissioned him as "king's antiquary," with power to search for records, manuscripts, and relics of antiquity, in all the cathedrals, colleges, abbeys, and priories of England. Accordingly he set out on a tour which lasted six years, and afforded him materials for study during the remainder of his life. On his return in 1542 he was rewarded by the king with the rectory of Haseley in Oxfordshire; in 1543 he became a canon of King's College (now Christ Church), Oxford, and about the same time a prebendary of Salisbury. Leland now withdrew to his house in the parish of St Michael le Querne, London, and devoted himself exclusively to the digesting of his information. In 1647 he fell into a state of insanity, which continued until his death on the 18th April 1652.

Some of Leland's papers, after passing through several hands, were deposited by Burton, the historian of Leicestershire, in the Bodleian Library at Oxford in 1832. Others came into the possession of Sir Robert Cotton, and are now, along with the rest of his books, in the British Museum. His principal works are *The Itinerary Journey and Search for English Antiquities; A New Years Gifte to Kings Henry the VIII. on the 87 years of his Reign*, London, 1549; *Commentarii de Scriptoribus Britannicis*, edited by Anthony Hall, Oxford, 1758, 2 vols. 8vo; *The Itinerary*, published by Thomas Hearne, Oxford, 1710-12, 9 vols. 8vo, and reprinted in 1770; and *De Rebus Britannicis Collectanea*, edited by Hearne, Oxf., 1718, 6 vols. 8vo, and reprinted at London in 1770. See *The Lives of those eminent antiquaries John Leland, Thomas Hearne, and Anthony a Wood*, vol. I., Oxford, 1772.

LELAND, JOHN (1691-1766), a polemical theologian of the 18th century, was born at Wigan, Lancashire, in 1691, and was educated in Dublin, where he made such progress in theological and other studies that in 1716, without having attended any college or hall, he was appointed first assistant and afterwards sole pastor of a congregation of Presbyterians in New Row. This office he continued to fill until his death on January 16, 1766.

Leland's first publication was *A Defence of Christianity* (1738), in reply to Tindal's *Christianity as Old as the Creation*, it was succeeded by his *Divine Authority of the Old and New Testaments asserted* (1738), in answer to *The Moral Philosopher of Morgan*; in 1741 he published two volumes, in the form of two letters, being *Remarks on [H. Dodwell's] Christianity not Founded on Arguments*; and in 1758 *Reflections on the Late Lord Bolingbroke's Letters on the Study and Use of History*. *A View of the Principal Intellectual Writers that have appeared in England* was published in 1754-55. This is the only work of the author—"most worthy, painstaking, and commonplace of devices," as he has recently been styled—which can now be said to have any present value. This value, however, is purely historical; his facts about the details are interesting and useful, but it may be safely conjectured that no one now reads his (doubtless sincere) arguments, here and elsewhere, against the creed he opposed without some sense of their hollowness, contradictoriness, and obvious unfairness. His latest work was a treatise entitled *The Advantage and Necessity of the Christian Revolution*.

shown from the State of Religion in the Ancient Eastern World. Discourses on various Subjects, with a Life prefixed, was published posthumously, 4 vols 8vo, 1768-69, also a Life by Hindeford, 1772.

LELEGES was the name applied to an early race or set of races around the Aegean Archipelago. The name occurs in Leucadia, Acaenia, Aetolia, Phocis, Locria, Boeotia, Megara, Laconia, Elis, the islands of the Aegean, the Troad, and Caria. It is hardly possible to suppose that a single race was to be found in so many widely separated localities. Herodotus identifies the Leleges with the Carians, saying that the ancient name of that race was Leleges, whereas Pausanias declares that the name Leleges was younger, and Athenaeus makes the Leleges serfs of the Carians. Homer introduces both Leleges and Carians as distant peoples in alliance with Troy. The former have a king Altes and a city Pedasus. Strabo counts the Leleges and the Carians different races, as intermingled that they were often identified. Both in Leucadia and in Laconia the story runs that the autochthonous inhabitants were the Leleges, whereas in Messenia the Leleges were an immigrant race who had founded Pylus. They were said to be the ancestors of the Taphians and Teleboans, two seafaring and piratic races. The only view as yet advanced which introduces any unity into these scattered notices is that of Curtius. According to him the name Leleges represents rather a stage in historical development than a single race. The name occurs always in the coast lands; and in the early stage of Greek history, when the simple barbarous tribes of older stock were stimulated to the first beginnings of progress and civilization by the appearance of foreign mariners on their shores, the mixed race of immigrants and natives was called Leleges. It is the almost universal opinion that the whole of the Aegean coast lands were occupied by homogeneous tribes of Aryan stock; on this view then the Leleges, i.e., as Strabo already maintained, the mixed people, represent one of the first stages of these original tribes in the path of civilization. Accounts which connect the Leleges with Egypt may be definitely rejected as fabulous.

See Deimling, *Leleger*; Curtius, *Greek History*, i.; Thuc., i. 4, *Finch*, x. 429; Strabo, pp. 821, 872, 880, &c.; Herod., i. 171; Pausan., i. 89, 6; Athen., vi. 271b.

LELEWEL, JOACHIM (1786-1861), Polish historian, was born at Warsaw in 1786. His family came from Prussia in the early part of the 18th century; his grandfather was appointed physician to the Polish king then reigning, and his father caused himself to be naturalized as a Polish citizen. The original form of the name appears to have been Loelheffel. From his earliest childhood the future historian showed his fondness for books. In the year 1807 we find him teacher in a school at Krzemieniec in Volhynia, and in 1814 professor of history at Vilna, a post which he quitted in 1820 for a four years' discharge of the same office at the university of Warsaw, but returned to it in 1824. His lectures enjoyed great popularity, and the enthusiasm felt for him by the students is shown in the beautiful lines addressed to him by Mickiewicz. But this very circumstance made him obnoxious to the Russian Government, and at Vilna Novosiltzev was then all-powerful. Lelewel was removed from his professorship, and returned to Warsaw, where he was elected a deputy to the diet in 1829. He joined the revolutionary movement with great enthusiasm, but was throughout deficient in energy, and, in fact, although the emperor Nicholas distinguished him as one of the most dangerous rebels, he did not appear to advantage as a man of action. On the suppression of the rebellion he made his way in disguise to Germany, and subsequently reached Paris in 1831. There, however, he was not allowed to stay long,

as the Government of Louis Philippe ordered him to quit French territory in 1835 at the request of the Russian ambassador. The cause of this expulsion is said to have been his activity in writing revolutionary proclamations. He now repaired to Brussels, where he for a time lectured on history at the university, but was from some cause or other compelled to abandon his occupation. Lelewel spent several years in Brussels in great poverty, barely earning a scanty livelihood by his writings. He died in 1861 at Paris, whether he had removed a short time previously.

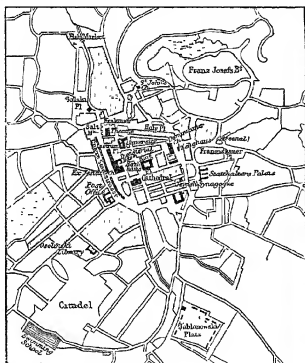
Lelewel was an indefatigable man of letters. He was of a simple austere character, and of the strictest probity—in short, of an antique type, one of the few men who have loved learning for its own sake. His literary activity was enormous, extending over the period from the "Edda Skandinavia" of 1807 to the *Géographie des Arabes*, 2 vols., Paris, 1851. Many of his works are concerned with Polish history, yet he by no means confined himself to it. Thus he has written on the trade of Carthage, on Erythraea the early geographers, and on numismatics (*La Numismatique du Moyen Age*, Paris, 1835, 2 vols., *Études Numismatiques*, Brussels, 1840). One of his most important publications was *La Géographie du Moyen Age*, Brussels, 1850-53, with an atlas of fifty plates entirely engraved by himself, for he rightly attached much importance to the accuracy of his maps that he would not allow them to be executed by any one else. His works on Polish history are monumental, they have been collected into a series under the title *Polska, dzieje i secesji jej respektowne* (Poland, her History and Affairs Surveyed), published at Poznań, 1854-1858, in 20 vols. He had intended to have written a complete history of the country on an extensive scale, but never accomplished the task. His method is shown in the little history of Poland, first published at Warsaw in Polish in 1828, under the title *Dzieje Polski*, and afterwards almost rewritten in the *Historia de Polonie*, published at Paris in 2 vols. in 1844. Two other works on Polish history which may be especially mentioned are an edition of the "Chronicle of Matthew of Cholewa" and "Ancient Memorials of Polish Legislation" (*Księga ustaw polskich i dawnościelnych*). While employed in the university library of Warsaw he studied bibliography, and the fruits of his labours may be seen in his *Bibliografia Księgowni* (A Couple of Books on Bibliography), 2 vols. 8vo, Vilna, 1823-26. The characteristics of Lelewel as an historian are great research and power to draw inferences from his facts, his style is too often careless, and his narrative is not picturesque, but his expressions are frequently terse and incisive. He has left valuable materials for a just comprehension of his career in his autobiography (*Adventures while Prosecuting Researches and Inquiries in Polish Matters*).

LELY, SIR PETER (1617-1680), a celebrated painter, was born at Soest, Westphalia, in 1617. His father, a military captain and a native of Holland, was originally called Van der Vees; the nickname of Le Lys or Lely, by which he was generally known, was adopted by his son as a proper surname. After studying for two years under Peter de Grebber, an artist of some note at Haarlem, Lely, induced by the patronage of Charles I. for the fine arts, removed to England in 1641. There he at first painted historical subjects and landscapes; and he soon became so eminent in his profession as to be employed by Charles to paint his portrait shortly after the death of Vanduyck. He afterwards portrayed Cromwell. At the Restoration his genius and gentlemanly manners won the favour of Charles II., who made him his state-painter, and afterwards knighted him. He formed a famous collection, the best of his time, containing drawings, prints, and paintings by the best masters; it sold by auction for no less than £26,000. His great example, however, was Vanduyck, whom, in some of his most successful pieces, he almost rivals. Lely's paintings are carefully finished, warm and clear in colouring, and animated in design. The graceful posture of the heads, the delicate rounding of the hands, and the broad folds of the draperies are admired in many of his portraits. The eyes of the ladies are drowsy with languid sentiment, and allegory of a commonplace sort is too freely introduced. His most famous work is a collection of portraits of the ladies of the court of Charles II., preserved at Hampton Court, and known by the title of the Windsor Beauties. Of his few historical pictures, the best is Susannah and the Elders, at Burlington House. His Juniter and Erythraea, in

the duke of Devonshire's collection, is also worthy of note. Lely was nearly as famous for crayon work as for oil-painting. Towards the close of his life he often retired to an estate which he had bought at Kew. He died of apoplexy in London (the Piazza, Covent Garden) in 1680, and was buried in Covent Garden Church, where a monument was afterwards erected to his memory. Peppy characterized Lely in a few graphic words—"a mighty proud man and full of state." The painter married an English lady of family, and left a son and daughter, who died young. His only disciples were Greenhill and Bucks-horn; he did not, however, allow them to obtain an insight into his special modes of work.

LE MANS. See MANS, LE

LEMBERG (i. e., *Leonberg*, also *Lemburg* or *Loewenburg*, Polish, *Lwow*; Lat., *Leopolis*), the capital of the Austrian crown-land of Galicia, and according to its population the third city of Austria-Hungary, lies 180 miles east of Cracow and 80 miles from the Russian frontier. The hollow of the Sarmatian plateau, in which the town is situated, is about 1000 feet above the sea-level, and, as drained by the Peltew, a tributary of the Bug, belongs to the basin of the Vistula. The Loewenburg proper or Castle Hill rises to 1300 feet. In the early part of the present century Lemberg would have been described as a small fortified place, with a number of large villages in the immediate



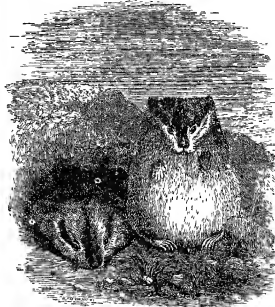
Plan of Lemberg

vicinity, but the fortifications were transformed into pleasure grounds about 1811, and the villages have gradually changed into suburb and town. The old city proper occupies only about 60 acres; the suburbs extend over 12 square miles. During the 16th and 17th centuries the most striking feature of Lemberg was the immense number of its ecclesiastical buildings, and it still possesses among the rest a Greek Catholic, a Roman Catholic, and an Armenian cathedral. The church of the Dominicans (an imitation of the Karlskirche at Vienna) contains a monument, by Thorwaldsen, to the countess Josepha Borkowska. Lemberg is the seat of a university, founded in 1784 by Joseph II., and restored by Francis I. in 1817; and in the national institution founded by Ossolinski it has

a noble library of books and manuscripts, and valuable antiquarian and scientific collections. The linguistic heterogeneity of the population requires the maintenance of three separate gymnasiums,—for the Poles, the Germans, and the Ruthenians respectively; and there are besides two normal colleges, a deaf and dumb institution, and a blind asylum. Industrially and commercially Lemberg is a more important city than Cracow, it has a chamber of trade and commerce, and among the leading articles of manufacture are flour, beer, vinegar, oil of oses, and matches. The population has increased from 87,109 in 1869 to 110,250 in 1880. At the former date 46,252 were Roman Catholics, 26,694 Jews, and 12,406 Greek Catholics.

Leopolis was founded about 1259 by the Ruthenian prince Daniel for his son Leo. From Cammir the Great, who captured it in 1846, it received the Magdeburg rights, and for almost two hundred years the public records were kept in German. During the whole period of Polish supremacy it was a most important city, and after the fall of Constantinople it greatly developed its trade with the East. In 1648 and 1655 it was besieged by the Cossacks, and in 1672 by the Turks. Charles XII. of Sweden captured it in 1704. In 1848 it was bombarded.

LEMMING, a small animal belonging to the order *Rodentia*, family *Muridae*, and subfamily *Arvicolinae*, or voles, of which the common water-rat and short-tailed field mouse of England are members. It is the *Myodes lemmus* (Linn.) of most modern zoological systems, the *Lemmus* *non negens* of Desmarest and some other authors. In both size and colour different specimens vary considerably, but its usual length is about two inches, and its soft fur yellowish-brown, marked with spots of dark brown and black. It has a short, rounded head, obtuse muzzle, small



Lemming

bead-like eyes, and short rounded ears, nearly concealed by the fur. The tail is very short. The feet are small, each with five claws, those of the fore feet strongest, and fitted for scratching and digging. The usual dwelling place of the lemmings is in the high lands or fells of the great central mountain chain of Norway and Sweden, from the southern branches of the Langfjeldene in Christiansand stiff to the North Cape and the Varangerfjord. South of the Arctic circle they are, under ordinary circumstances, exclusively confined to the plateaus covered with dwarf birch and juniper above the conifer region, though in Tromsø and in Finmarken they occur in all suitable localities

down to the level of the sea. The nest is formed under a tussock of grass or a stone, and constructed of short dry straws, and usually lined with hair. The number of young in each nest is generally five, sometimes only three, occasionally seven or eight, and at least two broods are produced annually. Their food is entirely vegetable, especially grass roots and stalks, shoots of the dwarf birch, reindeer lichens, and mosses, in search of which they form, in winter, long galleries through the turf or under the snow. They are restless, courageous, and pugnacious little animals. When suddenly disturbed, instead of trying to escape they will sit upright, with their back against a stone or other object of vantage, hissing and showing fight in a very determined manner.

The circumstance which has given more popular interest to the lemming than to a host of other species of the same order of animals, and has justified its treatment in a separate article in this work, is that certain districts of the cultivated lands of Norway and Sweden, where in ordinary circumstances they are quite unknown, are occasionally and at very uncertain intervals varying from five to twenty or more years, literally overrun by an army of these little creatures, which steadily and slowly advance, always in the same direction, and regardless of all obstacles, swimming across streams and even lakes of several miles in breadth, and committing considerable devastation on their line of march by the quantity of food they consume. In their turn they are pursued and harassed by crowds of beasts and birds of prey, as bears, wolves, foxes, dogs, wild cats, stoats, weasels, eagles, hawks, and owls, and never spared by man; even the domestic animals not usually predaceous, as cattle, goats, and reindeer, are said to join in the destruction, stamping them to the ground with their feet, and even eating their bodies. Numbers also die from diseases produced apparently from overcrowding. None ever return by the course by which they came, and the onward march of the survivors never ceases until they reach the sea, into which they plunge, and swimming onwards in the same direction as before perish in the waves. These extraordinary and sudden appearances of vast bodies of lemmings, and their singular habit of persistently pursuing the same onward course of migration, have given rise to various speculations, from the ancient belief of the Norwegian peasants, shared in by Olaus Magnus, that they fell down from the clouds, to the almost equally untenable hypothesis, ingeniously maintained by the late Mr W. D. Croch, that they are acting in these migrations in obedience to an instinct inherited from vastly ancient times, and are still seeking the congenial home in the submerged Atlantis, to which their ancestors of the Miocene period were wont to resort when driven from their ordinary dwelling places by crowding or scarcity of food. The principal really ascertained facts regarding these migrations, as stated by Mr R. Collett (*Proceedings of the Linnean Society*, vol. xiii. p. 327, 1878), seem to be as follows. When any combination of circumstances has occasioned an increase of the numbers of the lemmings in their ordinary dwelling places, impelled by the restless or migratory instinct possessed in a less developed degree by so many of their congeners, a movement takes place at the edge of the elevated plateau, and a migration towards the lower-lying land begins. The whole body moves forward slowly, always advancing in the same general direction in which they originally started, but following more or less the course of the great valleys. They only travel by night; and, staying in congenial places for considerable periods, with unaccustomed abundance of provender, notwithstanding all the destructive influences to which they are exposed, they multiply excessively during their journey, having still more numerous families and more frequently than in their

usual homes. The progress may last from one to three years, according to the route taken, and the distance to be traversed until the sea-coast is reached, which in a country so surrounded by water as the Scandinavian peninsula must be the ultimate goal of such a journey. This may be either the Atlantic or the Gulf of Bothnia, according as the migration has commenced from the west or the east side of the central elevated plateau. Those that finally perish in the sea, committing what appears to be a voluntary suicide, are only acting under the same blind impulse which has led them previously to cross smaller pieces of water with safety. Further information about the migrations of the lemming will be found in Mr Collett's paper referred to above, and also in those of Mr Croch in the same volume. (W. H. F.)

LEMNOS was an island in the northern part of the Aegean Sea, now called by the inhabitants Limnos. The Italian form of the name, Salimene, i.e., *ἡ νῆς Ἀλμεινῶν*, is not used in the island itself, but is commonly employed in geographical works. The island, which belongs to Turkey, is of considerable size: Piny says that the coast-line measured 112½ Roman miles, and the area has been estimated at 150 square miles. Great part of it is mountainous, but some very fertile valleys exist, to cultivate which two thousand yokes of oxen are employed. The hill-sides afford pasture for 20,000 sheep. No forests exist on the island; all the wood which is used is brought from the coast of Roumelia or from Thasos. A few mulberry and fruit trees grow, but no olives. The inhabitants number about 22,000, of whom 2000 are Turks and the rest Greeks. The chief towns are Kastro on the western coast, with a population of 4000 Greeks and 800 Turks, and Mudros on the southern coast. Kastro possesses an excellent harbour, and is the seat of all the trade carried on with the island. Greek, English, and Dutch consuls or consular agents were formerly stationed there; but the whole trade is now in Greek hands. The archbishop of Lemnos and Ai Strati, a small neighbouring island with 2000 inhabitants, resides in Kastro. In ancient times the island was sacred to Hephaestus, who as the legend tells fell on Lemnos when his father Zeus hurled him headlong out of Olympus. This tale, as well as the name *Æthalea*, sometimes applied to it, points to its volcanic character. It is said that fire occasionally blazed forth from Moeychlos, one of its mountains; and Pausanias (viii. 33) relates that a small island called Chryse off the Lemnian coast was swallowed up by the sea. All volcanic action is now extinct.

The most famous product of Lemnos is the medicinal earth, which is still used by the natives. At one time it was popular over western Europe under the name *terra argillata*. This name, like the Greek *Ἀργίλη ἀργή*, is derived from the stamp impressed on each piece of the earth, in ancient times the stamp was the head of Artemis. The Turks now believe that a vase of this earth destroys the effect of any poison drunk from it,—a belief which the ancients attached rather to the earth from Cape Kolus in Attica. Galen went to see the digging up of this earth (see Kuhn, *Medic. Gr. Opera*, vi. 178 sq.), on one day in each year a priestess performed the due ceremonies, and a wagon-load of earth was dug out. At the present time the day selected is the 6th of August, the feast of Christ the Saviour. Both the Turkish hodja and the Greek priest are present to perform the necessary ceremonies; the whole process takes place before daybreak. The earth is sold by apothecaries in stamped circular blocks. The hill from which the earth is dug is a dry mound, void of vegetation, beside the village of Kotschinos, and about two hours from the site of Hephaestus. The earth was considered in ancient times a cure for all festering wounds, and for the bite of poisonous snakes.

The name Lemnos is said by Herodotus (op. Steph. Byz.) to have been a title of Orpheus among the Thracians, and the earliest inhabitants are said to have been a Thracian tribe, called by the Greeks *Σίνες*, i.e., "the robbers." According to a famous legend the women were all deserted by their husbands, and in revenge murdered every man on the island. From this barbarous act, the expression *Λεμνιάνα δολοῦ*, *Ἀδύνατα ἔργα*, became proverbial. The Argonauts

landing soon after found only women in the island, ruled over by Hyppolyte, daughter of the old king Theseus. From the Argonauts and the Lemnian women were descended the race called Minyae, whose king Euneas, son of Jason and Hyppolyte, sent wine and provisions to the Greeks at Troy. The Minyae were expelled by a Peloponnesian tribe who came from Attica. The historical element underlying these traditions is probably that the original Thracian people were gradually brought into communication with the Greeks as navigation began to unite the scattered islands of the Aegean (see JASON); the Thracian inhabitants were barbarians in comparison with the Greek mariners. The worship of Cybele was characteristic of Thrace, whither it spread from Asia Minor at a very early period, and it deserves notice that Hyppolyte and Myrina (the name of one of the chief towns) are Amazon names, which are always connected with Asiatic Hyppolyte-worship. Coming down to a better authenticated period, we find that Lemnos was conquered by Oianes, one of the generals of Darius Hystaspes, but was soon reconquered by Miltiades, the tyrant of the Thracian Chersonese. Miltiades afterwards returned to Athens, and Lemnos continued an Athenian possession till the Macedonian empire absorbed it. On the vicissitudes of its history in the 3d century B.C. see Kohler in *Mitchell Inst. Athen.*, l. p. 261. The Romans declared it free in 167 B.C., but gave it over in 155 B.C. to Athens, and retained nominal possession of it till the whole of Greece was made a Roman province. A colony of Attic *καταπολιται* was established by Pericles, and many inscriptions on the island relate to Athenians. After the division of the empire, Lemnos of course passed under the Byzantine emperors, it shared in the vicissitudes of the eastern provinces, being alternately in the power of Greeks, Italians, and Turks, till finally the Turkish sultans became supreme in the Aegean. In 1476 the Venetians successfully defended Kalkinos or Kotschinos against a Turkish siege; but in 1667 Kastro was captured by the Turks from the Venetians after a siege of sixty-three days. Kastro was again besieged by the Russians in 1770.

Homer speaks as if there were one town in the island called Lemnos, but in historical times there was no such place. There were two towns, Myrina, now Kastro, and Hephestia. The latter was the chief town; it must have been of considerable number, the types being sometimes the Athenian goddesses and her owl, sometimes native religious symbols, the eagle of the Dioscuri, Apollo, &c. Few coins of Myrina are known. They belong to the period of Attic occupation, and bear Athenian types. A few coins are also known which bear the name, not of either city, but of the whole island. Coins were the first tokens of the state of Hephestia, at a deserted place named Paleokastro on the east coast. It had once a splendid harbour, which is now filled up. Its situation on the east explains why Miltiades attacked it first when he came from the Chersonese. It surrendered at once, whereas Myrina, with its very strong citadel built on a perpendicular rock, sustained a siege. It is said that the shadow of Mount Athos fell at sunset on a bronze cow in the agora of Myrina. Pliny says that Athos was 87 miles to the north-west; but the real distance is about 40 English miles. One legend localized in Lemnos still requires notice. Philoctetes was left there by the Greeks on their way to Troy; and there he suffered ten years' agony from his wounded foot, until Ulysses and Neoptolemus induced him to accompany them to Troy. He is said by Sophocles to have lived beside Mount Hermæus, which *Æschylus* (*Agam.*, 262) makes one of the beacon points to flash the news of Troy's downfall home to Argos.

See Rhodé, *Reise Lemnos*, *Compte Rend. Acad. Inscriptions* (where the latest account by a skilled eye-witness is to be found); the above-mentioned facts about the present state of the island are taken from him); also Hunt in Walpole's *Travels*; Belon du Mans, *Observations de plusieurs singularités*, &c.; Finlay, *Greece under the Romans*; Von Hammer, *Gesch. des Osm. Reiches*; 624, 664, 665, 1837. The chief references in ancient writers are *Hæcat.*, s. 693; v. 138; xiv. 239, &c.; Herod., iv. 146; Str., pp. 124, 330; Plin., iv. 23; xxxv. 13.

LEMON, the fruit of *Citrus Limonium*, Risse, which is regarded by some botanists as a variety of *Citrus medica*, L. The wild stock of the lemon tree is a native of the valleys of Kumaon and Sikkim in the North-West Provinces of India, ascending the mountains to a height of 4000 feet, and occurring under several forms.

The lemon seems to have been unknown to the ancient Greeks and Romans, and to have been introduced by the Arabs into Spain between the 12th and 13th centuries. In 1494 the fruit was cultivated in the Azores, and largely shipped to England, but since 1838 the exportation has ceased. As a cultivated plant the lemon is now met with throughout the Mediterranean region, in Spain and Portugal, in California and Florida, and in almost all tropical

and subtropical countries. Like the apple and pear, it varies exceedingly under cultivation. Russo and Poiteau enumerate forty-seven varieties of this fruit, although they maintain as distinct the sweet lime, *Citrus Limetta*, Russo, with eight varieties, and the sweet lemon, *Citrus Lumia*, Risse, which differ only in the fruit possessing an insipid instead of an acid juice, with twelve varieties.

The lemon is more delicate than the orange, although, according to Humboldt, both require an annual mean temperature of 62° Fahr. Unlike the orange, which presents a fine close head of deep green foliage, it forms a straggling bush, or small tree, 10 to 12 feet high, with paler, more scattered leaves, and short angular branches with sharp spines in the axils. The flowers, which possess a sweet odour quite distinct from that of the orange, are in part hermaphrodite and in part unisexual, the outside of the corolla having a purplish hue. The fruit, which is usually crowned with a nipple, consists of an outer rind or peel, the surface of which is more or less rough from the convex oil receptacles imbedded in it, and of a white inner rind, which is spongy and nearly tasteless, the whole of the interior of the fruit being filled with soft parenchymatous tissue, divided into about ten to twelve compartments, each generally containing two or three seeds. The white inner rind varies much in thickness in different kinds, but is never so thick as in the citron. As lemons are much more profitable to grow than oranges, on account of their keeping properties, and from their being less liable to injury during voyages, the cultivation of the lemon is preferred in Italy wherever it will succeed. In damp valleys it is liable to be attacked by a fungus called "charbon" (*Dematium monophyllum*), the stem, leaves, and fruit becoming covered with a blackish dust. This is said to be coincident with or subsequent to the attacks of a small oval brown insect, *Chermes hesperidum*, L. Trees grown in the shade, and not properly exposed to sunlight and air, suffer most severely from these pests. Syringing with milk of lime when the young insects are hatched, and before they have fixed themselves to the plant, seems to be the most effectual remedy known. Since the year 1875 this fungoid disease has made great ravages in Sicily among the lemon and citron trees, especially around Catania and Messina. M. Heritte attributes the prevalence of the disease to the fact that the growers have induced an unnatural degree of fertility in the trees, permitting them to bear enormous crops year after year. This loss of vitality is in some measure met by grafting healthy scions of the lemon on the bitter orange, but trees so grafted do not bear fruit until they are eight or ten years old.

The lemon tree is said to be exceedingly fruitful, a large one in Spain or Sicily ripening as many as three thousand fruits in favourable seasons. In the south of Europe lemons are collected more or less during every month of the year, but in Sicily the chief harvest takes place from the end of October to the end of December, those gathered during the last two months of the year being considered the best for keeping purposes. The fruit is gathered while still green. After collection the finest specimens are picked out and packed in cases, each containing about four hundred and twenty fruits, and also in boxes, three of which are equal to two cases, each lemon being separately packed in paper. The remainder, consisting of ill-shaped or unsound fruits, are reserved for the manufacture of the essential oil and juice. The whole of the sound lemons collected are usually packed in boxes, but those which are not exported immediately are carefully picked over and the unsound ones removed before shipment. The exportation is continued as required until April and May. The large lemon with a rougher rind, which appear in the London market in July and August, are grown at Sorrento

near Naples, and in this case are allowed to remain on the trees until ripe.

Candied lemon peel is usually made in England from a larger variety of the lemon cultivated in Sicily on higher ground than the common kind, from which it is distinguished by its thicker rind and larger size. This kind, known as the Spadaforte lemon, is also allowed to remain on the trees until ripe, and when gathered the fruit is cut in half longitudinally and pickled in brine, before being exported in casks. Before candying the lemons are soaked in fresh water to remove the salt. Citrons are also exported from Sicily in the same way, but these are about six times as expensive as lemons, and a comparatively small quantity is shipped. Besides those exported from Messina and Palermo, lemons are also imported into England to a less extent from the Riviera of Genoa, and from Malaga in Spain, the latter being the most esteemed. Of the numerous varieties the wax lemon, the imperial lemon, and the Gaeta lemon are considered to be the best.

The Greek island of Andros is said to produce ten millions of lemons annually; these are exported chiefly to Constantinople, the Black Sea, and the Danube, realizing an average price of £1 to £1, 3s. per thousand.

Until recently the United States have been large importers of lemons, at good prices, from the Mediterranean. In 1878 Palermo exported 463,977 boxes of this fruit, at 6s. 6d. per box. Owing to increased facilities for transit, and the hazardous character of the trade, the lemons are now chiefly exported by the proprietors of small plantations, who, in their eagerness to dispose of their stock, glut the market at New York and Philadelphia, and sometimes find the speculation a ruinous one.

For some years past lemons have been extensively cultivated in the south of California, and the new industry will probably affect the Mediterranean trade to a serious extent. In 1874 half a million Californian lemons were received in San Francisco. Since it was found that, with a little care in the selection of the soil, these trees could be grown throughout the State, they have been planted in immense numbers, and the produce of each tree has been found to bring from 80s to 60s. It has been estimated that in a few years the produce will be equal to the requirements of the Pacific States and Territories, and that ultimately the whole of the United States may be supplied with lemons from California. In east Florida also, where suitable land is obtainable at 15 to 20 dollars an acre, lemons, limes, citrons, and more especially oranges, are being raised in abundance. In New South Wales lemons are also grown, having been introduced into Sydney about the year 1790.

Lemons of ordinary size contain about 2 ounces of juice, of specific gravity 1.038-1.045, yielding on an average 32½ to 42-58 grains of citric acid per ounce. The amount of the acid, according to Stoddart, varies in different seasons, decreasing in lemons kept from February to July, at first slowly and afterwards rapidly, until at the end of that period it is all split up into glucose and carbonic acid,—the specific gravity of the juice being in February 1.046, in May 1.041, and in July 1.037, while the fruit is hardly altered in being distinguished as druggists' essence of lemon. An additional product is obtained by immersing the scarified lemons in warm water and separating the oil which floats off. *Essence of Citron distillate* is obtained by rubbing the surface of fresh lemons (or of those which have been submitted to the action of the *œnéille à piquer*) on a coarse grate of tinnet iron, and distilling the grated peel. The oil so obtained is colourless, and of inferior fragrance. An acid sold at a lower price, while that obtained by the cold processes has a yellow colour and powerful odor.

Essence of lemon is chiefly brought from Messina and Palermo packed in copper bottles holding 26 to 50 kilograms or more, and sometimes in tinned bottles of smaller size. It is said to be rarely found in a state of purity in commerce, almost all that comes into the market being diluted with the cheaper distilled oil. This fact may be considered as proved by the price at which the essence of lemon is sold in England, this being less than it costs the manufacturer to make it. When long kept the essence deposits a white

grains of it. From hesperidine it differs in dissolving in potash without alteration. It molts at 57°.

Various modes of preserving lemon juice in small quantities for medicinal or domestic use have been suggested. Mr Judine states that if allowed to deposit and then filtered through paper it keeps well. Dr Symes recommends heating the juice to 165° Fahr., filling bottles with it at that temperature, and immediately closing them, when perfectly full so as to keep out access of air. Another writer advises the addition of 10 per cent of alcohol. Perhaps the most simple method is to keep it covered with a layer of olive or almond oil in a closed vessel furnished with a glass tap, by which the clear liquid may be drawn off as required.

As a commercial article for use on shipboard as a preventive of scurvy, lemon juice is largely consumed. By the provisions of the Act of Parliament 30 & 31 Vict. c. 124, § 4, every ship going to other countries where lemon or lime juices cannot be obtained is required to take sufficient to give 1 ounce to every member of the crew daily. Of this juice it requires about 13,000 lemons to yield 1 pipe (108 gallons). Suchian juice in November yields about 9 ounces of crude citric acid per gallon, but only 6 ounces if the fruit is collected in April. The crude juice was formerly exported to England, and was often adulterated with sea-water, but is now almost entirely replaced by lime juice. It is said, however, to be still an article of considerable export from Turkey, where lemons are abundantly grown, to Odessa. But a concentrated lemon juice for the manufacture of citric acid is prepared in considerable quantities, chiefly at Messina and Palermo, by boiling down the crude juice in copper vessels over an open fire until its specific gravity is about 1.250, seven to ten pipes of raw making only one of concentrated lemon juice. Of this concentrated juice Messina exported in 1877 1,631,332 kilograms, valued at 2,446,996 lire, and in 1878 Naples exported it to the value of 4767.

Lemon juice for this purpose is prepared also from the fruits of limes and Bergamot oranges. It is said to be sometimes adulterated with sulphuric acid on arrival in England.

Essence or Essential Oil of Lemon.—The essential oil contained in the rind of the lemon also occurs in commerce as a distinct article. It is manufactured chiefly in Sicily, at Reggio, Calabria, and at Mentone and Nice in France. The small and irregularly shaped fruits are employed while still green, in which state the yield of oil is greater than when they are quite ripe. In Sicily and Calabria the oil is extracted in November and December, as follows. A workman cuts three longitudinal slices of each lemon, leaving a three-cornered central core having a flat piece of the rind on one side and base. These pieces are then divided transversely and cut on one side, and the strips of peel are thrown in another place. Next day the pieces of peel are deprived of their oil by pressing four or five times successively the outer surface of the peel (not the rind) bent into a convex shape, against a flat piece of wood. The pieces are then left hand and wrapped round the forefinger. The oil exudes in the hand, which are ruptured more easily in the fresh fruit than in the state in which lemons are imported, yield up their oil to the sponge, which when saturated is squeezed into an earthen vessel furnished with a spout and capable of holding about three pints. After a time the oil separates from the watery liquid which accompanies it, and is then decanted. By this process four hundred fruits yield 9 to 14 ounces of essence. The pieces of pulp are afterwards expressed to obtain lemon juice, and then distilled to obtain the small quantity of volatile oil they contain. At Mentone and Nice a different process is adopted. The lemons are placed in a *œnéille à piquer*, a shallow bowl of pewter about 6½ inches in diameter, having a lip for pouring on one side and a closed tube at the bottom about 6 inches long and 1 inch in diameter. A number of stout brass pins stand up about half an inch from the bottom of the vessel. The workman rubs a lemon over the pins, which rupture the oil vesicles, and the oil collects in the tube, which when it becomes full is emptied into another vessel that it may separate from the aqueous liquid mixed with it. When filtered it is known as *Essence de Citron ou Zeste*, or, in the English market as perfume's essence of lemon. Inferior qualities being distinguished as druggists' essence of lemon. An additional product is obtained by immersing the scarified lemons in warm water and separating the oil which floats off. *Essence of Citron distillate* is obtained by rubbing the surface of fresh lemons (or of those which have been submitted to the action of the *œnéille à piquer*) on a coarse grate of tinnet iron, and distilling the grated peel. The oil so obtained is colourless, and of inferior fragrance. An acid sold at a lower price, while that obtained by the cold processes has a yellow colour and powerful odor.

Essence of lemon is chiefly brought from Messina and Palermo packed in copper bottles holding 26 to 50 kilograms or more, and sometimes in tinned bottles of smaller size. It is said to be rarely found in a state of purity in commerce, almost all that comes into the market being diluted with the cheaper distilled oil. This fact may be considered as proved by the price at which the essence of lemon is sold in England, this being less than it costs the manufacturer to make it. When long kept the essence deposits a white

greasy stearoptene, apparently identical with the *bergaptene* obtained from the essential oil of the Bergamot orange. The chief constituent of oil of lemon is the terpene, $C_{15}H_{24}$, boiling at $348^{\circ} \pm 8^{\circ} \text{ Fahr}$, which, like oil of turpentine, readily yields crystals of terpin, $C_{15}H_{24} \cdot 3O_2H_2$, but differs in yielding the crystalline compound, $C_{15}H_{24} \cdot 3O_2H_2 + 3HCl$, oil of lemons also contains, according to Tilden, another hydrocarbon $C_{15}H_{22}$, boiling at 320° Fahr , a small amount of *cymene*, and a compound acetic ether, $C_{15}H_{22}O_2 \cdot C_2H_5$. The natural essence of lemon not being wholly soluble in rectified spirit of wine, an essence for calendering purposes is sometimes prepared by digesting 6 ounces of lemon peel in one pint of pure alcohol of 95 per cent, and when the resid has become brittle, which takes place in about two and a half hours, powdering it and percolating the alcohol through it. This article is known as lemon flavour.

The name lemon is also applied to some other fruits. The Java lemon is the fruit of *Citrus javanensis*, El., the pear lemon of a variety of *Citrus Lemetta*, and the pearl lemon of *Citrus margarita*. The fruit of a passion-flower, *Passiflora laricifolia*, is sometimes known as the water-lemon, and that of a Berberidaceous plant, *Podophyllum peltatum*, as the wild lemon. In France and Germany the lemon is known the citron, and hence much confusion arises concerning the fruits referred to in different works. The essential oil known as oil of cedar is usually a fictitious article instead of being prepared, as its name implies, from the citron (*Fr cedarius*). An essential oil is also prepared from *Citrus Limetta*, Risso, at Squillac in Calabria, and has an odour like that of Bergamot lime.

The juice of the sweet lime (*Citrus Lemetta*, Risso), which is now largely substituted in the British navy for lemon juice for the prevention of scurvy, is imported principally from Montserrat. This island, although it only contains an area of 47 square miles, possesses the most extensive and best cultivated plantations of limes, *Citrus Lemetta*, in the world. About thirty years ago a small plantation was commenced in the island by Mr Bulke, at considerable outlay and with no prospect of an immediate return, and hence was not at first attended with success. But the Montserrat Lime Juice Co now own 600 acres, bearing 12000 trees. Although the fruit is collected all the year round, it is never gathered from the trees, but gangs of women labourers are sent out about 5 o'clock in the morning to collect all the fallen fruit. These when brought home are immediately sorted into sound and unsound fruits. The sound fruits are then bruised by hand in an *aspidiot*, a mortar-like vessel with a number of projections on the bottom by this means the oil collects in the rind are ruptured and the oil collects at the bottom of the vessel. More oil may be obtained from green fruits, but these yield less juice and less citric acid, and are therefore not gathered. The limes are then placed in a hopper with a sliding bottom through which they are superheated by steam, and are then immediately washed with projecting spikes of different lengths. By these the fruit is torn to small pieces, which fall on a coarse copper sieve placed below. After passing through this strainer the juice is run directly into oaken puncheons or casks containing 100 gallons. These casks are filled quite full so as to exclude air, and bunged down immediately.—the small proportion of essential oil contained in the vegetable matter which passes through the sieve helping to preserve the juice from decomposition. The slightly musky flavour of lime juice is produced by keeping, even after a few days, although the fresh juice is quite free from it. The whole of the lime juice collected in the morning must be pressed for lime juice the same day, as the juice rapidly loses citric acid when exposed to the air, even as much as 8 ounces in one day, or the whole of the acid in three weeks. Even when run at once into the casks, although it may contain 18 or 14 ounces or rarely 15 ounces of citric acid per gallon, it seldom contains more than 6 or 10 ounces on arrival in England. The mass of fruit pulp, &c., remaining on the sieve is put in bags of coir or coconut fibre, and a number of these are placed one upon another, with strainers between, and then submitted to strong pressure in a screw press, to obtain more juice, the marc left after pressure being returned to the plantation as manure. The unsound limes are treated in like manner and the juice boiled down in copper pans to a consistence of about 40° (Twaddle), a loss of citric acid taking place if the liquor be further concentrated. It then forms a black fluid of a consistence approaching that of treacle, and is exported in casks to England for the manufacture of citric acid. Turbines of steam power are used as the motive for the machinery. Although the lime begins to bear in three or four years, until the trees are seven or eight years old the crops are very small. The trees require pruning and attention to keep them free from a species of mistletoe with red or yellow berries and a kind of dodder. They are usually manured with cow or sheep manure. A fringe resembling the lemon tree is also found in the same manner which attacks the lemon trees in Europe, occasionally injure the plantations. For these reasons they are continually being extended. The young plants are grown from seeds picked out of the straining staves, and are planted about 15 yards apart. In the plantations in the higher parts of the island the limes show a

tendency to assume the form of a lemon and to become thicker skinned, while nearer the sea they are smaller, more globular, and thinner skinned. The young leaves of the lime are used for perfuming the water in finger-glasses, a few being placed in the water and bruised before use. In 1874 concentrated lime juice was exported from Montserrat to the value of £28800, and in 1878 Surinam exported 34,900 litres of lime juice. From Dominica 11,285 gallons, valued at £1825, were shipped in 1875.

Other trees belonging to the same natural order to which the name of limes have been given are *Citrus aeda*, and *Atlantia monophylla*, the wild lime of the Hindus *Agave condensis*, the açooche lime of North America, and *Salix europæa*, the common lime or Linden tree, belong to other natural orders.

LEMONNIER, PIERRE CHARLES (1715-1799), a distinguished astronomer, was born in Paris, November 23, 1715, where his father combined the practice of astronomy with the profession of philosophy. His first recorded observation was made before he was sixteen, and the presentation of an elaborate lunar map procured for him admission to the Academy, April 21, 1736, at the early age of twenty. He was chosen in the same year to accompany Maupertuis and Clairaut on their geodesical expedition to Lapland. In 1738, shortly after his return, he explained, in a memoir read before the Academy, the striking advantages of Flamsteed's mode of determining right ascensions. Indeed his persistent recommendation of English methods and instruments combined with the labours of Lacaille to effect a revolution in French practical astronomy, and constituted the most eminent of his services to science. He corresponded with Bradley, was the first to represent the effects of nutation in the solar tables, and introduced, in 1742, the use of the transit-instrument at the Paris observatory. He visited England in 1748, and in company with the earl of Morton and Short the optician continued his journey to Scotland, where he observed the annular eclipse of July 26. The liberality of Louis XV., in whose favour he stood high, furnished him with the means of procuring the best instruments, many of them by English makers, and gave him the command of the royal printing establishment for the publication of his works. Amongst the fruits of his industry may be mentioned a laborious investigation of the disturbances of Jupiter by Saturn, the results of which were employed and confirmed by Euler in his prize essay of 1748; a series of lunar observations extending over fifty years; some interesting researches in terrestrial magnetism and atmospheric electricity, in the latter of which he detected a regular diurnal period; and the determination of the places of a great number of stars, including twelve separate observations of Uranus, between 1765 and its discovery as a planet. In his lectures at the Collège de France he first publicly expounded the analytical theory of gravitation, and his timely patronage secured the services of Lalande for astronomy. His temper was irritable, and his hasty utterances exposed him to retorts which he did not readily forgive. Against Lalande, his jealousy having been excited by his preference for Lacaille, he closed his doors "during an entire revolution of the moon's nodes." His career was arrested by paralysis late in 1791, and a repetition of the stroke terminated his life. He died at Héril near Bayeux, May 31, 1799. By his marriage with Mademoiselle de Cussy, he left three daughters, one of whom became the wife of Lagrange. He was admitted in 1739 to the Royal Society, and was one of the one hundred and forty-four original members of the Institute.

He wrote *Histoire Céleste*, 1741; *Théorie des Comètes*, 1748, a translation, with additions, of Halley's *Synopsis*, *Institutions astronomiques*, 1748, an improved translation of Keil's text-book; *Nouveau Zodiaque*, 1765, *Observations de la Lune, du Soleil, et des Planètes fixes*, 1761-78; *Lens du magnétisme*, 1775-78, &c.

LEMUR, a term applied by Linnaeus to a group of mammals, and suggested by the nocturnal habits and strange ghost-like appearance of some of its members. As they had previously no vernacular appellation in English, it has been generally adopted, and is now completely anglicized, making "lemurs" in the plural. The French call them *Makis*, the Germans *Habibeyen*, in allusion to their forming, in appearance at least, a transition from monkeys to ordinary quadrupeds. For the same reason they are called *Prosimies* by some systematic writers. When the name was bestowed by Linnaeus, only five species were known, of which one, *L. volans*, Linn., *Galeopithecus volans* of modern writers, is now removed by common consent from the group. Notwithstanding the discovery of many new and curious forms, the lemurs remain a very natural and circumscribed division of the animal kingdom, though no longer considered a single genus, but divided up into many genera and even families.

The Lemurs, or Lemnroid animals as they ought more properly to be called, were formerly associated with the monkeys in the Linnaean order *Primates*, and afterwards in the *Quadrumana* of Cuvier, forming in that order the third main division, called by Geoffroy St Hilaire *Strepsirrhini*, on account of the twisted form of the external nostrils, a division equivalent in value to the *Catarrhina* or Old World and the *Platyrrhina* or New World monkeys. As more complete knowledge of their organization has been gradually attained, the interval which separates them structurally from the monkeys has become continually more evident, and they are now considered either as a distinct suborder of the *Primates*, or even as forming an order apart, without any very near affinities with the animals with which they have hitherto been so closely associated.¹

The existing species are not numerous, and do not diverge widely in their organization or habits, being all of small or moderate size, all adapted to an arboreal life, climbing with ease, and, as they find their living, which consists of fruits, leaves, birds' eggs, small birds, reptiles, and insects, among the branches of the trees, they rarely have occasion to descend to the ground. None are aquatic, and none burrow in the earth. Many of the species, but by no means all, are nocturnal in their habits, spending the day in sleeping in holes, or rolled up in a ball, perched on a horizontal branch, or in the fork of a tree, and seeking their food by night. Their geographical distribution is very peculiar; by far the larger proportion of species, including all those to which the term "lemur" is now especially restricted, are exclusively inhabitants of Madagascar, where they are so abundant and widely distributed that it is said by M. Grandidier, who has contributed more than any other traveller to enrich our knowledge of the structure and manners of these animals, that there is not a little wood in the whole island in which some of them cannot be found. From Madagascar as a centre a few species less typical in character extend through the African continent westward as far as Senegambia, and others are found in the Oriental region as far east as the Philippine Islands and Celebes.

The following are the essential anatomical characters common to the whole group:—

Teeth heterodont, or divided by their form into incisors, canines, and molars, and diphyodont, or consisting of a first and second set. Molars multicuspidate. Skull with

complete bony margin to the orbits, which communicate freely (except in *Tarsius*) with the temporal fossae. Lacrymal foramen outside the margin of the orbit. Clavicles well developed. Radius and ulna distinct. Scaphoid, lunar, and central bones of the carpus almost always separate. Five digits on the manus and pes, though the index of the manus may be rudimentary. Pollex (or thumb) and hallux (or great toe) always well developed—the latter especially large, opposable to the other digits, and with a flat nail. The index or second digit of the pes always terminating in a long pointed claw. The fingers and toes generally not tapering towards their extremities, but (except in *Chiromys*) dilated, flattened, and rounded at the tips. Cerebral hemispheres not completely overlapping the cerebellum, and but little convoluted. Stomach simple. Cecum always present, generally large. The middle or transverse portion of the colon almost always folded or convoluted on itself. Uterus bicornuate. Placenta non-deciduate, diffused or bell-shaped—the whole of the chorion, except the cephalic pole, being covered with villositels. Allantois of great size.

In subdividing the group for the purpose of a more detailed description of the different animals of which it is composed, it must first be noted that there are two very aberrant forms, each represented by a single species—(1) the little *Tarsius* of the Indian archipelago, and (2) the singular *Chiromys* or aye-aye, which, though an inhabitant of the headquarters of the order, Madagascar, and living in the same forests and under the same external conditions as the most typical lemurs, exhibits a most remarkable specialization in the structure of its limbs and teeth, the latter being modified so as to resemble, at least superficially, those of the rodents, an order in which it was once placed. The differences between these two forms and the remaining lemurs is so great that the whole order naturally divides itself into three families, the first of which may be again divided into four subfamilies, which with the genera they contain may be thus arranged:—

Family 1. <i>Lemuridae</i> .		Genera.
Subfamily 1. <i>Indridinae</i>		<i>Indris</i> .
		<i>Propithecus</i> .
		<i>Aotus</i> .
2. <i>Lemurinae</i>		<i>Lemur</i> .
		<i>Haplorhina</i> .
		<i>Lepidolemur</i> .
3. <i>Galaginae</i>		<i>Chiropithecus</i> .
		<i>Galago</i> .
		<i>Loris</i> .
4. <i>Lorinae</i>		<i>Myotis</i> .
		<i>Myotis</i> .
		<i>Myotis</i> .
Family 2. <i>Tarsiidae</i>		<i>Tarsius</i> .
3. <i>Chiromyidae</i>		<i>Chiromys</i> .

FAMILY LEMURIDÆ.

Upper incisors two on each side, small and separated by an interval in the middle base. Upper canines large, conical, compressed, and pointed. Premolars two or three, molars three on each side above and below, with numerous, more or less pointed, cusps. In the front of the lower jaw are on each side two or three closely approximated, long, slender teeth lying almost horizontally and projecting forwards. These are generally considered to represent the molars and canines, but there is some doubt about their homologies, and they may be all considered as molars, the canine being absent. The first lower premolar larger than those behind it, and shaped like a canine. The orbit and temporal fossa widely continuous beneath the bar of bone (formed by the frontal and malar) constituting the posterior boundary of the former cavity. The zygomatic wall developed and distinct from the zygoma. All the digits of both feet (except the second of the hind foot) with flat nails, and corresponding form of ungual phalanges.

L. Subfamily *Indridinae*.—The dentition of the adult consists of thirty teeth, usually expressed by the formula $\frac{2.1.2.3}{2.1.2.3}$; but, as indicated above, they may be $\frac{2.1.2.3}{2.1.2.3}$. In the

¹ For the arguments in favour of the latter view see Alphonsus Milne-Edwards, "Observations sur quelques points de l'embryologie des Lemnroides et sur les affinités zoologiques de ces animaux," in the *Ann. des Sciences Nat.*, October 1871; and P. Gervais, "Esquisse des Lemnroides," in *Journ. de Zoologie*, tom. 1 p. 7. For those for retaining them among the *Primates*, see Milne, "On Lepidolemur and Chiromys, and on the Zoological Rank of the Lemnroides," in *Proc. Zool. Soc.*, 1875, p. 494.

middle, but not in contact with each other or the canines, in front of which they are both placed. Muzzle elongated. Ears conspicuous and tufted. Mamme two, pectoral. Ventrals C7, D12, L7 (or D13, L6), S9, C27.

Animals much about the size of a common cat, with fox-like faces, soft thick fur, and long tails well clothed with hair. Not having the same disproportionate size of the limbs as the last group, they are much more quadrupedal in their actions, walking on the ground or running along the branches of trees on all four feet, but also jump-

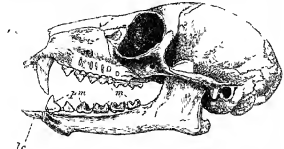


FIG. 3.—Skull of Ring-tailed Lemur (*Lemur catta*). $\times \frac{1}{2}$. Mrs. Roy Coll. Sanguis, *m*, upper canine; *l*, lower canine, *p*, premolar, *c*, two molars.

ing with marvellous agility. They are gregarious, living in small troops, are diurnal in their habits, but most active towards evening, when they make the woods resound with their loud cries, and feed not only on fruits and buds, but also on eggs, young birds, and insects. When at rest or sleeping, they generally coil their long, bushy tails around their bodies, apparently for the sake of the warmth it affords. They have usually either one or two young ones at a birth, which are at first nearly naked, and are emitted about, hanging close to and almost concealed by the hair of the mother's



FIG. 4.—Ring-tailed Lemur (*Lemur catta*) From life.

belly. After a while they change their position and mount upon the mother's back, where they are carried about until they are able to climb and leap by themselves. Though no member of the *Indras* has as yet lived long enough in captivity to be brought alive to Europe, the lemurs are commonly seen in menageries, and often breed in England. They present a great tendency to variation in their coloring, in consequence of which many animal species have been made. The most distinct, and at the same time most beautiful, is the ring-tailed lemur (*L. catta*, Linn., fig. 4), of a delicate grey colour, and with a long tail marked with alternating rings of black and white. This is said by Mr G. A. Shaw (*Proc Zool Soc.*, 1876, p. 132)

to be an exception to all the other lemurs in not being arboreal, but living chiefly among rocks and bushes. Pollen, however, says that it inhabits the forests of the south-west part of Madagascar, living, like its congeners, in considerable troops, and not differing from them in its habits. He adds that it is extremely gentle, and active and graceful in its movements, and utters at intervals a little plaintive cry like that of a domestic cat. All the others have the tail of uniform colour. The largest species is *L. variegatus*, Geoff., the tufted lemur, sometimes black and white, and sometimes reddish-brown, the variation apparently not depending on sex or age, but on the individual. In *L. macaco* the male is black and the female red, *L. swinhoi*, *L. collaris*, and *L. albigens* are other well-known species.

2 *Haplorhina*, Is Geoff.—Upper incisors very small, subequal, separated widely in the middle line. Those of each side in contact with each other and with the canines, the posterior one being placed on the inside, and not in front of the latter. Muzzle very short and truncated. Mamme four. There is apparently but one species, *H. griseus*, smaller than any of the true lemurs, of a dark grey colour, with round face and short ears. It is nocturnal, and lives chiefly among bamboo, subsisting on the young shoots. A second species has been named *H. sinensis*, but it is doubtful if it is not only a variety.

3 *Leptolemur*, Is Geoff., *Leptolemur* and *Microscelus*, Peters.—Upper incisors absent or only two in number and very small. Muzzle more elongated than in the last. No distinct os ciliare in the carpus. *L. musculus* is the best known species. It has, at all events when adult, no upper incisors. It is nocturnal, and like *Haplorhina* nocturnal in its habits. A second closely allied species, but with better developed penicillate, containing a pen of small styliform incisors, has been described by Peters under the name of *Microscelus capensis* (*Mondak Berlin Acad.*, 1874, p. 590).

III. Subfamily Galagidae.—Dentition as in *Leontideus*, from which they are distinguished by the elongation of the tarsus, caused by a peculiar modification of the os calcis and the navicular, the distal portion of the former and the whole of the latter having the form of nearly cylindrical rods placed side by side, while the other bones retain nearly their normal form and proportion.

1 *Chiropus*, Geoff.—Third upper penicula very much smaller than the first molar, and with only one external cusp. The animals included under this name appear to form a transition between the true lemurs and the galagos. The genus was originally established by Geoffroy St. Hilaire in 1813 for the description of three animals, only known at that time by drawings made in Madagascar by the traveller Commerson. Subsequent discoveries have brought to light several species that may be referred to it, including one or two which are sometimes considered as forming a genus apart under the name of *Microscelus*. They are all small, some being less than a rat in size, long-tailed, and nocturnal in their habits. One of the largest, *C. funebris*, is of a reddish-brown colour, and is distinguished by a dark median stripe on its back which divides on the top of the head into two branches, one of which passes forwards above each eye. The most interesting peculiarity of these animals, a knowledge of which we owe to M. Grandhoul, is that certain species (*C. samati*, *C. glauca*, *C. maki*, &c.) during the dry season coil themselves up in holes of trees, and pass into a state of torpidity, like that of the hibernating animals in the winter of northern climates. Before this takes place, an immense deposit of fat accumulates upon certain parts of the body, especially upon the basal portion of the tail, which has then dimensions corresponding to that of the well known fat-tailed sheep of the Cape, but which by the time they emerge from their torpor has acquired its normal proportions. The smallest species, to which many names have been given (*C. pusillus*, *rufus*, *smithi*, &c.), lives among the small branches on the tops of the highest trees, feeding on fruit and insects, and making nests which resemble those of birds.

2 *Galago*, Geoff.—*Otolemur*, Illiger.—Third upper penicula with two large external cusps, and nearly equaling the first molar in size. Os calcis about one-third the length of the tibia, and the navicular much longer than the cuboid. Ventrals C7, D13, L6, S9, C22-26. Tail long, and generally bushy. Ears large, rounded, naked, and capable of being folded at the will of the animal. Mamme four, two pectoral and two inguinal.

The galagos differ from all the lemurs previously mentioned, inasmuch as they are all inhabitants, not of Madagascar, but of the African continent, being widely distributed in the wooded districts from Senegambia in the west to Abyssinia in the east, and as far south as Natal. They pass the day in sleep, but are very active at night, feeding on fruit, insects, and small birds. When they descend to the ground they sit upright, and move about by jumping with their hind legs, like yahoos and kangaroos. They are pretty little animals, varying in size from that of a mouse to less than a rat, with large eyes and ears, soft woolly fur, and long tails. There are several species, of which *C. crassicaudus*, from Mozambique, is the largest. A similar species, or perhaps variety, from Angola is *C. montana*. *G. garnettii*, *alleni*, *mohoti*, *demidoffi*, and *baugottensis* are other recognized species. The last-mentioned

was the first known to science, having been brought from Sumatra by Adanson, and described in 1799 by Geoffroy, who adopted the name *Galago*, by which it was said to be called by the natives.

IV Subfamily *Lorinae*.—Dental formula as in *Lemurinae*. Index finger very short, sometimes rudimentary and nailless. Fore and hind limbs nearly equal in length. Tarsus not specially elongated. Pollux and hallux diverging widely from the other digits, the hallux especially being habitually directed backwards. Tail short or quite rudimentary. Mammary two, pectoral.

A small group of very peculiar animals, of essentially nocturnal habits, and remarkable for the slowness of their movements. They are completely arboreal, their limbs being formed only for climbing and clinging to branches, not for jumping or running. They have rounded heads, very large eyes, short ears, and thick, short, soft fur. They feed, not only on vegetable substances, but, like many of the *Lemurinae*, also on insects, eggs, and buds, which they steal upon while roosting at night. None of the species are found in Madagascar. One of the greatest anatomical peculiarities of these animals is the breaking up of the large arterial trunks of the limbs into numerous, small, parallel branches, constituting a *rete varicose*, which is found also in the two sloths, with which the lorins are sometimes confounded on account of the slowness of their movements. The animals of this group are usually divided into two genera, though the characters by which they are separated are very trivial. There are more properly two natural divisions.

A. Characterized by the index finger being small, but having the complete number of phalanges, and by their Asiatic habitat.

These form the genus *Loris* of Geoffroy St. Hilaire (1790), *Stenops* of Illiger (1811), but they were in 1812 divided by Geoffroy into two genera, *Nyctorhina* and *Loris*, a division which has been accepted by most modern zoologists.

Genus *Nyctorhina*, Geoff.—First upper incisor larger than the second, which is often only deciduous. Inner margin of the orbits separated from each other by a narrow flat space. Nasal and premaxillary bones projecting but very slightly in front of the maxillae. Body and limbs stout. No tail. Vertebrae: C7, D17, L6, S9, C12. The species are *N. tardigrada*, the common slow lemur of Java, of the Malay countries, Sumatra, and Borneo, *N. javanica*, of Java, and *N. concolor* (fig. 5), of Sum and Ceylon China. The



FIG 5.—Grey Loris (*Nyctorhina concolor*). From A. Milne-Edwards, *N. Archives du Muséum*, tome in pl. 3.

habits of all are much alike. They lead a solitary life in the recesses of large forests, chiefly in mountainous districts, where they sleep during the day in holes or fissures of large trees, rolled up into a ball, with the head between the hind legs. On the approach of evening they awake, and during the night they ramble among the branches of trees, slowly and quietly, in search of their food, which consists of tender leaves and fruit, small buds, insects, and waxes. When in quest of living prey, they move noiselessly till quite close, and then suddenly seize it with one of their hands. The female produces but one young one at a time. *L. tardigrada* was placed by Linnaeus at the head of the list of species of his genus *Lemur*, and its habits sometimes suggested the generic name, which was translated by Geoffroy to the less nocturnal and spectre-like Madagascan members of the group.¹

Genus *Loris*, Geoff.—Upper incisors very small and equal. Orbits very large, and only separated in the middle line above by a thin vertical plate of bone. Nasale and premaxillae produced forwards considerably beyond the anterior limits of the maxillae, and supporting a pointed nose. Body and limbs slender. No external tail. Vertebrae: C7, D14, L6, S8, C6.

¹ For the anatomy of this genus, see J. L. C. Shroeder van der Kolk and W. Vieillot, "Recherches d'anatomie comparée sur le genre *Stenops* Illiger," in *Biologien tot de Dierkunde*, part 1, Amsterdam, 1848-54.

One species, *L. gracilis*, the slender loris of Ceylon, a very strange-looking creature, about the size of a squirrel, or a yellowish-brown colour, with large, prominent eyes, pointed nose, long thin body, long, angularly bent, slender limbs, and no tail. Its habits are like those of the rest of the group.

B. Index finger reduced to a mere tubercle without nail. Both the lower species are from West Africa.

Genus *Perodicticus*, Bennett.—A short tail, about a third of the length of the trunk. Two or three of the anterior dorsal vertebrae have very long slender spinous processes which in the living animal project beyond the general level of the skin, forming distinct conical prominences, several of them so exceedingly thin and naked integument. *P. potto* (*Lemur potto*, Gmelin), the potto, is one of the oldest known members of the lemuroid group, having been described in 1705 by Bosman, who met with it in his voyage to Guinea. It was, however, lost sight of until 1825, when it was rediscovered in Sumatra and fully described by Bennett in the *Proceedings of the Zoological Society*, part 1, 1830-31, under the name of *Perodicticus Geoffroy*. Bennett's generic name has been retained, but the specific name bestowed by Gmelin, adopted from Bosman, has been retained. It is also found in the Gaboon. It is strictly nocturnal, and slower in its movements even than *Nyctorhina tardigrada*, which otherwise it much resembles in its habits.²

A second species, the avaritio (*P. calcaratus*, Smith), rather smaller and more delicately made, with smaller hands and feet, and rudimentary tail, constitutes the genus *Arctocebus*, Gray. It is found at Old Calabar, and in very rare, only a few individuals having as yet been met with. Its anatomy has been described by Professor Huxley in the *Proc. Zool Soc.*, 1864, p. 814. Vertebrae: C7, D15, L7, S8, C9.

FAMILY TARSIDAE

Dentition, $\frac{1}{1}$, $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$, total 94. The first upper incisor large, and in contact with its fellow of the opposite side. Canine of moderate size. Molars, with numerous pointed cusps. Lower canine semi-erect, its apex diverging from that of the single incisor. First lower premolar smaller than those behind it. Orbit to a large extent separated from the temporal fossa by a bony partition. Tibia slender, with its lower half confluent with the tibia. Second and third digits of the hind foot with compressed claws, all the other digits of both feet with flat nails. Calcaneum and navicular bone of the foot elongated as in the chirogales and galagids, but to a still greater extent. Colon short and not folded. Vertebrae: C7, D16, L8, S8, C7.

This family contains the single genus *Tarsius*, Story, of which but one species is known, *T. spectrum*, the tarsier, a very singular little animal, rather smaller than an English squirrel, with very large eyes and ears, a long thin tail, tufted at the end, and immensely elongated nasal portion of the foot, in allusion to which its generic name was given to it. It inhabits the forests of many of the islands of the Indo-Malayan archipelago, Sumatra, Borneo, Celebes, and some of the Philippines, feeds chiefly on insects and lizards, sleeps during the day, but is tolerably active at night, moving chiefly by jumping from place to place, an action for which the structure of its hind legs, which present a curious resemblance to those of a frog, seems particularly well adapted. It is rare, not more than two being generally found together, and only hangs forth one young at a time.³

FAMILY CHIROMYIDAE

Dentition of adult, $\frac{1}{1}$, $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$, total 18. Incisors very large, compressed, curved, with persistent pulps and enamel only in front as in rodents. Teeth of molar series with flat, very minutely tuberculated crowns. In the young the first set of teeth more resemble those of the avaritio (*Perodicticus*), $\frac{1}{1}$, $\frac{1}{1}$, $\frac{2}{2}$, $\frac{3}{3}$, all very small. Orbit surrounded by a ring of bone posteriorly, beneath which it communicates freely with the temporal fossa. Fibula well-developed and distinct from the tibia. All the digits of both feet with pointed rather compressed claws, except the hallux, which has a flattened nail. Middle digit of the hand excessively attenuated. Vertebrae: C7, D12, L6, S8, C7.

This family, like the last, is formed for the reception of a single genus, *Chiromys*, Cuvier, containing one species, *C. madagascariensis* (Gmelin), the aye-aye, an animal about the size of a cat, with a broad rounded head, short face, and large and naked ears. It has very large hands and long thin fingers with pointed claws, one of which (the middle or third) is remarkable for its extreme slenderness. The foot resembles that of the other lemurs in its large opposable hallux, with a flat nail, but all the other toes have pointed com-

² Van der Hoeven and Van Campen, "Onleedkundig oudesboek van der Potto van Bosman," in *Verh. Kon. Acad. van Wetenschappen*, Amsterdam, 1850.

³ F. Borestein, *Beitrag zur Naturgeschichte der Gattung Tarsius*, Berlin, 1846.

⁴ It was first named *Chiromys* by Geoffroy, but that name was withdrawn by him and it never of *Duconotus* as it had been previously given to a genus in the vegetable kingdom. It ought not, therefore, to be revived, as has been done by some modern authors.

pressed claws, like that of the second toe in the *Lemurina* and the second and third in the *Perodicticus*. Tail long and bushy. General colour dark brown, the outer fur being long and rather loose, with a woolly undercoat. Mammæ two, marginal in position. It is a native of Madagascar, where it was discovered by Sonnerat in 1789. The specimen brought to Paris by that traveller was the only one known until 1860. Since then many others have been obtained, and one has lived for several years in the gardens of the Zoological Society of London. Like so many of the lemurs, it is completely nocturnal in its habits, living either alone or in pairs, chiefly in the bamboo forests. Observations upon captive specimens have led to the conclusion that it feeds principally on succulent juices,



FIG. 6.—Skull of Ay-a-ye (*Pharyngus malagasyensis*) $\times \frac{1}{2}$
Mus. Roy. Coll. Surgeons

especially of the snger cane, which it obtains by tearing open the hard woody circumference of the stalk with its strong incisor teeth. It is said also to devour certain species of wood-boring caterpillars, which it obtains by first cutting down with its teeth upon their burrows, and then picking them out of their retreat with the claw of its attenuated middle finger. It constructs large ball-like nests of dried leaves, lodged in a fork of the branches of a large tree, and with the opening on one side. The resemblance of its teeth to those so characteristic of the *Dobsonia* caused it to be placed formerly in that order, and it was only when its anatomical characters were fully known that its true affinities with the lemurs became apparent.¹

Extract Lemnoroidea.—The disputed zoological position of the lemurs, and the great importance which has been attached to them by those naturalists who regard them as the direct transition between the lower and higher mammals, and survivors of a large group, now almost extinct, through which the higher *Primates*, including man, must have passed in the progress of their development, make the consideration of their ancient history one of great interest. Until very recently fossil lemurs were quite unknown, at all events the affinities of certain remains provisionally assigned to the group were much questioned, but within the last few years the existence of lemuroid animals in Europe during the later Eocene and early Miocene periods has been perfectly established, and remains of a large number of animals attributed, though with less certainty, to the group have been found in beds of corresponding age in North America. In 1862 Rüttimeyer described the fragment of a right maxilla and three molars from a siderolite deposit (Bohmerz) at Egerkingen, near Soleure, under the name of *Cenopithecus lemuroides*, supposing them to belong to an animal partaking of the characters of the American monkeys and the lemurs. The remains were, however, by most other paleontologists referred to the *Ungulata*. More recently M. Deltortie discovered in deposits which were being worked for phosphate of lime at Sainte Néboule de Bédier, department of Lot, France, regarded as of early Miocene age, a nearly complete cranium, and subsequently, at the same place, a portion of a ramus of a mandible of apparently the same species of animal. These were described by M. Deltortie in the *Actes de la Société Linnéenne de Bordeaux* for 1872 under the name of

Palaolemur bettlei. The cranium is generally well preserved, but unfortunately the anterior part, containing the incisor and canine teeth, has been broken off. Its affinity to the lemurine animals, especially to the African forms, the *Loxotus* and *Galagax*, is chiefly shown by the general form of the cranium, the large size and anterior direction of the orbits, the small and narrow muzzle, and the position of the lacrymal foramen outside the anterior edge of the orbit. In size the fossil is intermediate between the potto (*Perodicticus potto*) and *Galago crassicaudatus*. When the specimen came into the hands of M. Gaudry, that experienced and accurate paleontologist, with the rich treasures of the Paris Museum at hand for comparison, recognized that certain more or less fragmentary remains which had long been in the collection, and had been described from the teeth alone, and generally, though doubtfully referred to the *Ungulata*, were really nothing more than animals of the same group, and probably even the same species as *Palaolemur bettlei*. These were *Adaps parviusculus*, Cuvier, from the Paris gypsum, described and figured in the *Ossuaires fossiles*, *Aphelotherium duvernoyi*, Gervais, from the same beds, and other specimens from Barthélemy, near Apt. This result was fully acquiesced in by Gervais, who also added *Cenopithecus lemuroides*, Rüttimeyer, to the synonyms of the animal, which henceforth must be called *Adaps parviusculus*, as that was the name first assigned to it.

M. Deltortie's announcement of a fossil lemur from the south of France was soon followed by that of another species by M. H. Filhol, named *Nevolemur antiquus* (*Comptes Rendus*, 1873, tom. lxxvii p. 1111), which was afterwards more fully described and figured (*Annales des Sciences Géologiques*, tom. v. No. 4, 1874, and *Recherches sur les Phosphorites du Quercy*, 1876), and a second species of *Adaps*, of considerably larger size, *A. magnus*, Filhol, was added to the group, the latter, of which the skull is upwards of 4 inches in length, resembles M. Deltortie's in its general characters, but modified much in the way that the skulls of larger animals differ from the smaller ones of the same natural group. The brain-chamber and orbits are relatively smaller, the face larger, the muscular crests more developed, and the constriction between the cerebral and facial portion of the skull more marked. These modifications remove the skull in its general characters still further from the existing lemurs—so much so that M. Filhol refers it and the other species of *Adaps* to a distinct and hitherto unknown zoological type, intermediate between the lemurs and the pachyderms, to which he gives the name of *Pachylemur*. On the other hand he considers the *Nevolemur antiquus* found at St Antonin, which is a very small species, to be a true lemuroid, more nearly resembling *Galago senegalensis* than any existing species. Unfortunately in all these specimens the anterior part of the skull is so much injured that the character and numbers of the incisor teeth cannot be ascertained, a great want in determining the affinities of these animals. And even if the whole of the skulls were found, as long as nothing is known of the limbs, or of any other bones of the skeleton, the determination of their actual zoological position can only be considered as provisional. All the existing lemurs and pachyderms, or ungulates as they are now generally termed, are so essentially different in structure and mode of life that it is difficult to conceive of a transition from one to the other, and therefore any such forms when found will be full of interest. In skull and teeth characters, as far as they are yet known, these ancient lemur-like animals from France do not deviate sufficiently from the existing lemuroids to justify their separation, but it remains to be proved whether they had the opposable hallux and ungulate toes of the forms which now inhabit the world,

¹ R. Owen, "On the Ay-a-ye," in *Trans. Zool Soc.*, vol. v. p. 38, 1862; W. Peters, "Ueber die Säugethier-Gattung *Chiocys*," in *Abhandl. Königl. Akad. der Wissenschaften*, Berlin, 1866, p. 73.

or whether their limbs were of a more generalized type. The discussions which have taken place on their nature at all events show how little reliance can be placed upon the characters of the molar teeth alone in judging of the affinities of an extinct animal.

Perhaps the most important of all the numerous recent paleontological discoveries in the Tertiary beds of the rocky mountain district of North America has been that of animals which their describers believe to be low and generalized forms of the order *Primates*. Their existence was not suspected till 1872, in which year Professor Marsh and Professor Cope almost simultaneously announced the fact. Since that time numerous genera have been assigned to the group, including five which were previously described by Leidy from teeth alone, the nature of which he did not venture to determine. These are nearly all from the Eocene or lowest Miocene formations. Until we receive fuller information regarding the remains of these animals, it is premature to speculate upon their real character or affinities. The difficulty of doing so is at present enhanced by their describers in the provisional accounts already given adopting the old assumption that lemurs and monkeys are animals of the same general type, and speaking of them sometimes as one and sometimes as the other. It is possible that these animals, or some of them, may have been monkeys, in which case they were not lemurs; or they may have been lemurs, in which case they were not monkeys. It is possible also that they may form a connecting link between the two, and so justify their old association in one group. The recently described *Anaptomorphus homunculus* from the Lower Eocene of Wyoming, an animal smaller than *Tarsius spectrum*, is considered by Cope to be "the most simian lemur yet discovered, and probably representing the family from which the true monkeys and men were derived" (*Paleontological Bulletin*, No. 34, February 20, 1882). In this case the lemurs, which, judging by their present distribution, appear to have spread east and west from Madagascar, may have had quite a different origin.

Literature — Besides the works and memoirs on particular families and genera referred to above, see St. G. Mivart, "Notes on the Crania and Dentition of the *Lemuridae*," in *Proc. Zool. Soc.*, 1884 (p. 611-648) and 1887 (p. 960-976); Mivart and Murie, "On the Anatomy of the *Lemuridae*," in *Proc. Zool. Soc.*, vol. vii., 1879, pp. 1-119; W. Turner, "On the Fracturation of the Lemurs," in *Phil. Trans.*, clxvi., pp. 569-587; F. Poilen and D. O. Van Dam, *Recherches sur la Faune de Madagascar*, 2me partie, "Mammifères," 1885. (W H F)

LENA. See SIBERIA.

LENOLOS, NINON DE (1615-1705), was the daughter of a gentleman of good position in Touraine. Her long and eventful life divides into two periods, during the former of which she was the typical Frenchwoman of the gayest and most licentious society of the 17th century, during the latter the recognized leader of the fashion in Paris, and the friend of wits and poets. Of her earlier life she has said the better, and in her defence all that can be pleaded is that she had been educated by her father in the epicurean and sensual beliefs made popular by Montaigne, and that she retained throughout the frank demeanor, and disregard of money, which won from Saint Evremont the remark that she was an *honnete homme*. Against her, and the numerous specious defenses set up for her by contemporaneous and subsequent French writers, must be mentioned her absolute want of maternal feeling and even of natural shame. The well-known visit of Queen Christina to her attests the extent of her renown, or infamy, and the inefficiency of the threats of Anne of Austria prove her power. Of a perfectly different character was her later life, when, though she had continued her career of debauchery for a preposterous length of time, she settled

down to the social leadership of Paris. Then there were to be found in her salon all that was most witty and refined in France,—"ladies as well as gentlemen of the highest birth," remarks a correspondent to Madame de Sevigné, poets like Molière, abbés like Châteauneuf, Genoese preachers like Turretin, the protégé of Saint Evremont. It became the fashion for young men as well as old to throng round her, and the best of all introductions for a young man who wished to make a figure in society was an introduction to Mlle. de Lenolos. The cause for this surpassing social success is to be found perhaps as much in her past notoriety, and past intimacy with the great names of the last generation, as in the wit and tact, to which Saint Evremont, and after him Sainte-Beuve, ascribe it. Her long friendship with Saint Evremont must be shortly noticed. They were of the same age, and had been intimate in their youth, and throughout his long exile the wit seems to have kept a kind remembrance of Ninon. The few really authentic letters of Ninon herself are those addressed to her old friend, and the letters of both in the last few years of their equally long lives are exceptionally touching, and unique in the polite compliments with which they try to keep off old age. If Ninon owes part of her posthumous fame to the old wit, she owes at least as much to the young Aroust, who was presented to her as a promising boy poet by the abbé de Châteauneuf, to whom she left 2000 francs to buy books, and who, as Voltaire, was to write a letter on her which was to be the chief authority of many subsequent biographers. Her personal appearance is, according to Sainte-Beuve, best described in a novel of Mlle. de Soudry, and the characteristic of it was neither beauty nor wit, but high spirits, and perfect evenness of temperament.

The letters of Ninon published after her death were, according to Voltaire, all spurious, and the only authentic ones are those to Saint Evremont, which can be best studied in Denzmann's edition of *Saint Evremont*, and his notice on her. Sainte-Beuve has an interesting notice of these letters in the *Œuvres de La Fontaine*, vol. iv. Most biographies of Ninon are full of unauthentic stories.

LENFANT, JACQUES (1661-1728), author of numerous works, chiefly in ecclesiastical history, was born at Bazoches (Eure-et-Loir) on April 13, 1661. His father, Paul Lenfant, was Protestant pastor at Bazoches and afterwards at Châtillon-sur-Loire until the revocation of the edict of Nantes, when he removed to Caen. After studying at Saumur and Geneva, Lenfant completed his theological course at Heidelberg, where in 1684 he was ordained pastor of the French Protestant church, and appointed chaplain to the dowager electress palatine. The French invasion in 1688 compelled his withdrawal to Berlin, where in the following year he was again appointed by Frederick to be one of the ministers of the French Protestant church; this office he continued to hold until his death, ultimately adding to it that of chaplain to the king, with the dignity of consistorialrath. He visited Holland and England in 1707, and had the honour of preaching before Queen Anne, and, it is said, of being invited to become one of her chaplains. In search of materials for his histories he visited Helmstedt in 1712, and Leipzig in 1715 and 1725, but otherwise the course of his life was quite uneventful. He died at Berlin on August 7, 1728.

An exhaustive catalogue of his publications, thirty-two in all, will be found in Chantepie's *Dictionnaire*, where his personal excellences are dwelt upon with some fulness and warmth. See also *Flags France Protestante*. He is now best known by his *Histoire du Concile de Constantin, faite par ses membres d'Auteurs qui ont assisté au Concile* (Amsterdam, 1714; 2d ed., 1738; English translation, 1780). It is of course largely dependent upon the previous laborious work of Van der Hardt, but has indisputable literary merit peculiar to itself, and in particular has been printed on all sides for its famous. It was followed by *Histoire du Concile de Pise, et de sa suite* (Paris de plus mémorable depuis ce Concile jusqu'au Concile de Constantin (1724), and (posthumously) by

Histoire de la Guerre des Hussites et du Concile de Bâle (Amst., 1781), German translation, Vienna, 1783-84). Lennep was one of the chief promoters of the *Enzyklopädie Germanique*, begun in 1790, and he was associated with Besenrode in the preparation of the new French translation of the New Testament with original notes, published at Amsterdam in 1718.

LENKORAN, a town in Trans-Caucasia, on the Caspian, at the mouth of a small stream of its own name, and close to a great lagoon. The lighthouse stands in 38° 45' 38" N. lat., and 48° 50' 18" E. long. Taken by storm on New Year's day 1813 by General Kotliarski, Lenkoran was in the same year surrendered by Persia to Russia by the treaty of Gulistan along with the khanate of Talysh, of which it was the capital. In 1867 it had a population of 15,953; but according to the census of 1873 there were only 4779 inhabitants (734 Russians, 233 Armenians). The fort has been dismantled, and in trade the town is being far outstripped by Astara, the custom-house station on the Persian frontier.

The district of Lenkoran (2078 square miles), corresponding to the khanate of Talysh, is highly interesting from its physical peculiarities. It is a thickly wooded mountainous region, shut off from the dry Persian plateau by the Talysh range (7000-8000 feet high), and with a narrow marshy strip along the coast. The climate is exceptionally moist and warm (annual rainfall 52.79 inches; mean temperature in summer 75°, in winter 40°), and fosters the growth of even Indian forms of vegetation. The iron tree (*Parrotia persica*, C. A. Meyer), the silk acacia, *Carpinus Betulus*, *Quercus ibexica*, the box tree, and the walnut flourish freely, as well as the sumach, the pomegranate, and the *Gleditsia caspica*. The Bengal tiger is not unfrequently met with, and wild boars are abundant. Of the 95,482 inhabitants of Lenkoran, the Talyshians (42,999) form the most interesting and aboriginal element, belonging as they do to the Iranian family, and speaking an independently developed language closely related to Persian. They are of middle height and dark complexion, with generally straight nose, small round skull, small sharp chin, and large full eyes, which are expressive, however, rather of cunning than intelligence. They live exclusively on rice. In the northern half of the district the Tartar element predominates, and there are a number of villages (Pravolnoye, for instance, with 2000 inhabitants) occupied by various Russian sectarians.

LENNEP, a small town of Rhenish Prussia in the district of Düsseldorf, is situated 18 miles east of Düsseldorf and 9 miles south of Barmen, at a height of 1050 feet above the level of the sea. It lies in the heart of one of the busiest industrial districts in Germany, and carries on important manufactures of the finer kinds of cloth, wool, yarn, felt, and other articles. It is the seat of a small chamber of commerce, and possesses a large and well-equipped hospital. Lennep, which was the residence of the counts of Berg from 1226 to 1300, owes the foundation of its prosperity to an influx of Cologne weavers during the 14th century. Population (1880) 8077, about one-fourth of whom are Roman Catholics.

LENNEP, JACOB VAN (1802-1868), Dutch poet and novelist, was born March 24, 1802, at Amsterdam, where his father, David Jacob van Lennep, who also became known as a scholar and poet, was professor of eloquence and the classical languages in the Athenaeum. Lennep received his education partly in his native city and partly at Leyden, studying jurisprudence at the latter, and ultimately obtaining the degree of doctor of laws; he then settled as an advocate in Amsterdam. His first poetical efforts had been translations from Byron, of whom he was an ardent admirer, and in 1826 he published a collection of original *Academic Idylls* which had a modified success. His first attained genuine popularity by

the *Nederlandse Legendes*, which reproduced after the manner of Sir W. Scott, though without much psychological depth or literal accuracy, some of the more stirring incidents in the early history of his fatherland. His fame was further raised to a very high point by his comedies *Het Dorp aan die Grenzen* and *Het Dorp over die Grenzen*, which had reference to the political events of 1830. In 1829 he had broken ground in a new and hitherto untrodden field with the publication of *De Pleegsoon* ("The Adopted Son," 1829), the first of a series of historical romances in prose, which have acquired for him in Holland a position somewhat analogous to that which Scott holds throughout the reading world. The series included *De Roos van Dekama* (1837), *Onze Voorouders* (1838), *Ferdinand Huyck* (1840), *Elizabeth Musch* (1850), and *De Lotgevallen van Klaasje Zevender* (1856), several of which have been translated into German and French, and two ("The Rose of Dekama" and "The Adopted Son") into English. In a closely connected department of literature, his Dutch history for young people (*Geschiedenis van Noord-Nederland aan myne Kinderen verhaald*) is attractively written. Apart from the two comedies already mentioned, Lennep was the author of numerous dramatic pieces which have found much acceptance on the Dutch stage. For some years Lennep held a judicial appointment, and from 1853 to 1856 he was a member of the second chamber, in which he voted with the Conservative party. He died at Oosterbeek near Arnhem, on August 25, 1868. There is a collective edition of his *Poetische Werken* (18 vols., 1869-1872), and also of his *Romantische Werken* (23 vols., 1855-1872).

LENT (*lenten*, *lente*, from A. S. *lencen*, spring; comp. Du. *lente*, Germ. *lenz*), the ecclesiastical season known in the early Greek Church as *τεσσαράκωστή* (afterwards as *ἡ τεσσαράκωστή*), and in the Latin Church, from at least the 4th century, as *Quadragesima*.¹ Irenæus, in a passage which, though not free from difficulties, is yet clear enough in its general scope (*apud* Euseb., *H. E.*, v. 24), mentions that the custom of keeping a fast before Easter Sunday was quite old even in his day, but that no uniformity of observance had up to that time been established, some thinking they ought to fast for one day, others for two days, and others having further peculiarities. In Tertullian's day the Good Friday fast at all events was "communis et quasi publicæ jejuniæ religio" (*De Orat.*, c. 18), and elsewhere (*De Jejun.*, 2) he indicates his opinion that Christians ought to commemorate by a religious fast all the time during which "the bridegroom was taken away from them." This period of fasting was gradually extended, but still without uniformity of praxis. The diversity of usage covered by a common name is referred to by Socrates (*H. E.*, v. 28) as a source of perplexity to him. He tells us that in Rome the custom was to fast three continuous weeks before Easter, Saturdays and Sundays not being included; that in Illyria, Greece, and Alexandria the period of abstinence called *τεσσαράκωστή* extended over six weeks; and that in some other places, which he does not specify, the custom was to begin the fast seven weeks before Easter, but actually to observe it at intervals only for three periods of five days each, and nevertheless still to call it *τεσσαράκωστή*. Cassianus (*Coll.* 21, 5) calls attention to the fact that a fast of seven weeks, when Saturdays and Sundays, except Holy Saturday, are excluded as they ought to be, means a fast of thirty-six days in all, i.e., a title of the year, — an idea which seems to have found wide acceptance. Leo I. (*Serm.* 44) alludes to the fast of forty days as having apostolic

¹ Literally, it would seem, the fortieth day before Easter (comp. *Seogagesima*, *Septuagesima*). From *Quadragesima* comes the Italian *quaresima*, Spanish *cuaresma*, French *carême*.

authority, but the number does not seem to have been taken quite literally. In one of the homilies (*In Evang.*, xvi.) of Gregory the Great, the precise number is fixed as by Cassianus at thirty-six, but this figure is obtained by reckoning from the sixth Sunday before Easter and deducting Sundays only. In the *Corpus Særis Canonica* this passage is reproduced, but with an important change which must have been made before the end of the 8th century; it is to the effect that, in order to make up the sacred number of forty days dedicated to fasting by our Lord, it is necessary to take in as fasts the four days preceding Quadragesima Sunday. As regards the manner of observing Lent, various degrees of strictness have prevailed in the church. Perfect abstinence from all food every fasting day until evening is in theory at least required, and it has also been considered desirable that public worship with sermon should be attended daily, with frequent communion, especially on Saturday and Sunday; public amusements, especially stage plays, are prohibited, and the celebration of religious festivals, as also of birthdays and marriages, is held to be unsuitable; and increased diligence in almsgiving and deeds of charity is enjoined.

LENTIL, the seed of *Lens esculenta*, Monch, a small annual of the vetch tribe. The plant varies from 6 to 18 inches in height, and has many long ascending branches. The leaves are alternate, with six pairs of oblong-linear, obtuse, mucronate leaflets. The flowers, two to four in number, are of a pale blue colour, and are borne in the axils of the leaves, on a slender footstalk equalling the leaves in length; they are produced in June or early in July. The pods are about $\frac{1}{2}$ inch long, broadly oblong, slightly inflated, and contain two seeds, which are of the shape of a doubly convex lens, and about $\frac{1}{16}$ inch in diameter. There are several cultivated varieties of the plant, differing in size, hairiness, and colour of the leaves, flowers, and seeds. The last may be more or less compressed in shape, and in colour may vary from yellow or grey to dark brown; they are also sometimes mottled or speckled. In English commerce two kinds only of lentils are principally met with, viz., the French and the Egyptian. The former are usually vended entire, and are of an ash-grey colour externally and of a yellow tint within; the latter are usually sold like split peas, without the seed coat, and consist of the reddish-yellow cotyledons, which are smaller and rounder than those of the French lentil; the seed coat when present is of a dark brown colour. Egyptian lentils are chiefly imported from Alexandria. In 1880 there were shipped from that port 25,000 ardebs, or 17,000 quarters, of red lentils, valued at £25,000, of which amount 80 per cent. was taken by Great Britain. Considerable quantities of lentils are also imported into the United States, but are chiefly consumed by the Germans, with whom lentil soup is a favourite dish. The native country of the lentil is not known, although it is supposed to be indigenous to the Himalayas. It was probably one of the first plants brought under cultivation by mankind. The name *lens* (Heb. *לֶנֶס*) appears to be an original Semitic word, and the red pottage of lentils for which Esau sold his birthright (*Gen. xxx. 34*) was apparently made from the red Egyptian lentil. This lentil is cultivated in one or other variety in India, Persia, Syria, Egypt, Nubia, and North Africa, and in Europe, along the coast of the Mediterranean, and as far north as Germany, Holland, and France. According to Shaw, *Travels in Barbary*, lentils are dressed in that country in the same manner as beans; and in Egypt and Syria the parched seeds are exposed for sale in shops, and esteemed the best food to carry on long journeys. Lentils form a chief ingredient in the Spanish *puchero*, and are used in a similar way in France and other countries. For this purpose they are usually sold in the shelled state.

The reddish variety of the lentil ("*lentillon d'hiver*") is the kind most esteemed in Paris on account of the superior flavour of its smaller seeds. It is sown in autumn either with a cereal crop or alone, and is cultivated chiefly in the north and east of France. The large or common variety, "*lentille large blonde*," cultivated in Lorraine and at Galarand (*Eure-et-Loir*), and largely in Germany, is the most productive, lent is less esteemed. This kind has very small whitish flowers, two or rarely three on a footstalk, and the pods are generally one-seeded, the seeds being of a whitish or cream colour, about $\frac{1}{8}$ of an inch broad and $\frac{1}{16}$ inch thick. A single plant produces from 100 to 160 pods, which are flattened, about $\frac{3}{4}$ inch long and $\frac{1}{8}$ inch broad. Another variety, with seeds much in form and colour to the last, but of much smaller size, is known as the "*lentillon de Mars*." It is sown in spring. This variety and the "*lentille large*" are both sometimes called the "*lentille la reine*." A small variety, "*lentille verte du Puy*," cultivated chiefly in the department of Haute Loire and Cantal, is also grown as a vegetable and for forage. The Egyptian lentil was introduced into Britain in 1820. It has blue flowers. Another species of lentil, *E. monanthos*, L., is grown in France about Orleans and elsewhere under the name of "*jaissée*" and "*jarrière*." It is, according to M. Vilmonet, one of the best kinds of green food to grow on a poor dry sandy soil; on calcareous soil it does not succeed so well. It is usually sown in autumn with a little rye or winter oats, at the rate of a hectolitre to a hectare.

The lentil also prefers a light warm sandy soil, on rich land it runs to leaf and produces but few pods. The seeds are sown in March or April or early in May, according to the climate of the country, as they cannot endure night frosts. If for fodder they are sown broadcast, but in drills if the ripe seeds are required. The pods are gathered in August or September, as soon as they begin to turn brown,—the plants being pulled up like fax while the foliage is still green, and on a dry day left the pods split in drying and loss of seed takes place. Lentils keep best in the husk so far as flavour is concerned, and will keep good in this way for two years either for sowing or for food. An acre of green grounds on an average about 11 cwt. of seed and 30 cwt. of straw. The amount and character of the mineral matter requisite in the soil may be judged from the analysis of the ash, which in the case of a half bushel of pods—potash 34.6 per cent., soda 5.5, lime 8.8, phosphoric acid 36.5, chloride of sodium 7.6, while in the straw the percentages are—potash 10.8, lime 52.3, silica 17.6, phosphoric acid 13.3, chloride of sodium 2.1.

Lentils have recently attracted some notice among vegetarians as a food material. A Hindoo proverb says, "Rice is good, but lentils are my life." But in England they have been reputed difficult of digestion and apt to disorder the bowels and injure the sight. The husk of the seed is certainly indigestible, and to cook lentils properly requires at least two and a half hours; but undoubtedly they are richer in nutritious matter than almost any other kind of pulse, containing, according to Payen's analysis, 25.2 per cent. of nitrogenous matter (legumin), 55 per cent. of starch, and 2.6 per cent. of fatty matter. Fresenius's analysis differs in giving only 36 per cent. of starch. Emhof gives 52.61 of starch and 37.85 per cent. of nitrogenous matter. Lentils are more properly the food of the poor in all countries where they are grown, and have often been spared when better food could be obtained, hence the proverb "*Divice factus jam desunt gaudere lentis*." The seeds are said to be good for pigeons, or mixed in a groundstate with potatoes or barley for fattening pigs. The herbage is highly esteemed as green food for suckling ewes and all kinds of cattle (being said to increase the yield of milk), also for calves and lambs. Haller says that lentils are so flatulent as to kill horses. They were also believed to be the cause of severe scurfulous disorders common in Egypt. The bad reputation was probably due to the substitution of the seeds of the bitter vetch or tare lentil, *Ervum Ervilia*, L., a plant which closely resembles the true lentil in height, habit, flower, and pod, but whose seeds are without doubt possessed of deleterious properties—producing weakness, or, according to Lindley, even paralysis of the extremities in horses which have partaken of them.

A few years ago some cases of poisoning of pigs were traced by Mr W. Southall of Birmingham to the use of the seed of this plant in their food; it had been imported from Turkey under the name of *roet*, and was sold in England under the name of Egyptian peas. The chief symptom produced was severe vomiting, followed by speedy death. The poisonous principle seems to reside chiefly in the bitter seed coat, and can apparently be removed by steeping in water, since Gerard, speaking of the "*bitter vetch*" (*Ervum Ervilia*), says "*kine in Asia and in most other countries do eat thereof, being made sweet by steeping in water*." The seed of *Ervum Ervilia* is about the same size and almost exactly of the same reddish-brown colour as that of the Egyptian lentil, and when the seed coat is removed they are both of the same orange red hue, but the former is not so bright as the latter. The shape is the best means of distinguishing the two seeds, that of *E. Ervilia* being obtusely triangular.

See LENTIL is a name sometimes applied to the gulfweed *Sargassum vulgare*.

See Bailey and Trimen, *Medicinal Plants*, No. 76, *Pharmaceutical Journal* (3), vol. 2, p. 481; Watts, *Dictionary of Chemistry*, vol. III, pp. 566-71; Tyson, *Chemical Dictionary*, xiv, p. 572.

LENTINI. See LEONTINI.

LEO I., who alone of Roman pontiffs shares with Gregory I. the surname of THE GREAT, pope from 440 to 461, was a native of Rome, or, according to a less probable account, of Volterra in Tuscany. Of his family or of his early education nothing is known; that he was highly cultivated according to the standards of his time is obvious, but it does not appear that he could write Greek, or even that he understood that language. No certain traces of his early ecclesiastical career have been discovered. In one of the letters (*Ep.* 104) of Augustine, an acolyte named Leo is mentioned as having been in 418 the bearer of a communication from Sixtus of Rome (afterwards pope of that name) to Aurelius of Carthage against the Pelagians, but it is possible that this Leo is rather to be identified with the Leo a priest who is recorded to have been sent by Pope Celestine to Africa with reference to the matter of Apollinaris about the year 426. In 429, when the first unmistakable reference to Pope Leo occurs, he was still only a deacon, but already a man of commanding influence; it was at his suggestion that the *De Incarnatione* of the aged Caesarius, having reference to the Nestorian heresy, was composed in that year, and some two years later (about 431) we find Cyril of Alexandria writing to him that he might prevent the Roman Church from lending its support in any way to the ambitious schemes of Juvenal of Jerusalem. In 440, while Leo was in Gaul, whither he had been sent to compose some differences between Aetius and another general named Aribius, Pope Sixtus III. died, and the absent deacon, or rather archdeacon, was forthwith unanimously chosen to succeed him, and received consecration on his return six weeks afterwards (September 29). In 443 he began to take measures against the Manicheans (who since the capture of Carthage by Genseric in 439 had become very numerous at Rome), and in the following year he was able to report to the Italian bishops that some of the heretics had returned to Catholicism, while a large number had been sentenced to perpetual banishment "in accordance with the constitutions of the Christian emperors," and others had died; in seeking these out the help of the provincial clergy was sought. It was during the earlier years of Leo's pontificate that the events in Gaul occurred which resulted in his triumph over Hilarius of Arles, signalized by the edict of Valentinian III. (445), denouncing the contumacy of the Gallic bishop, and enacting "that nothing should be done in Gaul, contrary to ancient usage, without the authority of the bishop of Rome, and that the decree of the apostolic see should henceforth be law." In 447 he held the correspondence with Turribius of Astorga which led to the condemnation of the Priscillianists by the Spanish national church, and to the putting to death of Priscillian—an act which met with Leo's approval. In 448 he received with commendation a letter from Eutyches, the Constantinopolitan monk, complaining of the revival of the Nestorian heresy there; and in the following year Eutyches wrote his circular, appealing against the sentence which at the instance of Eusebius of Dorylaeum had been passed against him at a synod held in Constantinople under the presidency of the patriarch Flavian, and asking papal support at the oecumenical council at that time under summons to meet at Ephesus. The result of a correspondence was that Leo by his legates sent to Flavian that famous epistle in which he sets forth with great fulness of detail the doctrine ever since recognized as orthodox regarding the union of the two natures in the one person of Jesus Christ. The

narrative of the events at the "robber" synod at Ephesus belongs to general church history rather than to the biography of Leo; suffice it to say that his letter, though submitted, was not read by the assembled fathers, and that the papal legates had some difficulty in escaping with their lives from the violence of the theologians who, not content with deposing Flavian and Eusebius, shouted for the dividing of those who divided Christ. When the news of the result of this oecumenical council (oecumenical in every circumstance except that it was not presided over by the pope) reached Rome, Leo wrote to Theodosius "with groanings and tears," requesting the emperor to sanction another council, to be held this time, however, in Italy. In this petition he was supported by Valentinian III., by the empress-mother Galla Placidia, and by the empress Eudoxia, but the appeal was made in vain. A change in the position of affairs, however, was brought about by the accession in the following year of Marcian, who three days after coming to the throne published an edict bringing within the scope of the penal laws against heretics the supporters of the dogmas of Apollinaris and Eutyches. To convolve a synod in which greater orthodoxy might reasonably be expected was in these circumstances no longer difficult, but all Leo's efforts to secure that the meeting should take place on Italian soil were unavailing. When the synod of Chalcedon assembled in 451, the papal legates were treated with great respect, being provided with seats on the immediate right of the president, and Leo's former letter to Flavian was adopted by acclamation as formulating the creed of the universal church on the subject of the person of Christ. Among the reasons urged by Leo for holding this council in Italy had been the threatening attitude of the Huns; the dreaded irruption took place in the following year (452). After Aquileia had succumbed to Attila's long siege, the conqueror set out for Rome. Near the confluence of the Minio and the Po he was met by Leo, whose eloquence persuaded him to turn back. Leo, whose eloquence enhanced the impressiveness of the occurrence by an unnecessarily imagined miracle. The pope was less successful with Genseric when the Vandal chief arrived under the walls of Rome in 455, but he secured a promise that there should be no incendiarism or murder, and that three of the oldest basilicas should be exempt from plunder,—a promise which seems to have been faithfully observed. The death of Leo occurred in 461, according to the Roman breviary on April 11, on which day the festival of "Pope Leo, confessor and doctor of the church" is celebrated (duplex). The title of "doctor ecclesiae" was given by Benedict XIV. The successor of Leo was Hilarius or Hilarius, who had been one of the papal legates at the "robber" synod in 449.

As bishop of the diocese of Rome, Leo distinguished himself above all his predecessors by his preaching, to which he devoted himself with great zeal and success. From his short and pithy *Sermones* many of the lessons now to be found in the Roman breviary have been taken. Viewed in conjunction with his voluminous correspondence, the sermons sufficiently explain the secret of his greatness, which chiefly lay in the extraordinary strength and purity of his convictions as to the primacy of the successors of St. Peter at a time when the civil and ecclesiastical troubles of the civilized world made men willing enough to submit themselves to any authority whatever that could establish its right to exist by courage, honesty, and knowledge of affairs. The works of Leo I. were first collectively edited by Quenest (Lyons, 1700), and again, on the basis of this, in what is now the standard edition by Ballarín (Venice, 1758-59). Ninety-three *Sermones* and one hundred and seventy-three *Epistolae* occupy the first volume; the second contains the *Liber Sententiarum*, usually attributed to Leo, and the *De Fideione Orationum Genitum*, also ascribed, by Quenest and others, to him, but more probably the production of a certain Prosper, of whom nothing further is known. The works of Hilary of Arles are appended.

LEO II., pope from August 682 to July 683, was a Sicilian by birth, and succeeded Agatho I. Agatho had

been represented at the sixth œcumenical council (that of Constantinople in 680), where Pope Honorius I. was anathematized for his views in the Monothelitic controversy as a favourer of heresy, and the only fact of permanent historical interest with regard to Leo is that he wrote once and again in approbation of the decision of the council and in condemnation of Honorius, whom he regarded as one who "profana proditiōne immaculatam fidem subvertere conatus est" in their bearing upon the question of papal infallibility these words have excited considerable attention and controversy, and prominence is given to the circumstance that in the Greek text of the letter to the emperor in which this phrase occurs the milder expression *neposyphorov* ("subverti permittit") is used for "subvertere conatus est." Thus Hefele in his *Conciliengeschichte* (iii. 294) regards as alone expressing the true meaning of Leo. It was during Leo's pontificate that the dispendance of the see of Ravenna upon that of Rome was finally settled by imperial edict. Benedict II. succeeded him.

LEO III., whose pontificate (795-816) covered the last eighteen years of the reign of Charlemagne, was a native of Rome, and having been unanimously chosen successor of Adrian I. on December 26, 795, was consecrated to the office on the following day. His first act was to send to Charles as patriarch the standard of Rome along with the keys of the sepulchre of St Peter and of the city; a gracious and condescending letter in reply made it still more clear where all real power at that moment lay. For more than three years his term of office was quite uneventful, but at the end of that period the feelings of disappointment which had secretly been rankling in the breasts of Paschalis and Campulus, nephews of Adrian I., who had received from him the offices of *prætorius* and *æcellarius* respectively, suddenly manifested themselves in an organized attack upon Leo as he was riding in procession through the city on St George's day (April 23, 799), the object of his assailants was, by depriving him of his eyes and tongue, to disqualify him for the papal office, and, although they were unsuccessful in this attempt, he found it necessary to accept the protection of Winigis, the Frankish duke of Spolito, who came to the rescue. Having vainly requested the presence of Charles in Rome, Leo went beyond the Alps to meet the king at Paderborn; he was received with much ceremony and respect, but his enemies having sent in certain written charges, of which the character is not now known except that they were of a serious nature, Charles decided to appoint both the pope and his accusers to appear as parties before him when he should have arrived in Rome. Leo returned in great state to his diocese, and was received with honour; Charles, who did not arrive until November in the following year, lost no time in assuming the office of a judge, and the final result of his investigation was the acquittal of the pope, who at the same time, however, was permitted or rather required to clear himself by the oath of purgation. The coronation of the emperor—an act the precise meaning of which does not fall to be discussed here—followed two days afterwards; the effect of it was to bring out with increased clearness the personally subordinate position of Leo. The decision of the emperor, however, secured for Leo's pontificate an external peace which was only broken after the accession of Louis the Pious. His enemies began to renew their attacks; the violent repression of a conspiracy led to an open rebellion at Rome; serious charges were once more brought against him, when he was overtaken by death in 816. It was under this pontificate that Felix of Urgel, the adoptionist, was anathematized (795) by a Roman synod. Leo at another synod held in Rome in 810 admitted the dogmatic correctness of the "filioque," but deprecated its introduction into the creed. On this

point, however, the Frankish Church persevered in the course it had already initiated. Leo's successor was Stephen IV.

LEO IV., pope from 847 to 855, was a Roman by birth, and was unanimously chosen to succeed Sergius II. His pontificate was chiefly distinguished by his efforts to repair the damage done by the Saracens during the reign of his predecessor to various churches of the city, especially those of St Peter and St Paul. It was he who built and fortified the suburb on the right bank of the Tiber still known as the Civitas Leonina. A frightful conflagration, which he is said to have extinguished by his prayers, is the subject of Raphael's great work in the Sala dell' Incendio of the Vatican. He held three synods, one of them (in 850) distinguished by the presence of Louis II., but none of them otherwise of importance. This history of this papal struggle with Hincmar of Rheims, which began during Leo's pontificate, belongs rather to that of Nicolas I. Benedict III. was Leo's immediate successor.

LEO V., a native of Ardes, was pope for some thirty days in 903 after the death of Benedict IV. He was succeeded by Sergius III.

LEO VI. succeeded John X. in 928, and reigned seven months and a few days. He was succeeded by Stephen VIII.

LEO VII., pope from 936 to 939, was preceded by John XI., and followed by Stephen IX.

LEO VIII., pope from 963 to 965, a Roman by birth, held the lay office of "protoscrinius" when he was elected to the papal chair at the instance of Otto the Great by this Roman synod which deposed John XII. in December 963. Having been hurried with unseemly haste through all the intermediate orders, he received consecration two days after his election, which was unacceptable to the people. In February 964, the emperor having withdrawn from the city, Leo found it necessary to seek safety in flight, whereupon he was deposed by a synod held under the presidency of John XII. On the sudden death of the latter, the populace chose Benedict V. as his successor, but Otto, returning and laying siege to the city, compelled their acceptance of Leo. It is usually said that, at the synod which deposed Benedict, Leo conceded to the emperor and his successors as sovereign of Italy full rights of investiture, but the genuineness of the document on which this allegation rests is more than doubtful. Leo VIII. was succeeded by John XIII.

LEO IX., pope from 1049 to 1054, was a native of Upper Alsace, where he was born June 21, 1002. His proper name was Bruno; the family to which he belonged was of noble rank, and through his father he was related to the emperor Conrad II. He was educated at Toul, where he successively became canon and (1026) bishop; in the latter capacity he rendered important political services to his relative Conrad II., and afterwards to Henry III., and at the same time he became widely known as an earnest and reforming ecclesiastic by the zeal he showed in spreading the rule of the order of Cluny. On the death of Damasus II., Bruno was in December 1048, with the concurrence both of the emperor and of the Roman delegates, selected his successor by an assembly at Worms; he stipulated, however, as a condition of his acceptance that he should first proceed to Rome and be canonically elected by the voice of clergy and people. Setting out shortly after Christmas, he had a meeting with abbot Hugo of Cluny at Besançon, where he was joined by the young monk Hildebrand, who afterwards became Pope Gregory VII.; arriving in pilgrim garb at Rome in the following February, he was received with much cordiality, and at his consecration assumed the name of Leo IX. One of his first pontifical acts was to hold the well-known Easter synod.

An army of Swiss, called into the field by Leo's diplomacy, repelled the invasion, and Italy enjoyed peace until the death of Louis XII, two years subsequently, brought to the throne a young prince who only lived for military glory, and whose entire reign was dominated by the ambition of recovering Milan and Naples. On September 13, 1515, Francis I. totally defeated the Swiss at Marignano. One of the first consequences of the battle, which reduced Leo to submission by placing the Medici in Florence at the mercy of the victor, was the loss of Parma and Piacenza. These duchies, but recently acquired by Julius II., were reunited to Milan, and Leo, temporizing in the true spirit of Italian statecraft, consented to a public interview with Francis, and became apparently his ally. Little as the pope's professions were to be depended upon, Francis thus gained the substantial advantage of a concordat seriously restricting the liberties of the Church of France. Leo meanwhile endeavored to indemnify himself for the loss of Parma and Piacenza by seizing upon the duchy of Urbino for the benefit of his nephew Lorenzo, an enterprise fully as unscrupulous as any of the similar exploits of Caesar Borgia, and by no means executed with equal ability. After a severe struggle, however, Leo's arms triumphed for the time, but the undertaking proved as injurious to his credit as to his exchequer, and the financial exhaustion which it occasioned helped to prepare the great disaster of his reign. Another unfortunate occurrence of this period was a plot of several cardinals to poison the pope, which led to the execution of one and the imprisonment of several others. Leo has been accused of excessive severity, but apparently without reason, although he may be censured for having held out expectations of pardon which he did not intend to fulfil. This conspiracy probably made him distrustful of the sacred college as then constituted, and led to one of the most remarkable acts of his pontificate, the creation of thirty-one cardinals in a single day. This dangerous stretch of authority made him absolute master in his own court for the remainder of his reign, and it must be admitted that most of the new cardinals were men of distinguished merit. A much more momentous event was now at hand, which, however, belongs more properly to the biography of Luther than that of Leo. On All Saints' eve, 1517, the daring protest of Luther against the intolerable impetuosity and rapacity of the papal vendors of indulgences, commissioned by Leo to raise money for the rebuilding of St. Peter's, gave the signal for the Reformation. Leo was at first amused. "The axe," he said, alluding to the danger he had lately escaped from, the conspiracy of the cardinals, "is taken from the root, and laid to the branches." When at length his eyes were opened he followed the policy of mingled menace and cajolery which was alone possible where the secular arm was unavailable, and which might probably have succeeded with a man of different mould from Luther. By 1520 the breach had become irreparable, and an invincible fatality had linked the name of the most ostentatious of the popes with the profoundest humiliation of the church.

Leo died before the full extent of the calamity was apparent, and amid a full tide of political prosperity which would have easily consoled him for the diminution of his spiritual prerogatives. He had profited by the general tranquillity to expel the petty tyrants of the ecclesiastical states. Perugia, Sinigaglia, Fermo had been added to the domains of the church, and Ferrara had narrowly escaped. The death of his nephew Lorenzo about the same time made him the virtual ruler of Florence also. Abroad, his policy had apparently received a check by the election of Charles V. as emperor, but the continued rivalry between Charles and his competitor Francis soon

placed the dearest wish of his heart within his reach. "Could I recover Parma and Piacenza for the church," he had said to the Cardinal de' Medici, "I would willingly lay down my life." His wish was granted him. Allying himself with Charles, he contributed efficaciously to the expulsion of the French from Milan in November 1521. Parma and Piacenza returned to the Holy See, and there was talk of the Medici replacing the Sforzas on the ducal throne of Milan. The news reached Leo at his villa of Malhana on a November night. Overjoyed, his mind engrossed by ambitious projects, he long paced a chamber through whose open window streamed the chill and malarious air of the adjoining woods. He returned to Rome in apparent health, but on the 24th of November withdrew indisposed to his apartments, and on December 1 expired with such suddenness that the last sacraments could not be administered. Poison was generally suspected, but the circumstances alleged in support of this belief wear the aspect of inventions, and seem inconsistent with the universal dismay excited by his decease. There was more ground for this consternation than men fully knew. The most fortunate and magnificent of the popes had bequeathed his successors a religious schism and a bankrupt exchequer. If, however, his profusion had impoverished the church and indirectly occasioned the destruction of her visible unity, he had raised her to the highest rank as the apparent patron of whatever contributed to extend knowledge or to refine and embellish life. If he had not kindled the genius of Raphael, employed equally by his predecessor, he had recognized and fostered it, and in so doing had apparently reconciled antique art with Christianity, and effaced the reproach of indifference or hostility to culture which for fifteen centuries had more or less weighed upon the latter. As a patron of literature Leo's merits had been even more conspicuous—every Italian man of letters, in an age of singular intellectual brilliancy, had tasted or might have hoped to taste of his bounty; had Italy been Europe, the scholars and authors elsewhere forward in revolt would have been indissolubly attached to the Church of Rome. The essential paganism of the Renaissance art and literature was not then perceived; and even now that it is fully understood the prestige which Leo gave the church remains but little impaired. The hostility of the Renaissance to Catholicism has been unanswerably shown by Catholic writers themselves, but the popular imagination only notes that Raphael and Michelangelo wrought in the name of religion, and at the bidding of a pope. However severely then Leo may be judged from the strictly sacerdotal point of view, sacerdotalism itself cannot deny its obligations to him; while, from the point of view of liberal culture, he appears as near perfection in his ecclesiastical character as that character admits.

His personal disposition has been the subject of much controversy. "Among all the individuals who have attracted the attention of mankind, there is perhaps no one whose character has stood in so doubtful a light as that of Leo X." This exaggerated dictum of Roscoe at all events expresses the fact that man's view of Leo's character have been coloured in a more than ordinary degree by party spirit. To one class he represents the ideal of the papacy as a civilizing and beneficent institution; to another—comprising Catholics as well as Protestants—he is the personification of its worldliness and apostasy. The merit or demerit of his actions will be variously estimated to the end of time. The leading traits of his character, however, are matters of fact, which prepossessions should not be allowed to distort, and it may be confidently affirmed that they were mostly amiable and laudable. He was constitutionally kind, compassionate, and beautiful—endowed with Florentine prudence and circumspection, but cast altogether in a more liberal mould than the mercantile race from which he sprang. The best of the Medici except his father Lorenzo, he is in many points more humanly interesting than the latter, and the disadvantage at which he occasionally appears is mainly attributable to his being less perfectly equipped by nature for the part assigned to him by fortune. His geniality sometimes degenerated into indolence, and

in a certain degree injured the credit of the church. His æsthetic pantheism, though upheld by real religious sentiment, fixed the reproach of paganism upon her at the precise moment when an evangelical action was springing up. The best possible pope for the age that was going out, he was the worst possible for the age that was coming in. Hence the splendours of his administration were ephemeral, and the disaster lasting. If his reputation as a pope and a statesman is thus ambiguous, no such delation need be made from his serene fame as a patron of letters and art. In this respect he stands almost alone, except for such rare examples as his father and the modern kings of Bavaria, as a prince who did not merely strike a tacit bargain with men of genius, setting his patronage against their flattery, but one who entered into their pursuits from a genuine congeniality of taste and temperament, and aided them efficiently not only as their patron but as their companion. Unlike most exalted patrons of literature, he was a scholar first and a sovereign afterwards; hence his contact with the best intellect of his age was far more direct and personal than that of an Augustus or a Louis XIV. Great as were the obligations conferred upon individuals by his tact and discernment, it is no doubt true that the intellectual movement of his age arose and could well have subsisted without him. It is none the less true that, if not the source of that light, his court was the focus to which it converged, and which gave it back with a lustre which shall render the era that bears his name, in its literary and artistic aspects, one of the brightest periods in the history of mankind.

This life of Leo was written shortly after his death by Paolo Ottonio, bishop of Novara, who had known him intimately. Roscoe's celebrated biography, though sometimes distant and sometimes cold, is in the main a work of great merit, and very aptly comes from the entire sympathy between the author and the age he depicts and the subject of his biography. It has reserved much illustration from the notes of the German and Italian translators, Henke and Bött, but requires to be re-edited with the aid of the numerous publications from archives which have taken place since Roscoe's time. André's French life is a poor performance—partial, mainly borrowed from Roscoe, and disfigured by unsuccessful efforts at the picturesque. (H. G.)

LEO XI. (Alessandro de' Medici) was chosen, under French influence, to succeed Clement VIII. as pope on April 1, 1605, and died on April 27 of the same year. His successor was Paul V.

LEO XII. (Annibale della Genga), pope from 1823 to 1829, a native of Romagna, was born on August 22, 1760. In 1790 he first gained public recognition of his talents by the success with which he accomplished the delicate task laid upon him by Pius VI. of pronouncing a funeral discourse over the emperor Joseph II.; in 1793 he was sent as nuncio to Lucerne with the title of archbishop of Tyre; in the following year he went, also as nuncio, to Cologne; in 1805 he attended the diet of Ratisbon as papal plenipotentiary; and in 1808 he shared with Caprara a difficult mission to France. Some years of retirement at the abbey of Monticelli now followed; but in 1814 he was made the bearer of the pope's congratulations to Louis XVIII.; in 1816 he became cardinal priest of Sta. Maria Maggiore, receiving also the bishopric of Sinigaglia, while in 1820 he became cardinal vicarius. On September 28, 1823, he was chosen to fill the vacancy caused by the death of Pius VII.; at the time it was believed that he had not long to live, and, in point of fact, on the 23d day of the following December his condition became so serious that the last sacraments were administered to him; suddenly, however, he recovered. One of his first cares was for the due observance of the approaching jubilee year, and on May 27, 1824, the bull was sent forth which invited all Christendom to Rome in the following December; but foreign Governments responded coldly to the appeals made for their co-operation in forwarding pilgrims, and even Leo's own subjects viewed the preparations made in their neighbourhood with indifference or aversion, and the most determined efforts of the papal government did not succeed in averting a somewhat ridiculous failure. Throughout his pontificate Leo showed himself a man of simple tastes and laborious habits; his diplomatic relations with the European powers were on the whole characterized by firmness, tact, and moderation, and perhaps the most unfavourable criticism to be made upon his domestic policy is that it was unpractical in its heedlessness and unstatesmanlike in its severity. He

died on February 10, 1829, and was succeeded by Pius VIII.

LEO I., FLAVIUS, surnamed MAGNUS and THRAX, emperor of the East, was born about 400 A.D., in the country of the Bessi, Thrace, and succeeded Marcian in February 457. At the time of his elevation he was an obscure military tribune, but had become steward to Aspar, patrician and commander of the guards, who might himself have aspired to the purple had he not been tainted with the Arian heresy. In recommending his servant to the soldiers, who proclaimed him emperor, Aspar hoped through him to be able to exercise the reality of power. The election of Leo was ratified by the senate; his coronation by Anatolius, the patriarch of Constantinople, is said to have been the earliest instance of such an ecclesiastical ceremony. The precise nature of the military success against the barbarians which, according to the chronicles, the new emperor achieved in the first year of his reign is not accurately known. Of the more conspicuous incidents of his subsequent life, the first in chronological order is his intervention in the politico-religious troubles in Egypt, where the Eutychians had gained the upper hand, and, encouraged by the Arianizing Aspar, had made their own nominee, Timotheus Ailurus, patriarch of Alexandria. Leo made peace by deposing and banishing the new patriarch, and, when reminded by Aspar that it ill became a wearer of the purple to be guilty (as in this case he had been) of promise-breaking, retorted that it was equally unbecoming that a prince should be compelled to resign his own judgment and the public interest to the will of a subject. In 466 the Huns, invading Dacia, were defeated by Leo's generals Anthemius and Anastasius, and again by the latter in 468. In 468 Leo, in concert with Anthemius, whom in the intervening year he had caused to be made emperor of the West, equipped a naval armament against the Vandals of Africa, who, under Genseric, had long been the scourge of Italy and the Mediterranean. The large fleet of more than one thousand vessels was intrusted to the command of Leo's brother-in-law Basiliscus, who, after a prosperous passage, disembarked his troops safely at Cape Bonæ within 40 miles of Carthage, but weakly granted a truce of five days to the enemy; during the interval, favoured by the wind and the darkness of the night, the fleet of Genseric, with several fireships in tow, attacked the Roman vessels, burning and sinking one half of them, and thus causing the entire failure of the expedition. A widespread belief that the Arian Aspar had somehow helped to bring about this disastrous defeat furnished Leo with a pretext for getting rid of this dangerous kingmaker, who accordingly was treacherously put to death, along with one of his sons, in 471. To avenge (as they alleged) the murder, the Goths invaded Thrace, and ravaged the country almost to the walls of the capital. In October 473 Leo associated with himself his child grandson Leo II., and in the following year he died (February 8, 474); his successor survived him for a few months only. The somewhat misleading surname of Great borne by Leo I. is due solely to the obsequious gratitude of the orthodox party; by the Arians he was, not without some show of justice, nicknamed Macellarius ("butcher").

LEO III., FLAVIUS, surnamed THESAURARIUS, a native of Isauria, born about 680, was originally called Conon, a name which he dropped after he had risen to military distinction. In 713 he received from Anastasius II. the command of the eastern army; and, when that emperor was deposed by Theodosius III. in 716, Leo, marching to Constantinople, compelled the usurper to resign, and was himself made emperor amid much popular enthusiasm, in March 718. The internal troubles of the empire had meanwhile permitted the advance of the Arabs, who in

large numbers invested the capital by land and sea in the following August; the siege was not raised until 720. Relieved from this pressing danger, and also in 721 from a conspiracy originating with the deposed emperor Anastasius II., Leo speedily inaugurated the aggressive religious policy with which his name is associated, by promulgating, in 722, the edicts commanding the baptism of Jews and Montanists throughout the empire, and in 726 that against the "idolatry of image worship," which was destined ultimately to produce so important effects on the relations of Italy and the West with Byzantium. Instigated by Pope Gregory II., the Italians refused to obey the command to remove the pictures from their churches; and when Paulus, the newly-appointed exarch of Ravenna, sought to employ force, he was defeated and slain. A revolt which had broken out in the Cyclades and the Peloponnesus was with difficulty quelled, and an insurrection in Constantinople was only repressed after much bloodshed (730). In November 730 a council was held by Gregory II. at Rome, in which anathemas were pronounced against the destroyers of images, and therefore, by implication at least, against Leo. He retaliated by severing the Trans-Adriatic provinces from the Roman patriarchate, and by confiscating large possessions of the Roman see in Calabria and Sicily. Another council under Gregory III., in 732, joined in a solemn excommunication of all iconoclasts, and image worship was set up in Rome on a more splendid scale than had previously been known. The emperor made a last effort to relieve his exarch Eutychius, shut up in Ravenna, and to bring the pope and Italy to obedience; but the great fleet which he sent was wrecked in the Adriatic, and with it the exarchate became practically lost to the empire. The closing years of Leo's reign were disturbed by troubles with the Arabs; and 740 was made memorable by a great earthquake which devastated Constantinople, Thrace, and Bithynia. He died in 741.

LEO V, FLAVIUS, surnamed THE ARMENIAN, served as general under Nicephorus I., but was banished for treachery in 811. Shortly afterwards he was recalled and appointed commander of the eastern army by Michael I. After gaining some distinction in war with the Arabs in 812, he accompanied his sovereign, in 813, on an expedition against Crum, king of the Bulgarians. Taking advantage of the disaffection of the army during a battle with the enemy near Adrianople, he withdrew with the forces under his command, leaving Michael to total defeat. Shortly afterwards he was crowned at Constantinople without opposition (813). In 814, and again in the following year, he inflicted decisive defeats upon the Bulgarians. He then began to show great zeal against the image worshippers, but such was his severity that even his closest friend, Michael the Stammerer, who had done much to help him to the throne, ultimately turned against him. Michael was convicted of conspiracy and condemned to death, but by the intervention of his friends, who assassinated Leo in the palace chapel on Christmas Eve 820, was raised from prison to the throne.

LEO VI, FLAVIUS, surnamed SAPIENS and PHILO-SOPHUS, succeeded his father, Basil I., in 886, and died in 911. One of his first acts was to depose the well-known Photius, patriarch of Constantinople, who had been his tutor. The rest of his biography, so far as recorded, tells of unimportant wars with barbarians and struggles with churchmen. In explanation of his somewhat absurd surname, all that can be said, as Gibbon has remarked, is "that the son of Basil was less ignorant than the greater part of his contemporaries in church and state, that his education had been directed by the learned Photius, and that several books of profane and ecclesiastical science were composed by the pen, or in the name, of the imperial

philosopher." His works include a treatise on military tactics (*De Apparatu Bellico*, translated by Sir John Cheske in 1554, and frequently since), seventeen *Oracula*, in iambic verse, on the destinies of future emperors and patriarchs of Constantinople, thirty-three *Orations*, chiefly on theological subjects, and some epigrams in the Greek *Anthology*.

LEO, JOHANNES, usually called LEO AFRICANUS, sometimes ELIHERITANUS (i. e., of Granada), is best known as the author of a valuable *Africa Descriptio*, which long ranked as almost the only authority in regard more especially to the Sudan. Born probably at Granada, of a noble Moorish stock, Alhasan ibn Mohammed Abwezian Alfasi (for this was his real designation) received an excellent education at Fez, where his family settled after the expulsion from Spain. He was still in his sixteenth year when he began a course of travel which extended, not only through the northern and central parts of Africa (where he had advanced to the south-east of Lake Chad), but also into Arabia, Syria, Persia, Armenia, Tartary, and portions of Europe. As he was returning from Egypt about 1517, he was captured by pirates near the island of Goaba, and he was ultimately presented as a slave to Leo X. The pope no sooner discovered what manner of man he was than he assigned him a pension; and having persuaded him to profess the Christian faith, he stood sponsor at his baptism, and bestowed on him his own names, Johannes and Leo. The new convert, having made himself acquainted with Latin and Italian, not only taught Arabic to Ægidius Antonianus, bishop of Viterbo, and others, but wrote books in both tongues. He appears to have returned to Africa, and to have put off his Christianity, before his death, but the later part of his career is involved in obscurity. He was still alive in 1526.

The *Africa Descriptio* was originally written in Arabic, but the MS. (at one time in the library of Vincenzo Pinelli, 1558-1601) is not known to be extant. The author's own translation into possible Italian was first published by Ramusio, *Avvegamento e Viaggi*. Versions of this or of the widely used Latin translation by F. Florinus have appeared in English, French, Dutch, &c. For notices of Leo's other works see Leisbach's edition (Herborn, 1801).

LEOBESCHUTZ (Bohemian, *Libetzyce*), a town in the Prussian province of Silesia, circle of Oppeln, is situated on the Zinna, about 20 miles to the north-west of Ratibor. It carries on a considerable trade in wool, flax, and grain, its markets for these commodities being very numerously attended. The principal industries are carriage-building, wool-spinning, and glass-making. The town contains three Roman Catholic churches, a Protestant church, a synagogue, a new town-hall, and a gymnasium. Leobeschutz is known to have existed in the 10th century, and from 1524 to 1623 was capital of the principality of Jägerndorf, which was divided between Prussia and Austria in 1742. Population in 1880, 12,015.

LEOCHARES, one of the sculptors of the younger Attic school in the fine period of Greek art. He is called a young man in a pseudo-Platonic epistle which must be later than 366 B.C. He worked on the Mausoleum along with Scopas, Bryaxis, Timotheos, and Pythios about 366 B.C.; the west side of the frieze, of which all the extant fragments are in the British Museum, was entrusted to him. He made the statue of Isocrates which was erected at Athens about 354 B.C. Many other portrait statues are known to have been his work. Along with Lysippos he represented Alexander the Great engaged in a lion hunt. This group was in bronze, whereas another in the Philippon at Olympia, representing the family of Philip and Alexander, was in ivory and gold. Finally, an inscription records that he made the statues of an Athenian family. Though nothing is recorded of the character of these works, it may be gathered from the list that they were idealized.

portraits; chryselephantine statues were always ideal. Leochares was also the sculptor of many purely ideal works.

These comprise three statues of Zeus, of which one was on the Acropolis, one at the Piræus, and the third was carried away to Rome, where Pliny saw it on the Capitol, he is also recorded to have carved three statues of Apollo, one of which was bought by Dionysius of Syracuse. Absolutely nothing is known of the character of these works, but we are more fortunate in regard to his masterpiece, the Rape of Ganymede, of which many imitations have been preserved to us sufficient to give some idea of its real character. Ganymede, characterized as a shepherd by crook and syrinx, has been resting under a tree, when the eagle swoops down and bears him off direct heavenwards; the looks of both are directed upwards. Ganymede, a youth of perfect beauty, does not struggle, but yields himself completely to his captor, so that his body hangs down in easy, graceful lines. The eagle, with magnificent outstretched wings, conscious, as Pliny says, "what his burden is and to whom he bears it," grasps the boy gently with his talons, and seems to swoop straight upwards, unencumbered by the weight. The problem of supporting the figure in the air, clumsily solved in the imitation preserved at St Mark's in Venice by hanging the group up with a rope, was skillfully overcome by means of the tree from beneath which the boy has been seized; while the dog beneath, looking up after his master, both gives an appearance of naturalness to the whole scene, and suggests more vividly the idea that the boy is far above the ground. The great skill of the group lay in the manner in which the idea of swift easy motion upwards was expressed; while the widespread wings of the eagle and the drooping form of the boy gave a beautiful outline to the whole. Overbeck (*Gesch. der Griech. Plast.*, ii. 51) has well expressed the distinction between the fine character of this work and the sensualism of a later class of similar groups, where the eagle is obviously Zeus himself and not a mere messenger. The colossal acrolithic statue of Ares at Halicarnassus is sometimes attributed to Leochares, sometimes to Timotheus.

On the share of Leochares in the Mausoleum and on the style of the sculptures, see Newton, *Halicarnassus, Cnidus, and Branchidae*. On the inscriptions mentioning works of Leochares, see Overbeck, *Schriftquellen*. See also Jahn, *Archæol. Beitr.*, p. 20.

LEOMINSTER, a municipal and parliamentary borough and market-town of England in the county of Hereford, is situated in a rich agricultural country on the Lug, 160 miles west-north-west of London and 12 north of Hereford. The town has regular and spacious streets, and some fine old timber houses lend picturesque interest to its appearance. The parish church, which is of mixed architecture, including the fine Norman nave of the old priory church, and contains some of the most beautiful examples of window tracery in England, was restored in 1866, and enlarged by the addition of a south nave in 1879. The other public buildings are the corn exchange, erected in 1859 at a cost of £4000, and the town-hall, to make room for which, in 1855, the Batter Cross, a beautiful example of old timber work of the date 1663, was removed to form a private dwelling house. The principal industries of the town are leather and woollen manufactures, iron and brass founding, glove and hat making, and the manufacture of agricultural implements. Leominster originated in a monastery founded by Merwald king of Mercia, who had a castle near the town, where a fortress stood till 1056, when it was demolished by the Welsh. The town received a charter of incorporation from Queen Mary, and has sent members to Parliament since the 23d of Edward I.; in 1868 its representation was reduced from two members to one. The limits of the municipal and the parliamentary

boroughs are identical, the population in 1871 being 5863, which in 1881 had increased to 6042.

See the *History* by Price (1795) and Townsend (1868), and a paper by E. A. Freeman in *Archæologia Cambrensis*, 1868.

LEON, one of the forty-nine provinces of Spain, is bounded on the N. by Oviedo, on the E. by Palencia, on the S. by Valladolid and Zamora, and on the W. by Orense and Lugo, and has an area of 6166 square miles, with a population (in 1877) of 350,210. Its boundaries on the north and west, formed respectively by the central ridge and southerly offshoots of the great Cantabrian chain, are strongly marked; towards the south-east it merges imperceptibly into the Castilian plateau, the line of demarcation being for the most part merely conventional. It belongs partly to the Miño and partly to the Duero river system, these being separated by the montañas de Leon, which extend in a continuous wall (with passes at Manzanal and Poncedadon) from north to south-west. To the Miño flow the Sil, Boeza, Burbia, Cua, Valcarlos; the principal tributaries of the Duero are the Esla (with its affluents the Tuerito, Orbigo, Bernesga, Torio, Cuereño, and Coo) and the Valderaduey. To the north-west of the montañas de Leon is the district known as the Vierzo, a richly wooded pastoral and highland district, which in its lower valleys produces grain, fruit, and wine in abundance. The Tierra del Campo in the west of the province is fairly productive, but in need of irrigation. The hills of Leon were wrought for gold in the time of the Romans; iron is still obtained to some extent; and coal and antimony also occur. The commerce and industries of the province are unimportant. Besides Leon, the capital, the only towns of any note are Astorga and Ponferrada, respectively the Asturica Augusta and the Interamnium Flavium of the Romans. There is railway communication with Madrid; but the line from Leon to Gijón at present terminates, on the south side of the pass, at Busdongo, while that to Coruña does not extend further than Briñuela.

The province was anciently inhabited by the Vettones and Callæci, after the Roman conquest it formed part of Hispania Tarraconensis. Among the Christian kingdoms which arose in Spain at the Saracenic irruption of the 8th century reigned, Leon was one of the oldest, after that of Asturias, the title of king of Leon having been first assumed by Ordoño in 913. Ferdinand I. (the Great) of Castile united the crowns of Castile and Leon in the 11th century; the two were again separated in the 12th, until a final union took place (1230) in the person of St Ferdinand. The limits of the kingdom varied with the alternations of success and defeat in war, but roughly speaking it may be said to have embraced what are now the provinces of Leon, Palencia, Valladolid, Zamora, and Salamanca. The province of Leon prior to 1833 included Leon, Zamora, and Salamanca.

LEON, the capital of the above province, is pleasantly situated upon a rising ground in the angle formed by the Torio and Bernesga, which here unite to form the Leon, a tributary of the Esla, its distance north-west from Madrid is 258 miles. The town, which is surrounded by old and dilapidated walls, everywhere presents an aspect of ruin and decay. Many of the buildings are fine. Of these the most important is the cathedral, founded about 1195; it is built in the pointed Gothic style, of a warm cream-coloured stone, and is remarkable for its simplicity, lightness, and strength. The collegiate church of San Isidro was founded in 1083, and consecrated in 1149; it is Byzantine in character. The church belonging to the convent of San Marcos, ordered by Ferdinand V. in 1514, was begun by Charles V. in 1537, and consecrated in 1541. Other buildings of less architectural importance are the town-house, the episcopal palace, and that of the Guzman family. As might be expected from the ecclesiastical character of Leon, there are a variety of religious and charitable institutions; the industries of the place are linen weaving, glove making, and the knitting of caps and

stockings, but the trade is insignificant. The population in 1877 was 11,515.

Leon (Ario, *Leyon*) owes its name to the Legio Septima Gemina of Galba, which, under the later emperors at least, had its headquarters there. The place is mentioned under this name in the *Ann. Ant.* About 540 it fell into the hands of the Gothic king Leovigildo, and in 717 it capitulated to the Saracens. Retaken about 742, it ultimately, in the beginning of the 10th century, became the capital of the kingdom of Leon. About 906 it was taken by Almanzor, but on his death, which occurred soon afterwards, it reverted to the Spaniards. It was the seat of several ecclesiastical councils, one of which was held under Alphonso V., a second in 1090, and others in 1106, 1114, 1134, 1238, and 1298.

LEON, a city of Mexico, in the state of Guanajuato, the chief town of a department, and in population second only to the capital of the republic, from which it is distant about 100 miles. It is situated on the right bank of the Rio Torbio, in the midst of a fertile and flourishing region, and is altogether one of the best built and most prosperous places in the country, with a large trade in grain and other agricultural produce, and a number of considerable industries—cotton and woollen weaving, tanning, and saddlery. For some time Leon has aspired to become the chief town of a new state, and even to take the place of Mexico as the national capital. The opening of the railways south-east to Mexico and north-east to the Rio Grande will further stimulate its development. The foundation of Leon dates from 1576, and it has ranked as a city since 1836, but the beginning of its present prosperity belongs only to the middle of the century.

LEON, the chief city of a department of the same name in the republic of Nicaragua, situated in an extensive plain about midway between the great inland lake of Nicaragua and the Pacific Ocean. It is connected by rail (1881) with Comoto on the coast (which has taken the place of Realajo, its former port); and the line is being extended to Leon Viejo on Lake Managua, and thence to Granada. The city is spread over so wide an area that Squier, after a three months' residence, found himself discovering new and secluded portions. Its public buildings are among the finest of Central America. The cathedral (1746-1774) is a strong piece of masonry, with a roof of massive arches, which has several times been used as a fortress during the civil wars. The old episcopal palace (1678), the new episcopal palace (1873), and the college of St. Ramon (1678) also deserve to be mentioned. The population is estimated at from 20,000 to 30,000. Contiguous to Leon, and practically one with it, is the Indian pueblo of Subtiaba, which has its own public buildings, and among the rest a church which almost rivals the cathedral.

At the time of the Spanish conquest Subtiaba was the residence of the great cacique of Nagrendo, and the seat of an important temple. The city of Leon, founded by Hernandez de Cordova in 1523, was originally situated at the head of the western bay of Lake Managua, and was not removed to its present position till 1630. Thomas Gage, who visited it in 1865, describes it as a splendid city; and in 1885 it yielded rich booty to Dempsey and his company. See Squier, *Central America*, vol. I., and Scherzer, *Free States of Central America*.

LEON, LUIS PONCE DE (1528-1591), usually known as Fray Luis de Leon, Spanish religious writer, was born about 1528, most probably at Granada, entered the university of Salamanca, where Melchior Cano was a few years his senior, at the age of fourteen, and in 1544 became a member of the Augustinian community there. His academical promotion was comparatively rapid; in 1561 he obtained by public competition a theological chair at Salamanca, to which in 1571 was added that of sacred literature. His views in exegesis and Biblical criticism were so far in advance of those of the majority of his immediate contemporaries that he was denounced to the Inquisition for having written a too secular translation of the book of Canticles, and for maintaining the possibility

of correcting the text of the Vulgate. In March 1572 he was consequently thrown into prison at Valladolid, where his confinement lasted until December 1576, the charges against him were then abandoned, and he was released with an exhortation to circumspection, moderation, and prudence. He at once resumed his former posts at Salamanca, and the remainder of his days were passed in comparative peace. In 1580 a Latin commentary on Canticles was published, and in 1583-85 he gave to the world three books of a treatise on the names of Christ, which he had written in prison. In 1585 also appeared the most popular of his prose works, a treatise entitled *La Perfecta Casada* ("The Perfect Wife") for the use of a lady newly married. Shortly before his death, which occurred at Madrid on August 23, 1591, his appointment to be vicar-general of the Augustinian order was sanctioned by the pope.

It is chiefly as a poet that Fray Luis de Leon is now remembered and entitled to a high place among the classic authors of Spain. His poetical works include historical translations of all the *Eidylls* and two of the *Georgics* of Virgil, some thirty odes of Horace, forty psalms, and passages from the Greek and Italian, all characterized by much spirit and grace of style. The original pieces, which are chiefly translations, not merely possess the technical merits of idiom and versification which perhaps only Christian ears can appreciate, but in many cases give beautiful expression to feelings which are shared by the whole of the Christian world. Of one in particular, the ode "De la Vida del Cielo," Hallam has justly remarked that it is "an exquisite piece of lyric poetry, which in its peculiar line of devout aspiration has perhaps never been excelled." The works of Luis de Leon include a Spanish commentary on Canticles, which was not published until 1795, a translation, in Spanish octaves, of the same book, first printed in 1806, and an exposition of Job, which first appeared in 1779.

The first collective edition of *Obras propias y traducidas* was published by Quesvedo at Madrid in 1681, another, fuller and more carefully edited, appeared at Valencia in 1761, the latest and best is that of Merino (*Obras reconstruidas y oteadas con varios manuscritos*, 6 vols., Madrid, 1804-16). His original poems, with a German translation, by Schultze and Stueck, appeared at Minster in 1868. There are two recent German monographs on Luis de Leon (Wilke, *Fray Luis de Leon*, Halle, 1866, and Rensch, *Luis de Leon u. die spanische Inquisition*, 1878), and one in Spanish (José González de Tejada, *Vida de Fray Luis de Leon*, Madrid, 1868).

LEONARDO (or LIONARDO) DA VINCI was born in 1452 and died in 1519, having during his life excelled in almost every honourable human attainment and pursuit, the commercial and political excepted. Considering the range of his speculative as well as that of his practical powers, he seems certainly the man whose genius has the best right to be called universal of any that have ever lived. In the fine arts, he was the most accomplished painter of his generation and one of the most accomplished of the world, a distinguished sculptor, architect, and musician, and a luminous and pregnant critic. In inventions and experimental philosophy, he was a great mechanician and engineer, an anatomist, a botanist, a physiologist, an astronomer, a chemist, a geologist and geographer, an insatiable and successful explorer, in a word, along the whole range of the physical and mathematical sciences when most of those sciences were new. Unfortunately he paid the penalty of his universality. The multifariousness and the equal balance of his faculties caused him to labour promiscuously in all fields of effort. He set himself to perform tasks and to solve problems too arduous and too manifold for the strength of any single life. The consequence was that in art he was able to carry few undertakings to completion, and in science to bring no fully matured researches to the light. But the works of art which he did produce were of an excellence unapproached by his contemporaries, and only rivalled by men who came a generation after him, and profited by his example; while, in science both theoretical and applied, his unpublished writings and the records of his inventions prove him to have anticipated at a hundred points the great masters of

reasoned discovery in the ensuing age. No wonder, therefore, if there has always been a mysterious attraction about his name. He stands out to after times in the character of a great if only half-effectual magician, one pre-eminently less by performance than by power. He has been called the Faust of the Italian Renaissance. The description would be just if the legend of Faust had conferred upon its hero the artist's gift of creation, as well as the ingenuity of the mechanical inventor, and the philosopher's passion for truth. As it is, these three powers, the shaping or artistic, the contriving or mechanical, and the reasoning or philosophical, had never even been imagined as existing, still less have they ever been known actually to exist, in combination, in the same measure in which they were all combined in Leonardo.

The man thus extraordinarily gifted was the son of a Florentine lawyer, born out of wedlock by a peasant mother. The place of his birth was Vinci, a "castle" or fortified village in the Florentine territory near Empoli, from which his father's family derived its name. The Christian name of his father was Piero (the son of Antonio the son of Piero the son of Guido, all of whom had been men of law like their descendant). Leonardo's mother was called Caterina. Her relations with Ser Piero da Vinci seem to have come to an end almost immediately upon the birth of their son. She was soon afterwards married in her own rank of life. Ser Piero on his part was four times married, and had by his last two wives nine sons and two daughters; but the boy Leonardo had from the first been acknowledged by his father, who brought him up in his own house, principally, no doubt, at Florence. In that city Ser Piero followed his profession, and was after a while appointed notary to the signory, or governing council of the state, a post which several of his forefathers had filled before him. The son born to him before marriage grew up into a youth of manifest and shining promise. To signal beauty and activity of person he joined a winning charm of temper and manners, a tact for all societies, and an aptitude for all accomplishments. An inexhaustible energy lay beneath this amiable surface. Among the multifarious pursuits to which he set his hand, the favourite were modelling and drawing. His father, perceiving this, sought the advice of an acquaintance, Andrea del Verrocchio, who at once recognized the boy's vocation, and was selected by Ser Piero to be his master.

Verrocchio, as is well known, although not one of the great creative or inventive forces in the art of this age at Florence, was a thoroughly capable and spirited craftsman alike as goldsmith, sculptor, and painter, while in teaching he was particularly distinguished. In his studio Leonardo worked for several years in the company of Lorenzo di Credi and other less celebrated pupils. He had soon learnt all that his master had to teach—more than all, if we are to believe the oft-told tale of the figure, or figures, executed by the pupil in the picture of Christ's Baptism designed by the master for the monks of Vallombrosa. The work in question is now in the Academy at Florence. According to Vasari the angel kneeling on the left, with a drapery over its right arm, was put in by Leonardo, and when Verrocchio saw it his sense of its superiority to his own work caused him to forswear painting for ever after. The latter part of the story is certainly false. Moreover, a closer examination seems to detect the hand of Leonardo, not only in the figure of the angel, but also in that of Christ and in the landscape background, which are designed with extreme refinement, and painted in the new medium of oil, while the remainder of the picture has been executed by Verrocchio in his accustomed vehicle of tempera. The work was probably produced between 1480 and 1482, when Leonardo

was from eighteen to twenty years of age. By the latter date we find him enrolled in the lists of the painters' guild at Florence.

Here he continued to live and work probably for eight or nine years longer. Up till 1477 he is still spoken of as a pupil or apprentice of Verrocchio, but in 1478 he receives an independent commission from the signory, and in 1480 another from the monks of San Donato in Scopeto. He had in the meanwhile been taken into special favour by Lorenzo the Magnificent. The only memorials now existing of Leonardo's industry during this period consist of a number of scattered drawings and studies, most of them physiognomical, in chalk, pen, and silver point, besides two painted panels. One of these is a large and richly composed picture, or rather a finished preparation in monochrome for such a picture, of the Adoration of the Kings, this may have been done for the monks of San Donato, and is now in the Uffizi; the other is a similar preparation for a St. Jerome, now in the Vatican gallery at Rome. We possess, however, the record of an abundance of other work which has perished. Leonardo was not one of those artists who sought in the imitation of antique models the means of restoring art to its perfection. He hardly regarded the antique at all, and was an exclusive student of nature. From his earliest days he had flung himself upon that study with an unprecedented passion of delight and curiosity. In drawing from life he had found the way to unite precision with freedom, the subtlest accuracy of definition with vital movement and flow of line, as no draughtsman had been able to unite them before. He was the first painter to recognize light and shade as among the most significant and attractive of the world's appearances, and as elements of the utmost importance in his art, the earlier schools having with one consent neglected the elements of light and shade in favour of the elements of colour and line. But Leonardo was not a student of the broad, regular, patent appearances only of the world; its fugitive, fantastic, unaccustomed appearances attracted him most of all. Strange shapes of hills and rocks, rare plants and animals, unusual faces and figures of men, questionable smiles and expressions, whether beautiful or grotesque, far-fetched objects and curiosities, these were the things which he most loved to pore upon and keep in memory. Neither did he stop at mere appearances of any kind, but, having stamped the image of things upon his brain, went on indefatigably to probe their hidden laws and causes. The laws of light and shade, the laws of "perspective," including optics and the physiology of the eye, the laws of human and animal anatomy and muscular movement, and of the growth and structure of plants, all these and much more furnished food almost from the beginning to his insatiable spirit of inquiry. The evidence of his preferences and preoccupations is contained in the list of the lost works which he produced during this period. One of these was a painting of Adam and Eve in opaque water-colours; and in this, besides the beauty of the figures, the infinite truth and elaboration of the foliage and animals in the background are celebrated in terms which bring to mind the treatment of the subject by Albrecht Dürer, in his famous engraving done thirty years later. Again, a peasant of Vinci having in his simplicity asked Ser Piero to get a picture painted for him on a wooden shield, the father is said to have laughingly handed on the commission to his son, who thereupon shut himself up with all his noxious insects and grotesque reptiles he could find, observed and drew and dissected them assiduously, and produced at last a picture of a dragon compounded of their various shapes and aspects, which was so fierce and so life-like as to terrify all who saw it. With equal research and no less effect he painted on another occasion the head of a snake-

haired Medusa.¹ Lastly, Leonardo is related to have modelled in clay and cast in plaster, about this time, several heads of smiling women and children. In addition to these labours and researches, he was full of new ideas concerning both the laws and the applications of mechanical forces. His architectural and engineering projects were of a daring which amazed even the fellow-citizens of Alberti and Brunelleschi. History presents few figures more attractive to the mind's eye than that of Leonardo during this period of his all-capable and dazzling youth. There was nothing about him, as there was afterwards about Michelangelo, dark-tempered, secret, or morose; he was open and genial with all men. From time to time, indeed, he might shut himself up for a season in complete intellectual absorption, as when he toiled among his bats and wasps and lizards, forgetful of rest and food, and insensible to the noisomeness of their corruption; but anon we have to picture him as coming out and gathering about him a tatterdemalion company, and jesting with them until they were in fits of laughter, for the sake of observing their burlesque physiognomies; or anon as standing radiant in his rose-coloured cloak and his rich gold hair among the throng of young and old on the piazza, and holding them spell-bound while he expatiated on his plan for lifting the venerable baptistry of St John, the *bat San Giovanni* of Dante, up bodily from its foundations, and planting it anew on a stately basement of marble. Unluckily it is to the written biographies and to imagination that we have to trust exclusively for our picture. No portrait of Leonardo as he appeared during this period of his life has come down to us.

The interval between 1480 and 1487 is one during which the movements of our master are obscure, and can only be told conjecturally. Up to the former date we know with certainty that he was working at Florence, under the patronage of Lorenzo de' Medici. By the latter date he had definitely passed into the service of Duke Ludovico Sforza, called il Moro, at Milan. The main determining cause of his removal would seem to have been his selection by Ludovico for the task of erecting a great memorial statue in bronze to the honour of his victorious father, the condottiere Francesco Sforza. The project of such a monument had been already entertained by the last duke, Ludovico's elder brother. After Ludovico had possessed himself of the regency in 1480, he appears to have revived the scheme, and to have invited various artists to compete for its execution. One who complied with the invitation was the Florentine Antonio del Pollaiuolo, by whom a sketch for the monument is still preserved at Munich. It would seem as if the competition had been won by Leonardo, but a considerable time had been allowed to elapse before the work was actually put in hand. The question then arises, Was it during this period of postponement that Leonardo went on his mysterious travels to the East? The earlier biographers know nothing of these travels; recent investigation of Leonardo's MSS. has brought them to light. It has been not inaptly conjectured that the speculations of transcendental Platonism, which absorbed at this time the thoughts and the conversation of the Medicean circle, were uncongenial to

the essentially experimental cast of Leonardo's mind, and that he was not averse to escape from the atmosphere of Florence. At any rate his devouring curiosity would have made welcome the opportunity of enlarging his knowledge of men and countries by Eastern travel, even at the cost, which to one of his freethinking habits would not have been great, of a temporary compliance with Islamic observances. Certain it is that he took service as engineer with the sultan of "Babylon," which in the geographical nomenclature of those days meant Cairo, and in the course of his mission visited Egypt, Cyprus, Constantinople, the coasts of Asia Minor, especially the Cilician region about Mount Taurus, and Armenia. This biographical discovery adds to the career of Leonardo a characteristic touch of adventurous and far-sought experience. Perhaps it was his acquaintance with the Levant which made him adopt the Oriental mode of writing from right to left, a habit which some of his biographers have put down to his love of mystification, and others explain more simply by the fact (to which his friend Luca Pacioli bears explicit testimony) that he was left-handed. The probable date of Leonardo's Eastern travels falls between 1480 and 1483-84. By the last-named year, if not sooner, he was certainly back in Florence, whence he wrote to Ludovico il Moro at Milan a letter making him the formal offer of his services. The draught of this letter is still extant. It does not altogether tally with the statements of the earliest biographers, that Leonardo was recommended by Lorenzo de' Medici to the duke recent particularly for his accomplishments in music. Vasari indeed says expressly that Leonardo was the bearer to Ludovico of a lyre of his invention, ingeniously fashioned of silver in the form of a horse's head. In the autograph draft of the letter, to which we have referred, Leonardo rests his own title to patronage chiefly on his capabilities in military engineering. After explaining these under nine different heads he speaks under a tenth of his proficiency as a civil engineer and architect, and adds a brief paragraph with reference to what he can do in painting and sculpture, undertaking in particular to carry out in a fitting manner the monument to Francesco Sforza. We shall probably be safe in fixing between the years 1484 and 1485 as the date of his definitive removal to Milan.

From this time for the next fourteen or fifteen years (until the summer of 1499) Leonardo continued, with very brief intervals of absence, to reside in high favour and continual employment at the court of Ludovico il Moro. His occupations were as manifold as his capacities. He superintended the construction of military engines, and seems to have been occasionally present at sieges and on campaigns. He devised and carried out works of irrigation and other engineering schemes in the territory of the duchy. He designed a cupola for the cathedral of Milan, and was consulted on the works of Certosa of Pavia. He managed with ingenuity and splendour the masques, pageants, and ceremonial shows and festivals of the court. Withal he continued incessantly to accumulate observations and speculations in natural philosophy, working especially at anatomy with Marcantonio della Torre, and at geometry and optics with Fra Luca Pacioli, for whose book *De Divina Proportione* he designed the figures. He made excursions into the Alps, and studied and drew with minute fidelity the distribution and formation of the mountain masses. He was placed at the head of a school or "Academy" of arts and sciences, where he gathered about him a number of distinguished colleagues and eager disciples. His pupils in painting included the sons of several noble families of the city and territory.

Among the more immediate scholars of Leonardo may be mentioned Antonio Boltraffio, Marco d'Oggionio, Gian Petrucci, and

¹ A picture of this subject at the Uffizi still does duty for the original of Leonardo, but is in all likelihood merely the production of some later artist to whom the descriptions of his work have given the cue. In like manner, the Madonna in the Borghese gallery at Rome, in which occurs the motive of a bottle beaded with drops of dew, though it may well be the same painting which Vasari ascribed in the possession of Clement VII., is unquestionably the work, not of Leonardo, to whom Vasari ascribes it, but of his fellow-pupil Lorenzo di Credi. Altogether apocryphal, it may here be said, is the small Madonna which is made to pass for an early work of Leonardo in the gallery at Dresden.

the master's special friend and favorite, Salai or Salino. But by far the most important painter formed under Leonardo's influence at Milan was the admirable Bernardino Lunni. Other disciples or adherents of his school were Bazzi of Siena, called Il Sodoma, Gandenno Ferreri, Andrea Solario, Bernardino dei Conti, and Ambrogio Predis or de Predis. Several of the pupils or adherents here mentioned belong, however, to a later period of the master's life than that with which we are now concerned.

Leonardo's own chief undertakings in art during his residence at the court of Ludovico il Moro were two in number, namely, the equestrian monument of Francesco Sforza and the mural painting of the Last Supper. For the former he had probably made some preparatory sketches and models before he left Florence. After his arrival at Milan the work seems to have proceeded with many interruptions, and according to a MS. note of his own to have been finally and actively resumed in 1490. In the Royal Library at Windsor are preserved a whole series of small experimental studies for the monument. Leonardo was a great lover and student of horses, and would never be without some of the noble race in his stable. It is difficult to retrace the stages of development marked by the several sketches in question, or their relations to the final design. But it seems as if Leonardo had first proposed to represent his hero as mounted on a charger violently prancing or rearing above a fallen enemy, and had in the end decided to adopt a quieter action, more nearly resembling that of the work upon which Verrocchio was simultaneously engaged at Venice. Some difficulties must have been encountered in the casting, or there would have been no meaning in the words of Michelangelo when twelve years afterwards he is said to have taunted Leonardo with incapacity on that account. But contemporary writings are explicit to the effect that the group of horse and rider, 26 feet in height, was actually cast in bronze, and set up to the admiration and delight of the people, under a triumphal arch constructed for the purpose, during the festivities held at Milan in 1493 on the occasion of the marriage of the emperor Maximilian to a bride of the house of Sforza. Within ten years the glory of that house had departed. Ludovico, twice overthrown by the invaders whom he had himself called into Italy, lay languishing in a French prison, and his father's statue had served as a butt to the Gasccon archers of the army of Louis XII. In 1501 the duke Ercole d'Este sought leave from the French governor of Milan to have the statue removed to his own city; but nothing seems to have come of the project; and within a few years Leonardo's master-work in sculpture had passed from mischief and neglect being irretrievably destroyed.

Only a little less disastrous is the fate which has overtaken the second great enterprise of Leonardo's life at Milan, his painting of the Last Supper. This, with the Madonna di San Sisto and Michelangelo's Last Judgment, is the third most celebrated picture of the world. It was painted, twenty years the earliest of the three, on the refectory wall of the convent of Santa Maria delle Grazie at Milan, where its defaced remains are still an object of pilgrimage and wonder. The commission for the work came partly from the duke and partly from the monks of the convent. Leonardo is said to have consumed upwards of ten years upon his task, a circumstance which is not surprising when we consider his fustidious spirit and the multiplicity of other calls upon his time. But the monks were impatient, and could not make allowance for the intervals of apparent idleness, intervals really of brooding and searching and meditation, which were incidental to Leonardo's way of work. On one occasion it became necessary for the duke himself, whose dealings with his gifted servant seem to have been consistently intelligent and kind, to take the painter's part against the prior of the convent. But in

working out his conception of the scene, and in devising the pictorial means for its presentation, Leonardo allowed his craving for quintessential excellence to overmaster him. He could not rest satisfied without those richnesses and refinements of effect which are unattainable in the ordinary method of mural painting, that is, in fresco, but must needs contrive by his chemistry a method for painting on the wall in oil. Neither could any of the traditional ideals of art content him in the representation of the scene. He must toil and ponder until he had realized a more absolute set of types, and grouped them in more mastery and speaking actions, than had ever been attempted before. The master type of all, that of Christ, it is said that he could never even realize to the height of his conception at all, but left it to the last uncompleted. Unhappily Leonardo's chemistry was unequal to his purpose, and his work had begun to peel and stain within a few years of its execution. The operation of time and damp has since been accelerated at intervals by the vandalism of men. After almost disappearing, the picture has been revived once and again, latterly either from copies or from engravings taken during the earlier periods of its deterioration, until now there is probably not a vestige of the original workmanship remaining. Nevertheless, through all these veils of injury and disguise, it is still possible in some measure to appreciate the power of that creation which became from the first, and has ever since remained, the typical representation for all Christendom of the sacrament of Christ's Supper.

Goethe in his famous criticism has said all that needs to be said of the essential character of the work. The painter has departed from precedent in grouping the company of disciples, with their Master in the midst, along the far side and the two ends of a long, narrow table, and in leaving the most or service side of the table towards the spectator. The chamber is seen from a perfectly symmetrical perspective, its rear wall pierced by three plain openings which admit the sense of great distance and mystery from the open landscape beyond, by the central of these openings, which is the widest of the three, the head and shoulders of the Saviour are framed in. On his right and left are ranged the disciples in equal numbers. The severity of the composition has within a moment been broken by the words of their Master, "One of you shall betray Me." In the agitation of their consciences and affections, the disciples have started into groups or clusters along the table, some standing, some still remaining seated. There are four of these groups, of three disciples each, and each group is harmoniously interlinked by some natural connecting action with the next. Leonardo, though no student of the Greeks, has perfectly carried out the Greek principle of expressive variety in particulars subordinated to general symmetry. The relations of his groups to one another, and of each figure within the several groups to its neighbour and to the central figure of Christ, are not only triumphs of technical design, they are evidences of a complete science of human character, emotion, and physiognomy held at the service of a nobly inspired and nobly directed art. The furniture and accessories of the chamber, very simply conceived, have been rendered with scrupulous exactness and distinctness, yet they leave to the human and dramatic elements the absolute mastery of the scene. Neither do the academical deprisings of the personages impair the sense of imaginative truth with which the representation impresses us. Our first glance at the ruins of this famous picture makes us feel, and study does but strengthen the conviction, that the painter rose to the height of his argument, and realized worthily and for good this momentous scene in the spiritual history of mankind.

Of authentic preparatory studies for this work there remain but few. There is a sheet at the Louvre containing some rude sketches for the arrangement of the disciples about the table, and another of great interest at South Kensington, on which the painter has noted in writing the several dramatic motives which he proposes to embody in the disciples. At Windsor and Milan are a few finished studies in red chalk for the heads. A highly-reputed series of black crayon drawings of the same heads, of which the greater portion is at Weimar, has no just claim to originality. Of the other pictures and sculptures which Leonardo is known to have executed while in the service of the duke, such as the painting of the Nativity, sent as a present to the emperor Maximilian, and the portraits of Lucrezia Orselli and Cecilia Gallerani, one of the duke's mistresses, no trace remains, nor is there sufficient reason for accepting the recently suggested attribution to Leonardo of an

simulably wrought bust now preserved in the Louvre, of which the features are those of Ludovico's wife, the duchess Beatrice.

These services, especially the maintenance of his celebrated Academy, required on the part of Leonardo no inconsiderable outlay. On the other hand, the payments received by him seem to have been neither adequate nor regular, at all events during the latter part of his residence at the ducal court, when the exigencies of war and policy were already pressing hard upon Ludovico. Leonardo had finished his Last Supper between 1497 and 1499. In the spring of the latter year we find that he received, in consideration of payments due, the gift of a vineyard outside the city. Within a month or two his patron had fallen. Milan was taken and held in hostile occupation by the French. A contemporary historian has related with what admiration the invading monarch, Louis XII., when he entered the refectory of Sta Maria delle Grazie, fixed his gaze on the work of Leonardo, and how he desired, were it possible, that it should be transported across the Alps to France. But by this time or soon afterwards the painter himself had left Milan. In the spring of 1500 we hear of him working at Venice, where, among other things, he painted (not, it appears, from life) a portrait of Isabella Gonzaga, marchioness of Mantua. The well-known head in the manner of Leonardo at the Louvre, commonly known as the *Belle Ferronnière*, has sometimes been identified as the portrait in question; but not on sufficient grounds. Early in the next year, 1501, Leonardo was once more in Florence; and thither the same marchioness, Isabella Gonzaga, sent an envoy to endeavour to attach him to her service. His answer was not unfavourable, but the envoy reported that, though recently engaged upon one or two small pictures, he was for the moment indifferent to the brush, and wholly absorbed in mathematics. In the end he attached himself, not to the court of Mantua, but to the service of Cæsar Borgia, then in the plenitude of his criminal power, and almost within reach of the realization of his huge ambitions. Leonardo's new patron had been one of the worst enemies of the fallen Ludovico, and had entered Milan as a conqueror in the suite of the French king. But artists and men of letters formed, in those days, a caste apart, and changed service not less readily than did the *condottieri* or hired military commanders. Between the beginning of 1502 and the catastrophe which overtook the house of Borgia in the summer of 1503, Leonardo travelled as engineer in the employ of Duke Cæsar over a great part of Central Italy. In Umbria and the Marches, he visited Urbino, Pesaro, Rimini, Cesena, Cosenza, Buonconvento, Perugia, and Foligno; in Tuscany, he was at Chiusi, at Siena, at Piombino on the coast over against Elba, and southward at least as far as Orvieto and Lake Bolsena, or even, it would appear, as far as Rome. He has left notes and drawings taken at each of the stations we have named, besides a set of six large-scale maps drawn minutely with his own hand, and including nearly the whole territory of Tuscany and the Maremma between the Apennines and the Tyrrhene Sea. His excursions seem to have come to an end early in 1503, as by March of that year we find him once more in Florence.

To the period of three years' wandering which followed Leonardo's departure from Milan there ensued another period of three years, during which he lived a settled life at Florence. He was now fifty-one years of age, and the most famous artist of Italy, though within a year or two the young Michelangelo was destined to challenge his supremacy, and the still younger Raphael to apprehend and assimilate the secrets of his skill, as he did those of the skill of every great predecessor and every distinguished rival in succession. The first important commission put

into Leonardo's hands at Florence was that for an altarpiece for the church of the Servite monks (Santa Maria dell' Annunziata). The work had been already entrusted to Filippino Lippi, who had even made some beginning with it, but willingly gave up his claim in favour of his illustrious fellow-citizen. The monks undertook to lodge and nourish Leonardo in their convent while he carried on the work. After long premeditation he began, and prepared that admirable cartoon in black chalk which is now the treasured possession of the Royal Academy in London. The Virgin, partly seated on the left knee of St Anne, holds by the body the infant Christ, who leans across the figure of the elder woman, and lifts his hand in benediction of the little St John leaning against her knee. In the lines and management of the composition there is not less charm than there is research. The elder mother smiles upon her daughter, and the daughter smiles upon her child, each with a look of loving prescience and rapt self-congratulation which is the sweetest of all those mysterious expressions that Leonardo loved to seize and to perpetuate. When the cartoon was finished and exhibited, all Florence came flocking in delight to see and praise it. Between fastidiousness and preoccupation Leonardo, however, carried the undertaking no farther, and the work was put once more into the hands of Filippino Lippi, and on his death into those of Perugino. Leonardo's next great enterprise at Florence was a historical painting for the Palace of the Signory. He had been on the commission of artists appointed to determine where Michelangelo's statue of David should be placed, and now he was chosen, along with his young rival, to finish a mural picture for the new Hall of Council. Each painter chose a battle subject: Michelangelo, as is well known, the surprise of the Florentine forces in the act of bathing near Pise; Leonardo, an episode in the victory of the generals of the republic over Niccolò Piccinino at Anghiari, in the upper valley of the Tiber. In one of the sections of the *Treatise on Painting*, Leonardo has detailed at length, and obviously from his own observation, the pictorial aspects of a battle. His choice of such a subject was certainly not made from any love of warfare or indifference to its horrors. In the writings of Leonardo there occur almost as many trenchant sayings on life and human affairs as on art and natural law, and of war he has disposed in two words as a "bestial frenzy" (*paria bestialissima*). In his design for the Hall of Council, Leonardo set himself to depict this frenzy at its fiercest. He chose the moment of a terrific struggle for the colours between the opposing sides; hence the work became known in the history of art as the Battle of the Standard. Judging by the accounts of those who saw it, the tumultuous entanglement of men and horses, and the expressions of martial fury and despair, must in this case have been combined and rendered with a mastery not less commanding than had been the looks and gestures of souls' perplexity and dismay among the peaceful company on the convent wall at Milan. Leonardo had finished his cartoon in less than two years (1504-1506), and when it was exhibited along with that of Michelangelo, the two rival works seemed to all men a new revelation of the powers of art, and served as a model and example to the students of that generation, as the frescos of Masaccio in the Carmine had served to those of two generations earlier. The young Raphael is well known to have been one of those who profited by what they saw. Other Florentine artists who were especially influenced at this time by Leonardo were Fra Bartolommeo, Jacopo da Pontormo, Ridolfo del Ghirlandajo; and in sculpture Baccio Bandinelli and Rusconi. He also speaks of having among his pupils G. P. Perini called "Il Fattore," a certain Lorenzo, and a German Jacopo, who cannot be further identified.

His favourite assistant Salai had, we know, accompanied him from Milan, and remained with him.

Leonardo lost no time in proceeding to the execution of his design upon the mural surface; this time he had devised a technical method of which he regarded the success as certain, the colours were to be laid on a specially prepared ground, and then fixed by heat, in some way analogous to the processes of encaustic or enamel. When portions of the work were done the heat was applied, by means of fires lighted on platforms, but it was found to take effect unequally, and the result was a failure more or less complete. Leonardo abandoned the work in chagrin, and presently betook himself to Milan. Payments for his great battle-picture had been made to him in advance, and the gonfalonieri Piero Soderini complained on behalf of the signory that Leonardo had treated them ill. When, however, he soon afterwards honourably offered to refund the amount, the offer was not less honourably declined. The unfinished painting before long disappeared from the wall. The cartoon also, no less than the competing cartoon of Michelangelo, has perished. Our only memorials of the work are a few preliminary sketches, an engraving executed by Lucenti in 1558, not from the original but from a copy, and the far more celebrated engraving of Edelunk after a study made by Rubens, in his own essentially personal, ostentatious, un-Italian manner, of a portion only of the composition. During the years between 1500 and 1505 Leonardo was also engaged at intervals upon the portraits of two ladies of the city—Giovanna Bonci, and Lisa di Antonio Maria di Noldo Gherardini, the wife of Zanobi del Giocondo, commonly called *Mona* (i.e., Madonna) *Lisa* or *la Gioconda*. The first of these portraits is lost; the second was bought by Francis I. for four thousand gold florins, and is now one of the glories of the Louvre. In Madonna Lisa Leonardo seems to have found a sitter whose features possessed in a singular degree the intellectual charm in which he delighted, and in whose smile was realized that inward, haunting, mysterious expression which had always been his ideal. He worked, it is said, at her portrait during some portion of four successive years, causing music to be played during the sittings that the rapt expression might not fade from off her countenance, and labouring by all the means of which he was master to bring his work to perfection. It remains perhaps the most striking example of his powers. The richness of colouring on which Vasari expatiates has indeed flown, partly from injury, partly because in his preference for effects of light and shade the painter was accustomed to model his figures on a dark ground, and that in this picture the ground has to a large extent come through. Nevertheless, in its brown and faded state, the portrait is pre-eminent alike for fascination of expression, for refinement and precision of drawing, and for the romantic invention of its background, wherein a far-seen champagne with bridged rivers and winding roads is bounded by a fantastic coast of islands and rock-bound estuaries.

During these years of work at Florence, Leonardo's father died at a good old age in that city. Some stray notes, in which the painter mentions a visit to "Caterina" in the hospital, and inscribes the amount of expenses paid "for the funeral of Caterina," though they are of uncertain date, prove too that when Leonardo's peasant mother drew near her end her illustrious son was there to tend her. From his half brothers, the legitimate children of Ser Piero, Leonardo after their father's death experienced unkindness. They were all much younger than himself. One of them, who followed his father's profession, made himself the champion of the others in disputing Leonardo's claim to his share, first in the paternal inheritance, and then in that which had been left to be divided between the

brothers and sisters by an uncle. The litigation thus set on foot lasted for several years, and the annoyances attending it, with his disappointment at the failure of his great wall-painting, may have been among the causes which determined Leonardo to go back to Milan. Return thither he at all events did, with leave obtained from the signory, and attended by his faithful Salai, in the summer of 1506.

For nearly nine years after that he seems to have made the Lombard city his principal home, residing sometimes on his own vineyard and sometimes in the villa of a wealthy young friend and disciple, Francesco Melzi. The French remained in occupation at Milan until 1513, and Leonardo held the title of court painter and engineer to the French king, Louis XII., the transfer of his services having been formally requested by that monarch from the Florentine signory. The record of his occupations and performances during this period is meagre. He was several times, and for considerable periods at a time, in Florence, on business connected with the litigation above mentioned. From thence he writes at the beginning of 1511 to the French governor of Milan, asking about the payment of his salary, and saying that he means to bring with him on his return two pictures of the Madonna, of different sizes. But there can be no doubt that his thoughts became with his advancing years ever more and more engrossed in the problems of natural science. To this time belong a large proportion of the vast collections in which are accumulated the results of his observation and research.

There are only three extant pictures which we can with probability assign to this, the second Milanese period of Leonardo's career, and to what points within the period they refer. Two of these are replicas or rather variations of the same theme, the *Virgin and Child with St John the Baptist and an angel*, in a landscape of fantastic rocks and flowery grottoes by the sea-shore. The composition is known as the *Pierre aux Rochers*. The most celebrated version of it is that formerly in the collection of Francis I., and now in the Louvre. The other version was painted, according to Lomazzo, for the Cappella della Consolazione at Milan, where it was purchased in 1798 by Gavin Hamilton, and by him sold to the earl of Suffolk, from the hands of whose descendant it has lately passed into the National Gallery. Both of these paintings seem to betray signs of the handwork of the master himself, assisted probably in each case by pupils. Both have suffered, the French example most from repainting, the English most from blackening. On the whole, of these two admirable and fascinating pictures, the English example may be pronounced to be both of the higher antiquity and the greater beauty, having the advantage of the French especially in the difference of position in the right hand of the kneeling angel. The third picture conjecturally referred to about this date is also at the Louvre, and again represents a holy family. Leonardo has recurred to the motive on which he had founded his design for the Church of the Servites at Florence, in so far as he has seated the Virgin in the lap of St Anne, whom he depicts smiling at the happy intercourse of her mystic grandchild and his mother. But this time the Virgin stoops across as she sits, to lift the child from the ground on which he stands fondling a lamb. John the Baptist is absent, and the background is a pastoral landscape bounded towards the horizon by jagged mountains. The picture is unequally finished—minutely in some parts, and in others carelessly enough.

A great change took place in the affairs of Milan at the close of the year 1512. The French supremacy came to an end, and Maximilian Sforza, the son of Ludovico, returned for a few years to rule over the reduced dominions of his father. All affairs were thrown into confusion, and Milan ceased to be a desirable place of abode for Leonardo and his scholars. In the meantime Giovanni de' Medici, the son of the painter's ancient patron Lorenzo, was elected pope under the title of Leo X., and continued with still greater magnificence the encouragement of art and artists of which his walklike predecessor Julius had set the example. On the 24th September 1514 Leonardo too set out for Rome from Milan, with a company of his pupils. The youngest brother of the pope, Giuliano de' Medici, was his friend, but it is not true that Leonardo, as

Vasari says, had accompanied Giuliano to Rome on the occasion of his brother's elevation to the papal chair. Ill success attended the now ageing master during his stay in the shadow of St Peter's. He is said, indeed, to have delighted the pope, who was himself something of an alchemist, by his experiments and ingenuities in science, and especially by a kind of zoological toys, which he had invented by way of pastime, as well as mechanical tricks played upon living animals. But when, having received a commission for a picture, he was found distilling for himself a new medium of oils and herbs before he had begun the design, the pope was convinced, not quite unreasonably, that nothing serious would come of it. The hostility of Michelangelo, with whom Leonardo was in competition for the façade of San Lorenzo at Florence, may also have done something towards hindering the employment of the elder master on any important works. At all events no such employment came to him, and he seems, while he was at Rome, to have painted nothing but two small panels, one of a child, the other of a Madonna, for an official of the papal court.

By the end of the year 1515 Leonardo had left Rome and returned once more to Milan. In the meantime the brief rule of Maximilian Sforza had been terminated by the victory at Marignano of Francis I., who prevailed on Leonardo, by this time in his sixty-fourth year, to enter his service and return with him to France. It was in the beginning of 1516 that the painter crossed the Alps, taking with him his friend, the youthful Francesco Melzi. The Château Cloux in Touraine, near Amboise, was appointed for his place of residence. But his race was nearly run. In France he projected some canal works, and painted two pictures of classical mythology, which have been lost, a Leda and a Pomona; and that was all. He desired to put in order some of his vast accumulations of MS. notes and researches, but soon discovered that he who had been endeavouring so intently for all these years, in his own words, to learn to live had only been learning to die. That form of strength and beauty, and that exquisitely shaping and all-searching mind, were dissolved before decay or infirmity impaired them. Leonardo died at Cloux, in the sixty-seventh year of his age, on the 2d of May 1519. King Francis, then at his court of St Germain en Laye, is said to have wept for the loss of such a servant; that he was present beside the death-bed and held the dying painter in his arms is a familiar but an untrue tale.

The contents of our narrative will have justified the definition of Leonardo with which we set out, as a genius all but universal and a man pre-eminently great, yet great rather by power than by performance. Thus, in painting, there have come down to us no more than ten undisputed works from his hand; and among those ten are included the picture by his master Verrocchio in which Leonardo had only a share, as well as the cartoon at the Royal Academy, and the unfinished panels at the Uffizi and the Borghese gallery. Of the remaining well certified works of Leonardo, one is at the National Gallery (the Suffolk *Vierge aux Rochers*), the others are the second *Vierge aux Rochers*, the Virgin and Child with St Anne, the portrait of Mona Lisa, and the young John the Baptist, all at the Louvre. The remains of the fresco said to have been painted by Leonardo and Melzi together, in the villa which belonged to the latter at Vaprio near Milan, are too fragmentary and disputable to be counted. Of works, in addition to these, ordinarily claimed for Leonardo's hand, the best and nearest to his manner, if not actually his, is the portrait commonly known as *La Belle Ferronnière*, also at the Louvre, which students conjecture to be in reality that of the marchioness of Mantua, others that of Lucrezia Crivelli. Another highly reputed picture in the manner

of Leonardo is the *Vierge au Bas-relief* at Gaton Park; another version, however, of the same theme, said to be in no way inferior to that at Gaton, exists at Milan, and is there rightly attributed to Cesare da Sesto. The multitude of smiling daughters of Herodias, allegorical Floras, and the like, besides some admirable religious pictures (including the Christ Preaching to the Doctors, at the National Gallery), which are currently attributed in public and private galleries to Leonardo, belong really to the various pupils or imitators of his school—the greatest number to Bernardino Luini, who added to a peculiar grace and suavity of his own much of the great master's intellectual power and exquisiteness of choice and finish. Such as they are, the meagre original remains of Leonardo's craft in painting are enough to establish his place in history as the earliest complete painter of the Renaissance. In his work there are no longer to be perceived, as there are in that of all his contemporaries, any of the engaging imperfections of childhood; there is no longer any disproportion between the conception and its embodiment. He had wrestled with nature from the cradle, and for the purposes of pictorial representation had mastered her. He could draw with that ineffable left hand of his (the words are those of his friend Luca Pacioli) a line firmer, finer, and truer than has been drawn by the hand of any other man, excepting perhaps Albert Durer. Further, Leonardo carried the refinement of solid modelling in light and shade to the same high point to which he carried the refinements of linear definition. Colour he left where he found it, or rather perhaps, by his predilection for effects of light and shade, did something towards bringing about the degradation of colour. Of character and action he was an unrivalled master—preferring for his own pleasure the more far-fetched and enigmatical, sometimes even the grotesque among human types and expressions, but capable on occasion, as in his master-work of the Last Supper, of laying aside curiosity and strangeness, and treating a great theme in a great and classical spirit. If these qualities can be sufficiently discerned in the few extant paintings of this master, it is only by the study of his drawings and sketches that his industry and fertility in the graphic art can be appreciated. These are very numerous as well as very various in kind, and are widely scattered among different possessors, occurring sometimes apart from and sometimes in connexion with the sheets of his MS. notes and writings (see note below).

Passing from Leonardo's achievements in art to his attainments and inventions in science, a subject on which the present writer has no authority for speaking at first hand, it appears that, in this sphere also, the spirit of fanciful curiosity and ingenuity coexisted in Leonardo with an incomparably just and powerful grasp of natural fact and natural law. Gossiping biographers like best to speak of his mechanical birds, of his mechanical walking lion stuffed with lilies, of the lizard which he fitted with horns and artificial eyes and oscillating wings filled with quicksilver, and the like; but serious students assure us that he was one of the very greatest and most clear-sighted as well as one of the earliest of natural philosophers. They declare him to have been the founder of the study of the anatomy and structural classification of plants; the founder, or at least the chief reviver, of the science of hydraulics; to have anticipated many of the geometrical discoveries of Commandino, Autolycus, and Tartaglia; to have divined or gone far towards divining the laws of gravitation, the earth's rotation, and the molecular composition of water, the motion of waves, and even the undulatory theory of light and heat. He discovered the construction of the eye and the optical laws of vision, and invented the camera obscura. Among useful appliances he invented the saw which is still in use in the marble quarries of Carrara,

and a rope-making machine said to be better than any even yet in use. He investigated the composition of explosives and the application of steam power; he perceived that boats could be made to go by steam, and designed both steam-cannon and cannon to be loaded at the breach. He made innumerable designs for engines of war, and plans of tunnels and canals for traffic. A few of his practical inventions were carried out in his time, but both of these and of his speculative researches the vast majority, lying buried in unpublished MSS., remained after his death unknown or forgotten. The discoveries which he had made wholesale were left to be rediscovered piecemeal by the men of narrower genius who came after him.

So much for the intellectual side of Leonardo's character and career. As a moral being we are less able to discern what he was like. The man who carried in his brain so many images of subtle beauty, as well as half the hidden science of the future, must have lived spiritually, in the main, alone. Of things communicable he was at the same time, as we have said, communicative—a genial companion, a generous and loyal friend, ready and eloquent of discourse, and impressing all with whom he was brought in contact by the power and the charm of genius. We see him living on terms of constant affection with his father, tending the last hours of his mother, and in disputes with his brothers not the aggressor but the sufferer from aggression. We see him open-handed in giving, not grasping in getting—"poor," he says, "is the man of many wants", not prone to resentment—"the best shield against injustice is to double the cloak of long suffering"; zealous in labour above all men—"as a day well spent gives joyful sleep, so does a life well spent give joyful death." With these instincts and maxims, his moral experience is not likely to have been deeply troubled. In matters of religion he seems to have had some shade of the philosophical scepticism of a later age. In matters of the heart, if any consoling or any disturbing passion played a part in his life, we do not know it; we know only of affectionate relations with friends and pupils, of public and private regard mixed in the days of his youth with dazzled admiration, and in those of his age with something of reverential awe.

Of the presence and aspect of this illustrious man we have, as has been said, no record belonging to the earlier period of his life except that of the written descriptions which celebrate his beauty. The portraits which we possess represent him in after years, as he may have appeared during his second residence at Milan, when the character of sage and archmage had fully imprinted itself on his countenance. The features are grand, clear, and deeply lined, the mouth firmly set and almost stern, the eyes strong and intent beneath their bushy eyebrows, the hair long and white, descending and commingling with a majestic beard. The most authentic sheet which thus represents him is a drawing nearly in full face, unquestionably by his own hand, at Turin. Other studies, but none of such high quality as this, represent the same features in profile. On both the full-face and the profile drawings many painted portraits have been founded, some of them done by nearly contemporary hands; but none can with safety be attributed to the master himself.

The materials for a definitive life of Leonardo are at present wanting. They may be expected to be in great part supplied by the promised publication of Dr J. P. Richter's *The Literary Work of Leonardo da Vinci*. In the meantime the study of the painter (London, 1860), supplemented by his "Leonardo-Bronze" in *Ullrich's Geschichte der Malerei*, 1868, 1881, and by Ivan Lermoloff's (*St. Glor. Kordell*) in his *Verke in Leonardo's Meister in Florenz, Dresden, u. Berlin*, 1880, p. 107 sq. See also Carl Weermann in *Wilmann und Weermann, Geschichte der Malerei*, vol. II, p. 341 sq. On several matters of fact the authorities here named must be regarded as superseding all earlier biographies. The principal of these, taking them in the chronological order of their composition, are as follows: F. Jovin, "Vita Leonardo Vinci", printed in *Trionfo della Letteratura*, t. III, 1718-19, "Breve vita di Leonardo da Vinci, scritta da un Anonimo del 1600," printed by G. Milanesi in the *Archivio Storico Ital.*, 1872, p. 221 sq.; Vasari in his celebrated *Lives*, and Leonardo in his *Trattato dell'arte della pittura* (1485), and *Libro del tempo della pittura* (1490). From this time no constitution of importance was added until the work of Amoretti, which has furnished the foundation of all later biographies of Leonardo. The other chief contributions of new material have been contained in Passaghi, *Scuola di Leonardo da Vinci*, 1811, Gaye, *Catálogo di opere*, 1818, vol. I, pp. 243-251, the *Leonardatext* of Vasari, 1851, vol. VII, p. 11 sq., the new edition of the same by G. Milanesi, vol. I, p. 17 sq., G. L. Calvi, *Storia del professor di Leonardo da Vinci*, 1851, 1853, and Gust. Ullrich, *Historische Notizen u. Leonardo da Vinci*, 1853, 1872. The best general handling of the subject, antecedent to those mentioned at the beginning of our list, have been, those of G. Ardy, *Leonardo da Vinci*, 1854, and *Leonardo da Vinci*, 2d ed., Paris, 1876; and Charles Clément, *Raymond, Leonardo da Vinci, et Michelangelo*, 4th ed., Paris, 1879; in Germany, by G. F. Waagen, *Kleine Geschichte der Kunst*, 1876, W. Lohse, *Leonardo da Vinci*, 1881, and C. Bruns in *Dohme's Kunst u. Künstler*, vol. II, No. 81, in England, Mrs. Weston, *Life of Leonardo da Vinci*, London, 1874. With regard to the scientific attainments and achievements of Leonardo, the authorities are: B. Venturi, *Essai sur les ouvrages physico-mathématiques de Leonardo da Vinci*, Paris, 1797; Max Ueber M. A. Turin u. Leonardo da Vinci, Göttingen, 1848; Libri, *Storia delle Scienze Matematiche in Italia*, vol. II, Lombardini, *Dei tempi e del Progresso della Scienza Italiana*, Milan, 1872; G. Mongali, G. Gavai, and C. Belio, *Storia delle opere di Leonardo da Vinci*, Milan, 1873 (a summary of the conclusions of those writers is given in an essay by C. F. Black in *Mrs. Weston's biography*); and lastly, H. Grotte, *Leonardo da Vinci als Ingenieur u. Philosoph*, Berlin, 1874.

The celebrated *Veritas in Pictura*, which has hitherto been the only published portion of Leonardo's writings, consists of brief didactic sketches, or more properly personages, of practical dissection or critical remarks on all the branches as well as the conditions of a painter's practice. The original MS. draft of Leonardo has been lost, though a great number of sketches and fragments have been preserved in various extant volumes of his MSS. The work has been printed in two different forms, one of these is an abridged version consisting of 508 sections, the first edition of it was published in Paris in 1803, the last translated into English by J. F. Bland, in London, 1877. The other is a more extended version, an 812 sections, divided into eight books, this was printed in 1817 by Greg. Kneller at Rome, from a 17th century MS which was discovered in the Vatican Library, a German translation from the same MS, has been edited by G. H. Ludwig in *Reibberger's series of Quatzenchriften* (*Quatzenchriften*), the history of the book in general see Max Jordan, *Das Mittelalter des Leonardo da Vinci*, Leipzig, 1878.

The MSS., writings, sketches, and memoranda of Leonardo have undergone many vicissitudes since they were bequeathed in the mass by their author to his friend and nephew Francesco Melzi. Within fifty years of Leonardo's death the mass of that laborer had shivered them to pieces out of his hands, and they were in the possession partly of the sculptor Pompeo Leoni, and partly in that of Dr. Giulio Mancini. By Melzi a considerable portion of the MSS. was deposited in the Ambrosian Library at Milan. During the domination of the French under Bonaparte, these MSS. were brought to France, and the greater part of them were not restored to Milan, indeed, some of the MSS. were lost, and some of Leonardo's MSS. which he perhaps had the most valuable of them all, and is called from its title the *Codex Atlanticus*. Fourteen volumes now are in the library of the Institute at Paris. A number of other MSS. are in the library of the Louvre—the most important in the Royal Library at Windsor, some at the British Museum, and South Kensington (Pompeo Leoni), and partly in that of the Louvre and the Ambrosian Library. The well-known mass, beginning "Chi non può quel che vuol, quel che può voler," which has been quoted since the 16th century as of Leonardo's writing, is probably the work of a pupil, and which fifty years before his time (see G. Ullrich in the journal *Il Quotidiano*, 1878) (S C)

LEONIDAS ("Son of the Lion") was a very common Greek name. The most famous person who bore it was a king of Sparta, seventeenth of the Agid line. He had been king for one year when Xerxes invaded Greece, 480 a.c. The congress of the Greek states bent on resistance, which met at the Isthmus of Corinth, sent Leonidas with a force of at least 8000 men to hold the narrow pass of Thermopylae against the Persians (see GRECE). When the Persians, through the treacherous aid of Ephialtes, had turned the pass, Leonidas dismissed all his army except the 300 Spartan citizens, 700 Thespians, and the Theban contingent, which was suspected of treachery. Every man of the Lacedaemonians and Thespians died on the field, while the Thebans laid down their arms. A monument was erected on the spot where the Greeks made their final struggle. It was a lion, and we may compare with it the lion set up by the Thebans on the battlefield of Cheronnea to commemorate the sacred band who were all slain there 338 a.c. There is no foundation for the common story that Leonidas had only three hundred men with him at Thermopylae.

There were also two Greek poets named Leonidas. The elder was born at Tarentum, and lived in the time of Pyrrhus; he spent a wandering life of poverty. There remain over a hundred of his epigrams, chiefly inscriptions on works of art, or dedicatory offerings, which are among the best of their kind, showing much ingenuity of thought and cleverness of expression. The other was born at Alexandria, and came to live in Rome, where he obtained great reputation in the time of Nero. His epigrams are destitute of merit. The only ingenuity displayed in them

is that some of them have an equal number of letters in every verse.

LEONTINI, a town in the south-east of Sicily, was founded by the Chalcidians from Naxos (730 B.C.). Its history is so interwoven with that of its more powerful neighbour Syracuse that it can hardly be treated separately. The people of Leontini were more than once transferred to Syracuse, but the town was always refounded.¹ It was situated in a very fertile district, and was a wealthy place, as is proved by its numerous coins, on which ears of corn are a frequent type. The *locus classicus* for the topography of the ancient city is Polybius, vii. 6. The most distinguished name in literature belonging to Leontini is that of the sophist Gorgias. It continued to exist throughout the Roman and mediæval periods, and still preserves the old name slightly altered as Lentini.

LEOPARD, a name now commonly given to a well-known animal, called pard (*πάρος* and *πάρδαλις*) or panther (*πάνθηρ*) by the ancients. Leopard (*leo-pardus*) was a later term, originally applied, it is believed, to the animal now known as the cheetah or hunting leopard, upon the supposition that it was a creature intermediate between the lion and the true pard. If so it has been completely transferred to the more common species, and though in this sense a perfectly unnecessary and unmeaning term, has gradually superseded those by which this was originally known. *Pard*, so commonly used by Elizabethan authors, is now nearly obsolete in the English language, and panther has either become synonymous with leopard, or is used



Leopard

vaguely for any similar large feline animal, even the puma of America.

Owing to their extensive geographical range, and the great variations, both in size, form, and coloration to which leopards are subject, zoologists have scarcely decided whether all the forms popularly referred to this animal should be regarded as specifically alike, or whether they should constitute several distinct species, but the prevailing opinion at present is in favour of the former view. The attempts to separate a larger and more robust variety, under the name of panther, from a smaller and more

graceful form, to which the term leopard might properly be restricted, have failed owing to the existence of intermediate conditions which cannot be assigned definitely to either one or the other form. The most marked anatomical difference yet noted in different varieties of leopard is in the length of the tail as compared with that of the body, even the number of the caudal vertebrae showing variation, though within what limits, and whether correlated with other characters, has not yet been clearly ascertained. The fur of those specimens which inhabit the most northern confines of its range of distribution, as North China, is longer and softer, and the markings are consequently less distinct than on those from more congenial climates, and the well-marked variation thus produced has given rise to the idea of specific distinction.

Treating the species as one, it is the *Felis pardus*, Linn., of most systematic authors, belonging to the family *Felidae* (for the characters of which see MAMMALIA), and is one of the most typical members of the genus *Felis*, both in its structure and habits. It belongs to that section of the genus (which includes most of its larger members, as the lion and the tiger) in which the hyoid bone is loosely connected with the skull, owing to imperfect ossification of its anterior arch, and in which the pupil of the eye when contracted under the influence of light is crenulate, not linear as in the smaller cats. The teeth consist on each side of three small incisors, and a formidable large, conical, sharp-pointed canine above and below, and three premolars and one molar above, and two premolars and one molar below, all except the very small upper true molar with sharp compressed trenchant crowns. The skull can scarcely be distinguished, except by its inferior size, from that of the lion. There are seven cervical, thirteen dorsal, seven lumbar, three sacral, and usually twenty-three caudal vertebrae. The toes, five on the forefoot (of which the first or pollex is much shorter than the others) and four on the hind foot, are all armed with powerful, sharp-pointed, much-curved, compressed, retractile claws. The size of different individuals, as before said, varies greatly, the head and body usually measuring from $3\frac{1}{2}$ to $4\frac{1}{2}$ feet in length, and the tail from $2\frac{1}{2}$ to 3 feet, but specimens have been met with which fall short of or exceed these limits. The ground colour of the fur varies from a pale fawn to a rufous buff, graduating into a pure white on the under parts and inside of the limbs. This is spotted over with dark brown or black, the spots on the back and sides being arranged in rosettes or broken rings, which vary greatly in size and distinctness in different individuals, but are without the central spot seen in those of the jaguar. The spots on the under parts and limbs are simple and blacker than those on the other parts of the body. The bases of the ears behind are black, the tips buff. The upper side of the tail is buff, spotted with broken rings like the back, its under surface white with simple spots. The hair of the cubs is longer than that of the adults, its ground colour less bright, and its spots less distinct. Perfectly black leopards, which, however, in certain lights show the characteristic markings on the fur, are not uncommon. These appear to be examples of *melanism*, occurring as individual variations, sometimes in one cub out of a litter of which the rest are normally coloured, and therefore not indicating a distinct race, much less a species. These are met with chiefly in southern Asia. We are not aware of any recorded case from Africa, but the wild animals of that continent are not so well known.

In habits the leopard resembles the other large cat-like animals, yielding to none in the ferocity and bloodthirstiness of its disposition. It is exceedingly quick and active in its movements, but seizes its prey by waiting in ambush or stealthily approaching to within springing distance, when

¹ The restoration of the Leontine exiles was one of the alleged reasons for the Athenian expedition against Syracuse, 417 B.C.

it suddenly rushes upon it and tears it to ground with its powerful claws and teeth. It preys upon almost any animal it can overcome, such as antelopes, deer, sheep, goats, monkeys, peafowl, and is said to have a special liking for dogs. It not infrequently attacks human beings in India, chiefly children and old women, but instances have been known of a leopard becoming a regular "man-eater." When favourable opportunities occur, it often kills many more victims than it can devour at once, apparently to gratify its propensity for killing, or only for the sake of their fresh blood. It generally inhabits woody districts, and can climb high trees with facility when necessary for its safety when hunted, but usually lives on or near the ground, among rocks, bushes, and roots and low branches of large trees.

The present geographical range of the leopard is very extensive, as it is met with in various suitable localities, where not too much interfered with by human cultivation, throughout the greater part of Africa from Algeria to the Cape Colony, and through the whole of the south of Asia from Palestine to China, including all India south of the Himalayas, and the islands of Ceylon, Java, Sumatra, and Borneo. Fossil bones and teeth, indistinguishable from those of existing leopards, have been found in cave deposits of Pleistocene age in Spain, France, Germany, and England. The evidence of the former existence of the leopard in England is described at length by Boyd Dawkins and Sanford in their *British Pleistocene Mammalia* (Paleontographical Society, 1872). (W. H. F.)

LEOPARDI, GIACOMO (1798-1837), the one Italian poet of the 19th century who has taken an uncontested place among the classics of the language, was born at Recanati in the March of Ancona, June 29, 1798. All the circumstances of his parentage and education conspired to foster his precocious and sensitive genius at the expense of his physical and mental health. His family was ancient and patrician, but so deeply embarrassed as to be only rescued from ruin by the energy of his mother, who had taken the control of business matters entirely into her own hands, and whose engrossing devotion to her undertaking seems to have almost dried up the springs of maternal tenderness. Count Monsalvo Leopardi, the father, a mere nullity in his own household, secluded himself in his extensive library, to which his nervous, sickly, and deformed son had free access, and which absorbed him exclusively in the absence of any intelligent sympathy from his parents, any companionship except that of his brothers and sister, or any recreation in the dullness of Italian towns. The lad spent his days over grammars and dictionaries, learning Latin with little assistance, and Greek and the principal modern languages with none at all. Any ordinarily clever boy would have emerged from this discipline a mere pedant and bookworm. Leopardi came forth a Hellene, not merely a consummate Greek scholar, but penetrated with the classical conception of life, and a master of antique form and style. At sixteen he composed a Latin treatise on the Roman rhetoricians of the 2d century, a commentary on Porphyry's life of Plotinus, and a history of astronomy; at seventeen he wrote on the popular errors of the ancients, citing more than four hundred authors. A little later he imposed upon the first scholars of Italy by two odes in the manner of Anacreon. At eighteen he produced a poem of considerable length, the "Appressamento alla Morte," which, after being lost for many years, has recently been discovered and published by Signor Zanino Volta. It is a vision of the omnipotence of death, modelled upon Petrarch, but more truly inspired by Dante, and in its conception, machinery, and general tone offering a remarkable resemblance to Shelley's "Triumph of Life," written six years subsequently, and of which Leopardi probably never heard. This juvenile

work was succeeded (1819) by two lyrical compositions which at once placed the author upon the height which he maintained ever afterwards. The ode to Italy, and that on the monument to Dante erected at Florence, gave voice to the dismay and affliction with which Italy, aroused by the French Revolution from the torpor of the 17th and 18th centuries, contemplated her forlorn and degraded condition, her political impotence, her degeneracy in arts and arms, and the frivolity or stagnation of her intellectual life. They were the outcry of a student who had found an ideal of national existence in his books, and to whose disappointment everything in his own circumstances lent additional poignancy. But there is nothing unmanly or morbid in the expression of these sentiments, and the odes are surprisingly exempt from the failings characteristic of young poets. They are remarkably chaste in diction, close and nervous in style, sparing in fancy, and almost destitute of simile and metaphor, antique in spirit, yet pervaded by modern ideas, combining Landor's dignity with a considerable infusion of the passion of Byron. These qualities continued to characterize Leopardi's poetical writings throughout his life. A third ode, on Cardinal Mai's discoveries of ancient MSS., lamented in the same spirit of indignant sorrow the decadence of Italian literature. The publication of these pieces widened the breach between Leopardi and his father, a well-meaning but apparently dull and apathetic man, who had lived into the 19th century without imbibing any of its spirit, and who provoked his son's contempt by a supposition unpardonable in a scholar of real learning. Very probably from a mistaken idea of duty to his son, very probably, too, from his own entire dependence in pecuniary matters upon his wife, he for a long time obstinately refused Leopardi funds, recreation, change of scene, everything that could have contributed to combat the growing pessimism which eventually became nothing less than monomanical. The affection of his brothers and sister afforded him some consolation, and he found intellectual sympathy in the eminent scholar and patriot Pietro Giordani, with whom he assiduously corresponded at this period, partly on the ways and means of escaping from "this hermitage, or rather seraglio, where the delights of civil society and the advantages of solitary life are alike wanting." This forms the keynote of numerous letters of complaint and lamentation, as touching but as effeminate in their pathos as those of the banished Ovid. It must be remembered in fairness that the weakness of Leopardi's eyesight frequently deprived him for months together of the resource of study. At length (1822) his father allowed him to repair to Rome, where, though cheered by the encouragement of Bunsen and Niebuhr, he found little satisfaction in the trifling pedantry that passed for philology and archeology, while his sceptical opinions prevented his taking orders, the indispensable condition of public employment in the papal states. Dispirited, and with exhausted means, he returned to Recanati, where he spent three miserable years, brightened only by the production of several more lyrical masterpieces, which appeared in 1824. The most remarkable is perhaps the *Bruto Minore*, the condensation of his philosophy of despair. In 1825 he accepted an engagement to edit Cicero and Petrarch for the publisher Stella at Milan, and took up his residence at Bologna, where his life was for a time made almost cheerful by the friendship of the countess Malvezzi. In 1827 appeared the *Opere Morali*, consisting principally of dialogues and his imaginary biography of Filippo Ottonieri, which have given him a fame as a prose writer hardly inferior to his celebrity as a poet. Modern literature has few productions so eminently classical in form and spirit, so symmetrical in construction and faultless in style. Lucian is evidently

the model; but the wit and irony which were playthings to Lucian are terribly earnest with Leopardi. Leopardi's invention is fully equal to Lucian's, and his only drawback in comparison with his exemplar is that, while the latter's campaign against pretence and imposture commands hearty sympathy, Leopardi's philosophical creed is a repulsive hedonism in the disguise of austere stoicism. His Icelandic rebuking Nature for his cruelty and inhospitality, his Soul protesting against the original wrong of creation, his Familiar Spirit explaining the impossibility of making his master happy for a single instant—all, in fact, of the chief interlocutors in these dialogues profess the same unmitigated pessimism, claim emancipation from every illusion that renders life tolerable to the vulgar, and assert or imply a vast moral and intellectual superiority over unenlightened mankind. When, however, we come to inquire what it is the privation of which renders them miserable, we find it is nothing but pleasurable sensation, fame, fortune, or some other external thing which a lofty code of ethics would deny to be either indefinitely due to man or essential to his felicity. A page of *Sartor Resartus* scatters Leopardi's sophistry to the winds, and leaves nothing of his dialogues but the consummate literary skill that would render the least fragment precious. As works of art they are a possession for ever, as contributions to moral philosophy they are worthless, and apart from their literary qualities can only escape condemnation if regarded as lyrical expressions of emotion, the wail extorted from a diseased mind by a diseased body. "Filippo Ottomani" is a portrait of an imaginary philosopher, imitated from the biography of a real sage in Lucian's *Demonax*. Lucian has shown us the philosopher he wished to copy; Leopardi has truly depicted the philosopher he was. Nothing can be more striking or more tragic than the picture of the man superior to his fellows in every quality of head and heart, and yet condemned to sterility and impotence because he has, as he imagines, gone a step too far on the road to truth, and illusions exist for him no more. The little tract is full of remarks on life and character of surprising depth and justice, manifesting what powers of observation as well as reflection were possessed by the sickly youth who had seen so little of the world.

Want of means soon drove Leopardi back to Recanati, where, deaf, half-blind, sleepless, tortured by incessant pain, at war with himself and every one around him except his sister, he spent the two most unhappy years of his unhappy life. In May 1831 he escaped to Florence, where he formed the acquaintance of a young Swiss philologist, M. de Sinner. To him he confided his unpublished philosophical writings, with a view to their appearance in Germany. Sinner showed himself culpably remiss in the execution of his trust, and it is no adequate extenuation of his negligence that these treatises were of less value than Leopardi may have thought. Though continually reclaimed by the latter's friends after his death, they were never published by Sinner, but were purchased after his decease by the Italian Government, and, together with Leopardi's correspondence with the Swiss philologist, have been partially edited by M. Aulard. In 1831 appeared a new edition of Leopardi's poems, comprising several new pieces of the highest merit. These are in general less austere than his earlier compositions, and evince a greater tendency to description, and a keener interest in the works and ways of ordinary mankind. "The Resurrection," composed on occasion of his unexpected recovery, is a model of concentrated energy of diction, and "The Song of the Wandering Shepherd in Asia" is one of the highest flights of modern lyric poetry. The range of the author's ideas is still restricted, but his style and melody are unsurpassable. Shortly after the publication of these pieces

(October 1831) Leopardi was driven from Florence to Rome by an unhappy attachment, the history and object of which have remained unknown. His feelings are powerfully expressed in two poems, "To Himself" and "Aspasia," which seem, however, to breathe wounded pride at least as much as wounded love. In 1832 Leopardi returned to Florence, and there formed acquaintance with a young Neapolitan, Antonio Ranieri, himself an author of merit, and destined to enact towards him the part performed by Severn towards Keats, an enviable title to renown if Ranieri had not in his old age tarnished it by assuming the relation of Telralway to the deceased Byron. Leopardi accompanied Ranieri and his sister to Naples, and under their care enjoyed four years of comparative tranquillity. He made the acquaintance of the German poet Platen, his sole modern rival in the classical perfection of form, and composed "La Ginestra," the most consummate of all his lyrical masterpieces, strongly resembling Shelley's "Mont Blanc," but more perfect in expression. He also wrote at Naples "The Sequel to the Battle of the Frogs and Mice," his most sustained effort, a satire in ottava rima on the abortive Neapolitan revolution of 1820, clever and humorous, but obscure from the local character of the allusions. The more painful and disastrous details of his Neapolitan residence may be found by those who care to seek for them in the deplorable publication of Ranieri's posthumous age (*Sette anni di Sordani*). The decay of his constitution continued; he became dropsical, and a sudden crisis of his malady, unanticipated by himself alone, put an end to his life-long sufferings on June 18, 1837.

Leopardi's sole but sufficient apology for the effluency of emotions complained of, and at the same time the condition of his happiness, is to have been a poor invalid tortured by incessant pain, who in demanding pleasurable sensations for mankind was but craving what was indeed an absolute necessity for himself. With all his dramatic skill in dialogue, the cast of his mind was essentially subjective; he was wholly incapable of placing himself at any other point of view than his own. His philosophical opinions accordingly possess merely a personal interest, and are valueless except as illustrations of human nature in abnormal circumstances. The patriotic spirit of his earliest poems, the brief gleam of happiness he enjoyed in female society at Bologna, never, however, might have been his history and the spirit of his writings had his physical organization qualified him for either love or action. Devoid of every possibility of healthy energy, it is no wonder that he should have sunk into a despairing quietism, a solace probably to himself, and only harmful to others if represented as a powerful intellect's deliberate and unhesitant solution of the problem of the universe. Leopardi's perfect literary expression owes nothing to the nature of the ideas it is employed in embellishing, and is, indeed, most conspicuous when he stands upon common ground with other poets. Thus the magnificent description of the setting of the moon in "Il Trionfo della Luna" is finer than the reflections it evokes in, and his crowning work, "La Ginestra," owes most of its impressiveness to the assemblage of noble and picturesque objects which the poet summons as witnesses to the frailty of man. In the presence of Vesuvius and Pompeii such meditations seem natural, and, after all, the association of the destitution of mankind with the revolutions of nature produces rather a sentiment of grave and chastened exaltation than the self-abasement enforced by the poet. This natural and moral sublimity raises it above Leopardi's other lyrics, which in point of poetical feeling and literary workmanship are for the most part worthy on a par. They are truly classic—not as was Platen, by a laborious imitation of antique metres, but, as with Shelley and Landor and the English neo-classic poets, by a perfect appropriation of the classical spirit. As with the ancients, their range of sentiment is narrow but their form perfect; there is probably no other modern writer in whom it would be so impossible to alter a line without detriment. The same perfection characterizes Leopardi's prose writings, and his letters would be hardly less admirable but for the hollow professions and inflated compliments exalted by the conventional pretences of Italian correspondence. The instability of his letters to his father is especially painful; and his professed yearning for death is strangely associated with a frenzied dread of cholera. Censure, however, is silent in the contemplation of his moral and physical sufferings; and his intimates unanimously attest the attractiveness of his personal character save for some infirmities that should never have been dragged to light. As a precocious

and at the same time enduring genius he can only be compared to Pascal, whom he greatly resembles in many respects.

The poems which constitute Leopardi's principal title to immortality are only fifty-one in number, and some of these are merely fragments. They may for the most part be described as odes, meditative soliloquies, or impassioned addresses, generally couched in a lyrical form, although a few are in magnificent blank verse. Some idea of the style and spirit of the former might be obtained by imagining the thoughts of the last book of Spenser's *Faerie Queene* in the metre of his *Euphonia*. They were first edited completely by Bemeti at Florence in 1846, forming, along with the *Opere Morali*, the first volume of a proposed edition of Leopardi's works, which does not, however, include the "Sonnet to the Battle of the Frigo and Miso," first printed at Pisa in 1842, nor the recently discovered writings. Vols. II-IV contain the philosophical essays and translations, with some letters, and vols. V and VI the remainder of the correspondence. The juvenile essays preserved in his father's library at Recanati were edited by Guignou in 1874, with the consent of the family. Leopardi's biography is mainly in his letters, which his recent historians (Brandes, Ronché-Leclercq, Koss) have merely wrought up with the addition of criticisms, excellent in their way, more particularly Brandes's, but generally much overrating his significance in the history of human thought. In Gladstone's essay (*Guard. Rev.*, 1890), since reprinted in vol. IV of the author's *Gleanings*, 24, on the other hand, too much pervaded by the theological spirit, but in the main a pattern of generous and discriminating eulogy. Baurer's infelicitous contribution to his friend's biography has been mentioned, a recent publication by the countess Teresa Leopardi, widow of Leopardi's brother Carlo, has done much to correct misconceptions respecting the circumstances and feelings of his family. There are excellent German translations of his poems by Heyse and Brandes, it is very improbable that there will ever be an adequate one in English. A translation of his essays and dialogues by Mr. G. Edwards has, however, just appeared (1882), and most of the dialogues have been rendered into our language with extraordinary felicity by Mr. James Thomson, author of *The City of Dreadful Night*. It is much to be hoped that these versions may at last be disseminated from the files of the *National Examiner*, and made generally accessible. (R. G.)

LEOPOLD I. (1640-1705), Holy Roman emperor, the second son of the emperor Ferdinand III and Maria Anna of Spain, was born June 9, 1640. He became king of Hungary in 1655, and king of Bohemia in 1658, in which year he also received the imperial crown, the electors having chosen him in preference to Louis XIV. of France. Leopold had been educated for the church, and throughout life he had the tastes and sympathies of a churchman rather than those of a secular ruler. He secluded himself as much as possible from the world, and would have preferred to live in peace, yet his long reign was destined to be one of the most agitated periods in German history. It happened that he had in Louis XIV. a rival of extraordinary power, and Leopold was in no respect a match for his craft, ambition, and audacity. The serious difficulties of Leopold's career began in 1682, when the mismanagement of his ministers in regard to Transylvania made war with Turkey inevitable. The Turks invaded Hungary, and, having seized Grosswarden and Neuhausel, broke into Moravia and Silesia. The princes of the empire, who had been made virtually independent by the results of the Thirty Years' War, watched the progress of the struggle with indifference; but in 1683, Leopold having made a personal appeal to them in the diet at Ratibon, they were induced to grant him aid. On the 1st of August 1684 Montecuculi defeated the Turks at St. Gotthard on the Raab, and had the war been prosecuted with energy much future disaster would probably have been prevented. The emperor, however, made no further use of his victory than to induce the Turks to accept an armistice for twenty years. He allowed them to retain Grosswarden and Neuhausel, and their candidate for the principality of Transylvania was formally recognized. In 1672 Leopold came for the first time into direct collision with Louis XIV. As it seemed highly probable that the French king would not be content with the conquest of Holland, Leopold, as head of his hereditary territories and as emperor, associated himself with Brandenburg and Spain for the support of the Dutch.

For some time, in consequence of the intrigues of Prince Lobkowitz, the emperor's minister, the war was conducted indolently by the Germans; and early in 1675 Turenne gained a series of brilliant victories in Alsace. Later in the same year Turenne was slain, and his army defeated at Salsbach, and Montecuculi forced his way across the French frontier. The treaty of Nimueguen having been signed by the Dutch in 1678, the emperor concluded peace in 1679. The French retained Fleisburg in Breisgau; and soon afterwards Louis XIV., instead of giving up towns which he had undertaken to resign, seized many new cities and districts. To these acts of robbery he gave an appearance of legality by instituting so-called "Chambéis of Reunion." The German people bitterly resented his aggression, but the princes declined to interfere, and the energies of the emperor were fully occupied elsewhere. His system of government in Hungary was arbitrary and tyrannical, and in 1682 the Hungarians, headed by Emeric Tokolyi, broke into open revolt. They were encouraged by Louis XIV., who stirred up the Turks to join them in attacking Austria. In 1683 a Turkish army of 200,000 men, led by the grand vizier Kara Mustapha, entered Hungary, and pushed on to Vienna, which they besieged from the 14th of July till the 12th of September. The German princes were unwilling to act even in such an emergency as this, but at last an imperial army under the electors of Bavaria and Saxony marched towards Vienna, and they were joined by John Sobieski of Poland with a corps of 28,000 men. These troops, in association with the emperor's army under Duke Charles of Lorraine, attacked the Turks on the 12th of September 1683, at the Kahlenberg, near Vienna. The Turks were so effectually defeated that they were soon driven from Hungary. Another great victory was gained over them at Mohacz in 1687, and in 1697 they were defeated by Prince Eugene at Zenta. In 1699 the treaty of Carlowitz was signed, whereby the emperor became complete master of the districts which the Turks had conquered in Hungary. Twelve years before (1687), the Hungarians, worn out by the struggle, had submitted to the emperor at the diet of Piesburg, the monarchy being made hereditary in the house of Hapsburg instead of elective. This settlement had scarcely been concluded when the emperor was involved in new troubles by the French invasion of the Palatinate in 1688. On this occasion Louis XIV. had to account with an antagonist of a very different character from the emperor Leopold. William of Orange, who raised to the throne of England, made it the object of his life to break the supremacy of France; and through his efforts was formed the Grand Alliance, which for more than eight years carried on war by sea and land. The emperor did not approve of the treaty of Ryswick (1697), but after the withdrawal of his allies he had no alternative but to consent to the establishment of peace. Louis was compelled to cede most of the acquisitions he had made after the treaty of Nimueguen, but retained Strasburg. In 1701 began the war of the Spanish succession, waged by Leopold in defence of the claims of his second son Charles against those of Philip of Anjou, grandson of Louis XIV. In this war Leopold was supported by the empire, and by England, Holland, and Prussia. It opened with several victories gained by Prince Eugene; but afterwards King Joseph and the margrave of Baden were repeatedly defeated, and the emperor was weakened by a renewal of the movement for national independence in Hungary. His confidence was revived by the battle of Blenheim, but he did not live to see the full results of that great victory. On the 5th of May 1705 he died of dropsy in the chest. He was a man of ungainly appearance, the most prominent feature of his face being his large hanging under-lip. The life of his court

was regulated in accordance with the strictest rules of Spanish etiquette, but in his relations to his family a naturally kind disposition often broke through the crust of rigid conventions. Although one of the most intolerant sovereigns of his age, he gave considerable attention to science, and took a prominent part in the establishment of the universities of Innsbruck, Olmutz, Halle, and Breslau. Early in his reign he allowed his judgment to be controlled by his cabinet, but he never placed implicit trust in any minister after the discovery that Lobkowitz had been in communication with the French. He was married three times, and two of his sons became emperors—Joseph I. and Charles VI. (v. si.)

LEOPOLD II., Holy Roman emperor, was born on the 5th of May 1747. After the death of his father, the emperor Francis I., in 1765, he became grand-duke of Tuscany, a country which he ruled for twenty-five years in a thoroughly enlightened spirit. Earlier than his brother, Joseph II., he saw the necessity of ecclesiastical reform, but he effected with moderation and good sense the changes which he considered advisable. Agriculture, industry, and commerce he encouraged in accordance with the ideas of his age, and Tuscany owed to him a well-conceived criminal code. He had even prepared a scheme for instituting representative government in Tuscany when, in 1790, he succeeded Joseph II. in the hereditary lands of the house of Hapsburg and in the empire. Joseph, with all his good intentions, had left his hereditary states in much confusion, and vigour and prudence were essential for the re-establishment of order. The chief difficulty was in the Netherlands, which were disinclined to respond to Leopold's advances. He despatched an army against them, and it entered Brussels on the 3d of December 1791. The country was then at his mercy; but he acted with great discretion, restoring certain ancient rights which Joseph, in his zeal for improvement, had withdrawn. In Hungary, too, the emperor succeeded in calming popular excitement; and on the 4th of August 1791 the treaty of Sistova was signed, bringing to an end the unlucky war which Joseph had waged with the Turks. The violence of the French Revolutionists produced a bad effect on the internal policy of Leopold, who supposed that it was necessary, not only to introduce a secret police, but to limit the freedom of the press. The same influences led him to conciliate Prussia, which had been always on its guard against Austria since the establishment of the Confederation of Princes by Frederick the Great. On the 27th of August 1791 the emperor and the king of Prussia met at Pillnitz; and it was agreed that they should act together for the deliverance of Louis XVI. of France. In pursuance of this understanding a defensive and offensive treaty of alliance between Austria and Prussia was concluded on the 7th of February 1792; but the emperor's schemes were suddenly broken by death. He died on the 1st of March 1792, and was succeeded by his son, the emperor Francis II.

LEOPOLD I. (1790–1865), king of the Belgians, was the fourth son of Francis, duke of Saxe-Coburg-Saalfeld, and thus the uncle of Queen Victoria of England. His youth was chiefly spent in the Russian military service; he commanded a battalion at Lützen, Bautzen, and Leipzig, entered Paris with the allied sovereigns, and accompanied them to England. In May 1815 he married the Princess Charlotte, only child of the Prince Regent (who died in the following year), having previously been created duke of Kendal in the English peerage. In 1830 he declined the crown of Greece, but was elected to the throne of Belgium in June 1831. For the subsequent events of his life see BELGIUM, vol. iii. p. 528 sq.

LEOPOLD I. (1676–1747), duke of Anhalt-Dessau, *der alte Dessauer*, a famous Prussian general, was born at

Dessau, July 3, 1676. Possessing great physical energy and an absorbing interest in military affairs, he at an early age displayed capacity for commands of high responsibility. On the death of his father in 1693 he succeeded him as colonel of a regiment in the service of Brandenburg, and, having rendered invaluable assistance at the capture of Namur by William III. of Orange in 1696, he obtained the rank of major-general. Returning shortly afterwards to his principality, he conceived a passionate attachment for the daughter of an apothecary, whom he raised to the rank of nobility and made his wife on reaching his majority. During the years that he now spent in his principality, he won the ardent affection of the mass of the people, both by his considerate regard for their welfare and by the influence of his strong personality. In command of a division of twelve thousand men at Bielefeld in 1704, Leopold so acted in a critical contingency as practically to turn the scales of victory, and in Eugene's Italian campaigns he was conspicuous at the battle of Cassano in 1706, the storming of Turin in 1706, and in other affairs of minor importance. After serving as a volunteer at Malplaquet in 1709, he received an independent command from Prussia, and rendered important assistance to Marlborough against Villars. Created field-marshal in 1715, he gained the special confidence of Frederick William I., and it was in no small degree to his instructions in military tactics, and the splendid perfection to which he had brought the small army of Prussia, that the great military triumphs of Frederick II. were due. His more important military inventions are the iron ram-rod and the equal step. As a general he specially excelled in stratagems and surprises, in which he was greatly aided by his daring and impetuous energy. These qualities were specially displayed in the surprise and bloodless capture of Mors castle in 1712, the seizure during night of the island of Rugen in 1715, the formation in 1741 of the famous entrenched camp at Götting near Magdeburg, where with an army of thirty-six thousand men he was prepared for events either in Saxony or Hanover, the defeat of the Austrians at Neustadt in 1744, and the expulsion of the Saxons, though superior both in numbers and artillery, from a strongly entrenched position at Kesselsdorf in 1745. He died 7th April 1747. Leopold is graphically portrayed in Carlyle's *Frederick*, where he is spoken of as "a man of vast dumb faculty, dumb but fertile, deep—no end of imagination, no end of ingenuities—with as much mother wit as in whole talking parliaments."

See also the *Lebens* by Varnhagen von Ense, 8d. edition 1872, Hoesius 1876, and Siebigk 1876, and Crouzet, *Militärische Denkwürdigkeiten des Fürsten Leopold von Anhalt-Dessau*, 1875.

LEPANTO (the Italian form of the modern Greek *Epakto*), known in ancient times as Naupactus, a name which has recently been revived in official documents, is a town in the nomarchy of Achaïa and Ætolia, Greece, situated on a bay on the north side of the straits of Lepanto, by which the gulf of the same name is connected with that of Patras. It stands on the south-eastern and southern slopes of one of the spurs of Mount Rigan; the surrounding plain is well watered and fertile, but the harbour, once the best on the northern coast of the Corinthian Gulf, is now almost entirely choked up, and is accessible only to the smallest craft. Lepanto is an episcopal see; the population of the deme of Naupactus in 1879 was 5298.

According to traditional etymology, Naupactus derived its name from the circumstance that here the Heracleids built the fleet with which they expelled the Peloponnesians. The place is first mentioned in actual history as having been taken from the Lœvi Ozolæ by the Athenians, who settled it with Messenian helots at the close of the third Messenian war (455 B.C.), and who made it their chief military and naval station in western Greece during the war of the Peloponnesians. After Agamemnon it was successively held by the Locrians, Achæans, and Ætolians, and finally, after a siege of two

months, it fell into the hands of the Romans, 191 a.c. It was still a flourishing place in the time of Pausanias, but according to Ptolemy it was destroyed by an earthquake in the reign of Justinian. In the Middle Ages it fell into the hands of the Venetians, who fortified it so strongly that in 1477 it successfully resisted a four months' siege by a Turkish army thirty thousand strong. In 1499, however, it was taken by Bajazet II. The south of the Gulf of Lepanto was the scene of the great sea fight in which the naval power of Turkey was for the time being destroyed by the united naval, Spanish, and Venetian forces (October 7, 1571). See JONK OF AUSTRIA. In 1678 it was recaptured by the Venetians, but was again restored in 1696 by the treaty of Calovista to the Turks; it was the year of independence it finally became Greek once more (March 1830).

LEPIDOSIREN is the name of one of the most remarkable genera of fishes, of which one species (*Lepidosiren paradoxa*) has been found in tributaries of the river Amazon, and the other (*Lepidosiren annectens*) occurs in the systems of all the large rivers of tropical Africa. The latter species differs in some points, notably in having six instead of five branchial arches, from *L. paradoxa*, and therefore has been generally separated by Owen under the name of *Protopterus*,—which name likewise is in common use. Together with the Australian *Ceratodus*, the lepidosirens are the only living representatives of a very old type of fishes, the *Dipnoi*, which reaches back to the Devonian age, thus giving us an insight into the organization of fishes of which nothing but some obscure and fragmentary impressions of the hard parts are preserved. The body of *Lepidosiren* is eel-shaped, and covered with small thin scales. A single vertical fin surrounds its posterior part of the body and the tail; the paired fins are reduced to two pairs of long threads, internally supported by a series of small cartilages. The dentition is very characteristic, and consists of a pair of conical pointed vomerine teeth, and a pair of large cuspidate and ribbed molar teeth on the palate and in the lower jaw. The skeleton is notochordal; and lungs are present in addition to gills. From this latter fact it may be inferred that the lepidosirens can breathe air as well as water; and, although they have never been observed to leave the water voluntarily, either in a state of nature or in captivity, they rise from time to time to the surface to fill their lungs with a fresh supply of air; further, when, during the hot season, the water of the tanks in which they live changes into mud, branchial respiration is entirely superseded by pulmonary. Of the habits of *Lepidosiren paradoxa* scarcely anything is known; only a few specimens have been found by naturalists, and neither Bates nor Wallace succeeded in obtaining one. This species, therefore, is one of the greatest desiderata in zoological museums. The African species, on the other hand, is common in the upper Nile, in the central lake-region, on the Zambesi, and in all the rivers of the west coast. Baker states that in some districts of central Africa the lepidosirens is so abundant as to form an article of food, fresh and dried. Specimens living in pools which dry up during the hot season bury themselves in the mud, and form an oval cavity, the inside of which is lined with a protecting coat of hardened mucus, and in which they wait, coiled up and in a torpid condition, for the return of the rainy season. These retreats are discovered by the natives by a circular opening at the upper surface, which is closed by the mucous film. If the capsules are not broken, the fishes, imbedded in the clay-balls, can be transported to Europe, and emerge from their prison on being placed in tepid water. Both species attain to a length of 6 feet, and feed on frogs, fishes, and other of aquatic animals. For the details of the organization the *Lepidosiren* see the article ICHTHIOLOGY.

LEPIDUS, M. *ÆMILIUS*, a member of the second Roman triumvirate, was a son of M. *Æmilius* Lepidus, who had been consul in 137 a.c. He joined the party of Cæsar

in the civil wars, and was by the dictator thrice nominated *magister equitum* and raised to the consulship 46 a.c. He was a man of great wealth and influence, and it was probably more on this ground than on account of his ability that Cæsar raised him to such honours. In the beginning of 44 a.c. he was sent to Gallia Narbonensis, but before he had left the city with his army Cæsar was murdered. Lepidus, as commander of the only army near Rome, became a man of great importance in the troubles which followed. Taking part with Antony, he joined in the reconciliation which the latter effected with the senatorial party, and afterwards sided with him when open war broke out, and Antony, after his defeat at Mutina, joined Lepidus in Gaul, and in August 43 a.c. Octavian, who had forced the senate to make him consul, effected an arrangement with Antony and Lepidus, and the triumvirate was organized at Bononia. Antony and Octavian soon reduced Lepidus to an inferior position. His province of Gaul and Spain was taken from him; and, though he was included in the triumvirate when it was renewed in 37 a.c., his power was only nominal. He made an effort in the following year to regain some reality of power, conquered part of Sicily, and claimed the whole island as his province, but Octavian found means to sap the fidelity of his soldiers, and he was obliged to supplicate for his life. He was allowed to retain his fortune and the office of *pontifex maximus*, to which he had been appointed in 44 a.c., but had to retire into private life. He died 13 a.c.

Lepidus was the cognomen of a Roman family in the patrician *gens Æmilia*. The first of this name of whom anything is recorded is M. *Æmilius* Lepidus, consul 385 a.c. From this time onwards the family continued in an almost unbroken series of distinguished men till in the 1st century after Christ it disappears. Another M. *Æmilius* Lepidus was one of the three ambassadors sent to Egypt as *legates* of the infant king Ptolemy. He was consul in 157 and 176, censor 179, *pontifex maximus* from 160 onwards, and was six times chosen by the censors *prætor senatus*. He died in 162. It is uncertain whether he is the Lepidus who is commemorated on a coin of the *gens Æmilia* as having slain an enemy and saved a citizen's life at the age of fifteen, while still dressed in the boy's *togæ prætextæ*. Another of the Lepidi was C. Lepidus, 137 a.c. Being sent to Spain to conduct the Numantine war, he began against the will of the senate to attack the Væcæ. This enterprise was so unsuccessful that he was deprived of his command in 130 and condemned to pay a fine. He was among the greatest of the earlier Roman orators, and Cicero praises him for having introduced the well-constructed sentence and given flow of language from Greek into Roman oratory. He contributed much to forming the style of Tiberius Gracchus.

Another of the same name was infamous for his aggressive pretensions in Sicily (81 a.c.). In the civil wars he sided with Sulla and bought much of the confiscated property of the Marian partisans. Afterwards he became leader of the popular party, and was with the help of Pompey elected consul for 78 a.c., against the will of Sulla. When the dictator died, Lepidus tried in vain to prevent the burial of his body in the Campus Martius, and to alter the constitution established by him. His colleague Lucius Cælius found a pretext to place his veto on Lepidus's proposals; and the quarrel between the two parties in the state became so inflamed that the senate made the consuls swear not to take up arms. Lepidus was then ordered by the senate to go to his province, Transalpine Gaul; but he stopped in Etruria on his way from the city, and began to levy an army. He was declared a public enemy early in 77 a.c., and forthwith marched against Rome. A battle took place in the Campus Martius, Pompey and Cælius commanding the senatorial army, and Lepidus was defeated. He sailed to Sardinia, where he was also repulsed; and soon after he died. One of his two sons was L. *Æmilius* Paulus, consul 69, who built during his childhood in 66 the Basilica *Æmilia* in the forum.

LEPROSY (*Lepra Arabum*, *Elephantiasis Græcorum*, *Ausatz*, *Spedalkheit*), the greatest disease of mediæval Christendom, is identified, on the one hand, with a disease endemic from the earliest historical times (1500 a.c.) in the delta and valley of the Nile, and on the other hand with a disease now common in Asia, Africa, South America, the West Indies, and certain isolated localities of Europe. An authentic representation of the leprosy of the

Middle Ages exists in a picture at Munich by Holbein, painted at Augsburg in 1516; St Elizabeth gives bread and wine to a prostrate group of lepers, including a bearded man whose face is covered with large round reddish knobs, an old woman whose arm is covered with brown blotches, the leg swathed in bandages through which matter oozes, the bare knees also marked with discoloured spots, and on the head a white rag or plaster, and, thirdly, a young man whose neck and face (especially round the somewhat hairless eyebrows) are spotted with brown patches of various size. It is conjectured by Virchow that the painter had made studies of lepers from the leper-houses then existing at Augsburg. These external characters of mediæval leprosy agree with the descriptions of it by the ancients, and with the pictures of modern leprosy given by Danielsen and Boeck for Norway, by various authors for sporadic European cases, by Anderson for Malacca, by Carter for India, by Wolff for Madeira, and by Hillis for British Guiana. There has been some confusion in the technical naming of the disease; it is called *Elephantiasis* (*Leontiasis*, *Satyriasis*) by the Greek writers, and *Lepros* by the Arabians. The latter term has been generally adopted in modern books, but in England the name of *Lepros* is applied (after Willan) to an entirely different disease of the skin.

History.—Egypt was regarded by the ancients (positively by Lucretius) as the country whence leprosy came. It was probably endemic among the Hebrews when they migrated from Egypt. The minute diagnostic indications given in Lev. xii. appear to relate to true leprosy and to other diseases that might be mistaken for it, and the frequently recurring word *Sār'a'ath* (translated "leprosy") is best taken in a generic sense; those cases in which progress would show itself at so short intervals as seven days, and those cases for which the ceremonial of cleansing was provided, could hardly have been cases of leprosy, a disease always incurable, and with stages reckoned rather by months or years than by weeks. Herodotus knew of leprosy as existing in Persia. The earlier Greek and Latin writers speak of it as a foreign disease, but it became established in Greece and Italy in the 1st century A.C.; Pliny implies that it was introduced by the army of Pompey returning from Syria. The disease soon appeared in the Roman colonies of Spain, Gaul, and Britain. The Lombard king Rothar (7th century) made laws regulating the marriage of lepers, and similar laws were made by Pippin and Charlemagne. Leprosy-houses existed at Verdun, Metz, and Maestricht in the 7th century, at St Gall in the 8th, and at Canterbury in the 11th. It was amidst the stir and movement of the crusades that leprosy grew to be epidemic in western Europe; it attacked the people in great numbers and in all ranks (including members of royal families). Leprosy-houses (mostly religious and dedicated to St Lazarus, but in northern Europe more secular and dedicated to St George) were founded in every considerable town; the total number of these in Europe was loosely estimated by Matthew Paris at 19,000, the number in France is independently estimated at 2000, and (according to Sir J. Y. Simpson) there were 95 houses of the first class in England (of these 7 at Norwich and 5 at Lynn), and several in Ireland and Scotland. The isolation of lepers was strictly enforced by law and popular sentiment. They wore a special costume, usually a long grey gown with hood drawn over the face, and carried a wooden clapper to give warning of their approach. They were forbidden to enter inns, churches, mills, or bakehouses, to touch healthy persons or eat with them, to wash in the streams, or to walk in narrow footpaths. Their outcast state was signified by the German name (*Aussatz*); the Chronicle of Limburg (under the year 1374) speaks of a

famous monkish poet, whose songs all Germany was singing, as one "*der ward von den Leuten aussatzig, und war nicht rein*." The disease began to decline (first in Italy) in the 15th century, and had mostly disappeared in the 17th. A leprosy-house was founded in Edinburgh (at Greenside) as late as 1591, and it was not till 1741 (others give 1798) that the last known leper died in Shetland.

Present Geographical Distribution.—Survivals of the great mediæval outbreak are found on the west coast of Norway (about two thousand lepers, leper hospital at Bergen founded 1277, now added to), in the Baltic provinces of Russia (leper hospitals founded at Riga in 1220 and Revel 1237, not now in use), on the Riviera (a small and diminishing number), on the Sicilian coasts, and in certain coast provinces of Spain and Portugal (leper hospital at Lisbon since the 13th century). Sporadic cases of home origin have also been described for Hungary and Roumania; the cases occurring in England and France are in persons who have been born or have lived in the East or West Indies. The disease is met with also in Iceland, along the Caspian and delta of the Volga, along the Black Sea, and in islands of the Levant (especially Scio and Crete). It is common all over the East from Syria to Japan and Kamohatke, in Egypt and North African states, in West Africa from the Senegal to the Congo, in Cape Colony, Madagascar, Mauritius, Isle de Bourbon, St Helena, Madeira, Canaries and Azores, Brazil, Central America, the West Indies, Mexico, New Brunswick (small isolated French colony), and especially in the Hawaiian Islands. Leprosy has been found among Chinese immigrants in the United States as far east as Chicago, and in Queensland. Leprosy hospitals (with inmates numbering from two hundred downwards) are kept up in several of the West Indian colonies, at Tracadie (New Brunswick), at Cape Town, in Mauritius, at Malacca and Singapore, at Colombo, at Madras, Coclén, and Bangalore, at Bombay and Rajkot, and at Calcutta, Benares, and Agra. There are also leper hospitals at Bergen (3), Molde, and Trondhjem, at San Remo, at Oporto, Coimbra, and Lisbon, at Terceira (Azores), Las Palmas (Grand Canary) since 15th century, and Funchal (Madeira) since about 1500, at Pernambuco, Bahia, and Rio, at Honolulu, at Macao (for two hundred years) and Canton, in Java (several) and in Amboyna, at Scio (since 1445), Scutari, Damascus, and Jerusalem. A ruined convent at Ramleh accommodates thirty lepers or more, and a mosque at Nablus is occupied by about seventy. In several of the above instances the leper hospital is built upon an outlying island. Leprosy villages occur in China and Japan, and in Persia. Leprosy communities exist in Crete, but the largest of them is now mostly occupied by a non-leprosy population. Throughout the East, including British India, the hospital accommodation for lepers is only casual, and isolation is not carried out to the same extent as during the prevalence of the disease in Europe.

Definition, Characters, Pathology, and Causation.—Leprosy is an incurable constitutional disease, marked externally by discoloured patches and nodules on the skin, and deeply implicating the structure and function of the peripheral nervous system. Like the infections, it has a prodromal stage, which is uncertain in its character, and is measured rather by months or years than by days or weeks; the chief prodromitory symptoms are unaccountable lassitude and mental depression, pains in the limbs and joints, febrile periods (cold and hot fits), loss of appetite, and nausea. That stage is followed by the "periodically eruptive stage," during which blotches on the skin come and go; sooner or later these erythematous congestions and exudations leave either permanent spots, brown or blanched, which are often without feeling, or they leave nodules. The disease diverges into two main

varieties, the spotted (*Lepra maculosa*) and the nodular (*Lepra tuberculosa*). The two kinds are found side by side in the same population, and sometimes in the same person. The maculae arise in the place of former recurrent spots, and are often raised indurations; when the pigmentation deepens, the disease is *L. maculosa nigra*; when the spots become blanched, it is *L. maculosa alba* or white leprosy. Anæsthesia, which very generally goes with the leprosy process, is especially marked in the blanched spots, hence the name *L. anæsthetica*. Anæsthetic spots are apt to have bullæ forming on them (*pemphigus leprosus*), their periodical eruption being attended with fever. The nodules (characteristic of the other form) generally arise also in the situation of old blotches, they are at first small scattered points, but they grow and coalesce to the size of lentils, hazel nuts, or walnuts. While the maculae of leprosy may occur in any part, the nodules are most apt to form on the face (brows, eyelids, ears, wings of the nose, lips, cheeks), causing thickening of all the features (*Leontiasis, Satyrismus*); but they often occur on the hands and feet, and sometimes over the whole body. The nodules, from being exposed to the weather and to injuries, often ulcerate, and the ulcers, like those of syphilis and lupus, tend to spread. Maculae, especially on the limbs, are liable to slighter ulcerations followed by incrustation. Deep ulceration and necrosis occur at the joints of the fingers and toes, which may drop off joint by joint, leaving a well-healed stump (*L. mutilans*). Certain mucous membranes thicken, become nodulated, and ulcerate, viz. the conjunctiva cornea (causing *pannus leprosus*), and the lining of the mouth, nose, throat, and larynx (causing hoarseness). The external groups of lymphatic glands enlarge, leprosy affections of the viscera also are described. The peripheral nerves are the subject of thickenings and degenerations like those in the skin. The new-formed tissue in all situations is granulation-like, as in syphilis and lupus; and leprosy, with those two diseases, is treated of by Virchow under the head of granuloma. By some the nervous lesions (including an alleged affection of the spinal cord) are taken to be primary, while the changes in the skin and other parts (with anæsthesia) are held to be secondary and due to disordered innervation. Leprosy has been claimed as one of the diseases caused by parasites, on several occasions by old writers in the gross sense, and recently by observers who have found innumerable minute bacillus-rods within the cells of the leprosy new growth. The essential cause of leprosy is unknown. It probably arose in the Delta and valley of the Nile in prehistoric times, and under similar climatic and telluric conditions in other (chiefly inter-tropical) countries; and the most memorable fact in its history is its rise and subsidence as an epidemic disease in Europe. It is now endemic (chiefly but not exclusively) among peoples who inhabit the sea-coast or the estuaries of rivers, who live much on fish (often putrid), and who intermarry closely. The old opinion that leprosy is contagious is now generally discredited.

Literature—For history and geographical distribution, see Hirsch, *Handbuch der historisch-geographischen Ethnologie*, 1st ed., Erlangen, 1880 (with exhaustive literature). For pathology, Virchow, *Die krankhaften Geschwülste*, Berlin, 1858-67, vol. ii. For clinical histories, R. Leving, *Elephantiasis Græcorum or True Leprosy*, London, 1878, chap. iv. For mediæval leprosy—in Germany, Virchow, in *Virchow's Archiv*, five articles, vols. xxiii-xxv, 1880-81; in the Netherlands, Jansen, in *Nederl. Tijdschr. voor Geneeskunde*, vol. 1, 1867; in Britain, J. Y. Simpson, *Edin. Med. and Surg. Journ.*, three articles, vols. lxxv and lxxvi, 1848-47. Treatises on modern leprosy in particular localities: Danneberg and Beck (Norway), *Travels in Spitzbergen*, with atlas of twenty-four coloured plates, Paris, 1848; A. F. Anderson, *Leprosy as met with in the Straits Settlements*, coloured photographs with explanatory notes, London, 1872; H. Vandyke Carter (Bombay), *On Leprosy and Elephantiasis*, with coloured plates, London, 1874; Billar, *Leprosy in British Guiana*, an account of West Indian leprosy, with twenty-

two coloured plates, London, 1882. See also the dermatological works of Hebra, Erasmus Wilson, Bazin, and Hutchinson. An important early work is that of P. G. Hensler, *Vom abendländischen Aussatz am Mittelalter*, Hamburg, 1790. (C C)

LEPTIS, now **LEBDA**, the leading city of the ancient Tripolis, Northern Africa, extensive ruins of which exist on the coast, about 50 miles east of Tripoli. Leptis Magna, as it is usually called to distinguish it from Leptis Parva (now Lema) in Byzantium, was a Phœnician colony, probably superimposed on an old Libyan settlement. The old town, of which the massive quays and docks are still extant, is similar to Carthage in position and plan, occupying a tongue of land to the west of the harbour. The new town, whose simple appellation Neapolis almost threatened the disuse of the name Leptis, is much more extensive, but the ruins belong to the later period of the Roman empire. Septimius Severus was a native of the place, and he not only bestowed upon it the *ius Italicum*, but enriched it with many costly buildings, the most remarkable being the palatium dedicated *fortunæ sue* (Procopius). Ammianus mentions that Leptis was laid waste by the Austurians (a Libyan tribe) in 370; and, though Justinian enclosed a part of the city with new walls and made it the military seat of the province of Tripolis, it never recovered its prosperity, and from the time of the Arab conquest it disappears from history. The local inscriptions are Greek, Latin, and Punic. See *Travels of Ali Bey* (by Bédin y Lablich), Barth, *Wanderungen*, &c.; and *Corpus Inscr. Lat.*, viii.

LERIDA, one of the forty-nine provinces of Spain, is bounded on the N. by France (and the "republic" of Andorra), on the E. by Gerona and Barcelona, on the S. by Tarragona, and on the W. by Saragossa and Huesca, and has an area of 4772 square miles, with a population (in 1877) of 285,297. It is almost entirely mountainous, and partakes of the features common to the whole southern slope of the Pyrenees. The principal river is the Segre, a tributary of the Ebro. The province has five cities, Lérida, Balaguer (Bergusia), Cervera, Seo de Urgel, and Solsona, but only the first-mentioned of these has a population exceeding 5000; the next largest (Balaguer) in 1877 had only 4742. The inhabitants are chiefly employed in pastoral occupations.

Lérida, the capital of the above province, and in point of numbers and prosperity the second city in Catalonia, is situated on the right bank of the Segre, crossed there by a handsome stone bridge. The distance by rail from Saragossa and Barcelona respectively are 114 and 113 miles. The old cathedral, on the top of an eminence overlooking the town, was begun in 1203 and consecrated in 1278; it is a Gothic building of merit in some respects, but is rapidly going to decay, having never been used for religious purposes since 1707. The actual cathedral is a Græco-Roman structure dating only from 1749. The town has no other feature of interest. There are manufactures of glass, leather, paper, and of woollen and cotton goods, and a considerable trade in the timber brought down from the Pyrenees by the Segre. Population in 1877, 20,369.

Lérida is the *linda* of the Romans, and was the capital of the people whom they called *Ulerenses* (Pliny) or *Ilergetes* (Ptolemy). By situation the city of Catalonia and Aragon, it was from a very early period an important military station. In the Punic wars it sided with the Carthaginians and suffered much from the Roman arms. In its immediate neighbourhood Hannu was defeated by Scipio in 218 B.C., and it afterwards became famous as the scene of Cæsar's arduous struggle with Pompey's generals Afranius and Petrus in the first year of the civil war (49 B.C.). It was already a municipium in the time of Augustus, and enjoyed great prosperity under later emperors. Under the Goths it became an episcopal see, and at least one ecclesiastical council is recorded to have met there (in 546). Under the Saracens Lérida became one of the principal cities of the province of Saragossa; it became tributary to the Franks in 793, but was reconquered in 797. In 1146 it fell into the hands of Don Ramon Berenguer IV., last count of Barcelona. In modern times it has come through numerous sieges, having been

taken by the French in November 1707 during the war of succession, and again in 1812. In 1820 James II. of Aragon founded a university at Lérida, which achieved some repute in its day, but is now extinct. Pope Calixtus III. at one time taught within its walls, and Vicente Ferrer was one of its alumni.

LERMONTOFF, MIKHAIL YUREVITCH (1814-1841), often styled the poet of the Caucasus, was born in Moscow, but belonged to a respectable family of the Tula government, and was brought up in the village of Tarkhanu (in the Penzensk government), which now preserves his dust. By his grandmother—on whom the whole care of his childhood was devolved by his mother's early death and his father's military service—no cost nor pains was spared to give him the best education she could think of. The intellectual atmosphere which he breathed in his youth differed little from that in which Pushkin had grown up, though the domination of French had begun to give way before the fancy for English, and Lamartine shared his popularity with Byron. From the academic gymnasium in Moscow Lermontoff passed in 1830 to the university, but there his career came to an untimely close through the part he took in some acts of insubordination to an obnoxious teacher. From 1830 to 1834 he attended the school of cadets at St Petersburg, and in due course he became an officer in the guards. To his own and the nation's anger at the loss of Pushkin (1837) the young soldier gave vent in a passionate poem addressed to the czar, and the very voice which proclaimed that, if Russia took no vengeance on the assassin of her poet, no second poet would be given her was itself an intimation that a poet had come already. The czar, however, seems to have found more impertinence than inspiration in the address, for Lermontoff was forthwith sent off to the Caucasus as an officer of dragoons. He had been in the Caucasus with his grandmother as a boy of ten, and he found himself at home by yet deeper sympathies than those of childish recollection. The stern and rocky virtues of the mountaineers against whom he had to fight, no less than the scenery of the rocks and mountains themselves, proved akin to his heart; the emperor had exiled him to his native land. He was in St Petersburg in 1838 and 1839, and in the latter year wrote the novel *A Hero of Our Time*, which is said to have been the occasion of the duel in which he lost his life in July 1841. In this contest he had purposely selected the edge of a precipice, so that if either combatant was wounded so as to fall his fate should be sealed.

Lermontoff published only one small collection of poems in 1840. Three volumes, much mutilated by the censorship, were issued in 1845 by Glazouff; and there have been full editions of his works in 1890 and 1893. To Bodenstedt's German translation of his poems (*Mikhail Lermontoff's poetischer Nachlass*, Berlin, 1842, 2 vols.), which indeed was the first satisfactory collection, he is indebted for a wide reputation outside of Russia. His novel has found several translators (August Bolte, Berlin, 1859, &c.). Among his best-known pieces are "Ismail-Bey," "Hadji Abrek," "Walerik," "The Novice," and, remarkable as an imitation of the old Russian ballad, "The song of the Czar Ivan Vasilvitch, his young bodyguard, and the bold merchant Kalashnikov."

See Tullander, "Le Poète du Caucase," in *Revue des Deux Mondes* (February 1890), republished in *Albums et Contes*, Paris, 1896, and Proust's "Materiales for the Biography of Lermontoff," prefixed to the 1893 edition of his works.

LEROUX, PIERRE (1798-1871), a French writer on philosophy and politics, commonly recognized as the chief of the (so-called) Humanitarian school, was born at Paris in 1798. He was the son of an artisan. He received his early education at the Lycée Charlemagne, and continued his studies at Rennes. Having obtained an admission to the Polytechnic school, he renounced it in order to support by the labour of his hands his mother and family, who had been left destitute by the death of his father. He first worked as a mason, but soon became a compositor in the printing establishment of his cousin, and afterwards over-seer in that of M. Panckoucke. In 1824 P. Dubois, a

former schoolfellow, associated him with himself in the foundation of the *Globe* newspaper, in which he became a co-worker with De Broglie, Guizot, Duvergier de Hauranne, Jouffroy, and other distinguished persons. For some time he occupied the position of an advanced Liberal of the ordinary type, but in January 1831 he gave his adhesion to the Saint-Simonian community, of which he became a prominent member; and under his influence the *Globe* became the organ of its doctrines. In November of the same year, when Entanin preached the enfranchisement of women and the functions of the *couple-prêtre*, Leroux took the part of Bazard, and, protesting in the name of morality, separated himself from the sect. In 1835, in conjunction with J. Reynaud, who had seceded with him, he founded the *Encyclopédie Nouvelle*, in which he expounded his philosophical and social views. Amongst the articles which he inserted in it were one entitled *De l'Égalité*, and a *Réfutation de l'Électisme*, which afterwards appeared as separate works. In 1840 he published his treatise *De l'Humanité*, which contains the fullest exposition of his system, and was regarded as the philosophical manifesto of the Humanitarians. In 1841, disgusted with the *Revue des Deux Mondes* on account of its desertion of the democratic cause, he established, with the aid of M. Viardot and Mme. George Sand, the *Revue Indépendante*. By his philosophic association with the latter eminent writer he obtained the advantage of an eloquent interpreter, capable of charming and impressing the masses. Mme. Sand's *Spiridion*, which was dedicated to him, her *Sept Cordes de la Lyre*, her *Consuelo*, and its continuation *La Comtesse de Rudolstadt*, were written under the Humanitarian inspiration. From the year 1843 M. Leroux devoted himself to the practical applications of his doctrines. He established at Boussac (Creuse) a printing association organized according to his systematic ideas, and founded the *Revue Sociale*, in which, as well as in separate publications, he continued to explain and develop his theoretic views and his suggestions for the renovation of society, professing, amongst other things, to supply "a pacific solution of the problem of the proletariat." After the outbreak of the revolution of 1848 he was elected to the constituent assembly as representative of the department of the Seine, obtaining 90,000 votes, and afterwards, in 1849, to the legislative assembly. He spoke there on the organization of labour, on the colonization of Algeria, and other questions. His discourses from the tribune were sometimes of so abstract and mystical a character, and contained proposals so eccentric and impracticable that they rather created ridicule than influenced opinion. The *coup d'état* of 1851 made him an exile; he settled with his family in Jersey, where he pursued agricultural experiments. The general amnesty of 1860 permitted his return to France, but he lived at Lausanne till after the definitive amnesty of 1869, when he again fixed his residence at Paris. He died there in April 1871, during the reign of the Commune. That body deputed two of its members to attend his funeral, as a homage, "not to the partisan of the mystical idea, of which we now feel the evil, but to the politician who, after the days of June, courageously undertook the defence of the vanquished."

The writings of Leroux, though they won a transitory clasp and gave him a position as head of a school, appear to have no permanent significance in the history of thought. His social theories do not rest on any scientific basis; he was rather the propagandist of sentiments and aspirations than the expounder of well-defined and distinctly appreciable ideas. He seems to have had a natural bent towards the mystic and the nebulous. He has, indeed, a system, but it is a singular medley of doctrines borrowed, not only from Saint-Simonianism, but from Pythagorean and Buddhist sources. In philosophy his fundamental principle is that of what he calls the "trid,"—a triad of which he endeavours to pervade all things, which in God is "power, intelligence, and love" in man "sensation,

sentiment, and knowledge." His religious doctrine is Pantheistic; and, rejecting the belief in a future life as commonly conceived, he substitutes for it a theory of metempsychosis. In social economy his views are very vague, he preserves the family, country, and property, but finds in all three, as they now are, a despotism which must be eliminated. He imagines certain combinations by which this triple tyranny can be abolished, so that the human being may be developed under the influence of those several institutions without being oppressed by them. But his solution seems to require the creation of families without heads, countries without governments, and property without rights of possession. In politics he advocates absolute equality—a democracy pushed to anarchy. A full exposition of his system will be found in L. Reybaud's *Études sur les Réformateurs et Socialistes Modernes*.

The full title of Leroux's principal work is *Le l'Humanité, de son principe et de son avenir, où se trouve exposée la vraie définition de la religion, et où l'on explique le sens, la suite, et l'achèvement du Mouvement du Christianisme*. A second edition of this work appeared in 1845. Amongst his other publications, in addition to some already mentioned, are—*Discours sur la situation actuelle de la Société et de l'esprit humain*, 1841, new ed., 2 vols., 1847, *D'une Religion nationale, ou du Cible, 1846*, *Discours sur la fusion des lettres de travail*, 1848, *Prêt d'une Constitution démocratique et sociale*, 1848, *De Christianisme et de ses origines démocratiques*, 1848, *La Carrière de M. Aguado, ou se trouvent les richesses qui paient les pauvres*, 1848, *De la Ploutocratie; ou du gouvernement des riches*, 1848, *Malheur et les Économistes, ou l'aveu-t-il toujours des pauvres?* 1849, *Quelques pages de l'Érèbe*, 1859, perhaps of a philosophical poem, entitled *La Grèce de Socrate*, 1863-64, *Joh, thème en cinq actes, par le prophète Israhel, traduit de l'Ébreu*, 1866. M. Leroux also produced, with the aid of an anonymous collaborator, a translation of Goethe's *Werther*, which was published in 1849, with a preface by George Sand.

LERWICK. See SHETLAND ISLANDS.

LE SAGE, ALAIN REY (1668-1747), novelist and dramatist, was born at Sarzeau in the peninsula of Rhuy, between the Morbihan and the sea, on the 8th of May 1668, and died on the 17th of November 1747, at Boulogne-sur-Mer. Rhuy was a legal district, and Claude Le Sage, the father of the novelist, held the united positions of advocate, notary, and registrar of its royal court. His wife's name was Jeanne Brenugat. Both father and mother died when Le Sage was very young, and his property was wasted or embezzled by his guardians. Little is known of his youth except that he went to school with the Jesuits at Vannes until he was eighteen. Conjecture has it that he continued his studies at Paris, and it is certain that he was called to the bar at the capital in 1692. In August 1694 he married the daughter of a joiner, Marie Elizabeth Huyard. She was beautiful but had no fortune, and Le Sage had little practice. About this time he met his old schoolfellow the dramatist Danchet, and is said to have been advised by him to betake himself to literature. He began modestly as a translator, and published in 1695 a French version of the *Epistles* of Aristænetus, which was not successful. Shortly afterwards he found a valuable patron and adviser in the Abbé de Lyonne, who bestowed on him an annuity of 600 livres, and recommended him to exchange the classics for Spanish literature, of which he was himself a student and collector. Le Sage began by translating plays chiefly from Rojas and Lope de Vega. *Le Traite Puné* and *Le Point d'Honneur* from the former, *Don Félix de Mendocce* from the latter, were acted or published in the first two or three years of the 18th century. In 1704 he translated the continuation of Don Quixote by Avellaneda, and soon afterwards adapted a play from Calderon, *Don César Ursin*, which had a divided fate, being successful at court and damned in the city. He was, however, nearly forty before he obtained anything like decided success. But in 1707 his admirable farce of *Crispin Rival de son Maître* was acted with great applause, and *Le Diable Boiteux* was published. This latter went through several editions in the same year, and was frequently reprinted till 1725, when Le Sage altered and improved it considerably, giving it its present form. Notwithstanding the success of *Crispin*, the actors did not

like Le Sage, and refused a small piece of his called *Les Étrennes*. He thereupon altered it into *Turcaret*, his theatrical masterpiece, and one of the best comedies in French literature. This appeared in 1709. Some years passed before he again attempted romance writing, and then the first two parts of *Gil Blas* appeared in 1715. Strange to say, it was not so popular as the *Diabre Boiteux*. Le Sage worked at it for a long time, and did not bring out the third part till 1734, nor the fourth till 1735. For this last he had been paid to the extent of a hundred pistoles some years before its appearance. This is the only positive statement we have about his gains. During these twenty years he was, however, continually busy. Notwithstanding the great merit and success of *Turcaret* and *Crispin*, the Théâtre Français did not welcome him, and in the year of the publication of *Gil Blas* he began to write for the Théâtre de la Foire—the comic opera held in booths at festival time. This, though not a very dignified occupation, was followed by many writers of distinction at this time, and by none more assiduously than by Le Sage. According to one computation he produced either alone or with others about a hundred pieces, varying from strings of songs with no regular dialogue, to comedettes only distinguished from regular plays by the introduction of music. He was also industrious in prose fiction. Besides finishing *Gil Blas* he translated the *Orlando Innamorato*, rearranged *Guzman d'Alfarache*, published two more or less original novels, *Le Bachelier de Salamancue* and *Estevanilla Gonzalez*, and in 1733 produced the *Vie et Aventures de M. de Beauchêne*, which is curiously like certain works of Defoe. Besides all this, Le Sage was also the author of *La Valise Trouvée*, a collection of imaginary letters, and of some minor pieces, of which *Une Journée des Parques* is the most remarkable. This laborious life he continued until 1740, when he was more than seventy years of age. His eldest son had become an actor, and Le Sage had disowned him, but the second was a canon at Boulogne in comfortable circumstances. In the year just mentioned his father and mother went to live with him. At Boulogne Le Sage spent the last seven years of his life, dying, as has been said, on the 17th of November 1747, at the age of nearly eighty.

Not much is known of Le Sage's life and personality, and the foregoing paragraph contains not only the most important but almost the only facts available for it. The few anecdotes which we have of him represent him as a man of very independent temper, declining to accept the condescending patronage which in the earlier part of the century was still the portion of men of letters. Thus it is said that, on being remonstrated with, as he thought impolitely, for an unavoidable delay in appearing at the duchess of Bouillon's house to read *Turcaret*, he at once put the play in his pocket and retired, refusing absolutely to return. In his old age, when he was very deaf, he is also said to have been decidedly arbitrary in his choice of the persons whom he permitted to have access to his trumpet, but this is not unusual in such cases. It may, however, be said that as in time so in position he occupies a place apart from most of the great writers of the 17th and 18th centuries respectively. He was not the object of royal patronage like the first, nor the pet of *salons* and coteries like the second. Indeed he seems all his life to have been purely domestic in his habits, and purely literary in his interests.

The importance of Le Sage in French and in European literature is not entirely the same, and he has the rare distinction of being more important in the latter than in the former. His literary work may be divided into three parts. The first contains his *Théâtre de la Foire* and his few miscellaneous writings, the second his two remarkable

plays *Crispin* and *Turcaret*, the third his prose fictions. In the first two he swims within the general literary current in France; he can be and must be compared with others of his own nation. But in the third he emerges altogether from merely national companionship. It is not with Frenchmen that he is to be measured. He formed no school in France, he followed no French models. His work, admirable as it is from the mere point of view of style and form, is a parenthesis in the general development of the French novel. That product works its way from *Madame de la Fayette* through *Marivaux* and *Prévost*, not through *Le Sage*. His literary ancestors are Spaniards, his literary contemporaries and successors are Englishmen. The position is almost unique, it is certainly interesting and remarkable in the highest degree.

Of *Le Sage's* miscellaneous work, including his numerous farce-opérettes, there is not much to be said except that they are the very best kind of literary hack work. The pure and original style of the author, his abundant wit, his cool humorous attitude towards human life, which wanted only greater earnestness and a wider conception of that life to turn it into true humour, are discernible throughout. But this portion of his work is practically forgotten, and no sensible critic who has taken the trouble to examine it will say that for the world at large there is any reason why it should be resuscitated. Of such work every generation produces its own quota, which is sufficient for the day. *Crispin* and *Turcaret* show a stronger and more deeply marked genius, which but for the ill-will of the actors might have gone far in this direction. But *Le Sage's* peculiar unwillingness to attempt anything absolutely new discovered itself here. Even when he had devoted himself to the Foire theatre, it seems that he was unwilling to attempt when occasion called for it the absolute innovation of a piece with only one actor, a crux which *Piron*, a lesser but a bolder genius, accepted and carried through. *Crispin* and *Turcaret* are unquestionably Moliéresque, though they are perhaps more original in their following of Molière than any other plays that can be named. For this also was part of *Le Sage's* idiosyncrasy that, while he was apparently unable or unwilling to strike out an entirely novel line for himself, he had no sooner entered upon the beaten path than he left it to follow his own devices. *Crispin Révolté* or *Maitre* is a farce in one act and many scenes, after the earlier manner of motion. Its plot is somewhat extravagant, inasmuch as it lies in the effort of a knavish valet, not as usual to further his master's interests, but to supplant that master. But the charm of the piece consists first in the lively bustling action of the short scenes which take each other up so promptly and smartly that the spectator has not time to cavil at the improbability of the action, and secondly in the abundant wit of the dialogue. *Turcaret* is a far more important piece of work. The only thing which prevents it from holding the very highest place is a certain want of unity in the plot. This unity, however, which was too often attained by Molière through the exaggeration of the ruling-passion theory, as in *Tartuffe* and the *Misanthrope*, is compensated in *Turcaret* by the most masterly profusion of character-drawing in the separate parts. *Turcaret*, the ruthless, dishonest, and dissolute financier, his vulgar wife as dissolute as himself, the hare-brained marquis, the knavish cavalier, the baroness (a coquette with the finer edge taken off her fine-ladyhood, yet by no means unlovable), are each and all finished portraits of the best comic type, while almost as much may be said of the minor characters. The style and dialogue are also worthy of the highest praise; the wit never degenerates into mere "wit-combat."

It is, however, as a novelist that the world has agreed to remember *Le Sage*, and the world as usual is right. A

great deal of unnecessary labour has been spent on the discussion of his claims to originality. What has been already said will give a sufficient clue through this thorny ground. In mere form *Le Sage* is not original. He does little more than adopt that of the Spanish picaresque romance of the 16th and 17th century. Often, too, he prefers merely to rearrange and adapt existing work, and still oftener to give himself a kind of start by adopting the work of a preceding writer as a basis. But it may be laid down as a positive truth that he never in any work that pretends to originality at all is guilty of anything that can fairly be called plagiarism. Indeed we may go further, and say that he is very fond of asserting or suggesting his indebtedness when he is really dealing with his own funds. Thus the *Diablo Botteux* borrows the title, and for a chapter too the plan and almost the words, of the *Diablo Cojuelo* of Luis Vélez de Guevara. But after a few pages *Le Sage* leaves his predecessor alone. Even the plan of the Spanish original is entirely discarded, and the incidents, the episodes, the style, are as independent as if such a book as the *Diablo Cojuelo* had never existed. The case of *Gil Blas* is still more remarkable. It was at first alleged that *Le Sage* had borrowed it from the *Alarcos de Obregon* of Vincent Espinel, a curiously rash assertion, inasmuch as that work exists and is easily accessible, and as the slightest consultation of it proves that, though it furnished *Le Sage* with separate incidents and hints for more than one of his books, *Gil Blas* as a whole is not in the least indebted to it. Afterwards Father Isla asserted that *Gil Blas* was a mere translation from an actual Spanish book—an assertion at once incapable of proof and disproof, inasmuch as there is no trace whatever of any such book. A third hypothesis is that there was some manuscript original which *Le Sage* may have worked up in his usual way, in the same way, for instance, as he professes himself to have worked up the *Bachelier de Salamanca*. This also is in the nature of it incapable of refutation, though the argument from the *Bachelier* is strong against it, for there could be no reason why *Le Sage* should be more reticent of his obligations in the one case than in the other. Except, however, for historical reasons, the controversy is one which may be safely neglected. There is as little doubt (with the limitations already laid down) of the originality of *Le Sage* as of that of any great writer in the world. *Gil Blas* then remains its property, and it is admittedly the capital example of its own style. Fielding has been called the prose Homer of human nature, but in the sense in which the expression was used it is doubtful whether his master (as *Le Sage* certainly was) is not better entitled to the term. For *Le Sage* has not only the characteristic which Homer and Shakespeare have of absolute truth to human nature as distinguished from truth to this or that national character, but he has what has been called the quality of detachment, which they also have. He never takes sides with his characters as Fielding does. Asmodeus and Don Cleofas, *Gil Blas* and the Archbishop and Doctor Sangrado, are produced by him with exactly the same impartiality of attitude. Except that he brought into novel writing its highest quality of artistic truth, it perhaps cannot be said that he did much to advance prose fiction in itself. He invented, as had been said, no new *genre*; he did not, as *Marivaux* and *Prévost* did, help on the novel as distinguished from the romance. In form his books are undistinguishable, not merely from the Spanish romances which are, as have been said, their direct originals, but from the medieval *romans d'aventures* and the Greek prose romances. But in individual excellences they have few rivals. Nor should it be forgotten, as it sometimes is, that *Le Sage* was a great master of French style, the greatest unquestionably between the classics of the 17th century and the

classics of the 18th. He is perhaps the last great writer before the decadence (for since the time of Paul Louis Courier it has not been denied that the *philosophic* period is in point of style a period of decadence). His style is perfectly easy at the same time that it is often admirably epigrammatic. It has plenty of colour, plenty of flexibility, and may be said to be exceptionally well fitted for general literary work.

The dates of the original editions of Le Sage's most important works have already been given. He published during his life a collection of his regular dramatic works, and also one of his pieces for the Foire, but the latter is far from exhaustive, nor is there any edition which can be called so, though the *Œuvres Choisies* of 1782 and 1818 are useful. The *Double Botteux* and *Œil Bleu* have been reprinted and translated numberless times. Both will be found conveniently printed, together with *Edouard Goussier* and *Goussier d'Alfort*, the best of the minor novels, in four volumes of Garnier's *Bibliothèque Américaine* (Paris, 1866). *Parovert* and *Crispin* are to be found in all collected editions of the French drama. There is a useful edition of them, with ample specimens of Le Sage's work for the Foire, in two volumes (Paris, 1821) (G. B.).

LESBOS was the name applied by the Greeks to the island now called Meolia—the ancient name of the chief city on the island, Mytilene, having been in the Middle Ages applied to the whole island. It lies along the coast of Mysia, north of the entrance to the Gulf of Smyrna. Strabo estimates its circumference as 1100 stadia, about 138 miles, and Scylax reckons it seventh in size of the islands in the Mediterranean Sea. The narrowest part of the channel which divides it from the Mysian coast, between the promontory of Argencum and the town of Assos, is about 8 miles wide. The island is of irregular shape; it has three prominent points, Argencum on the north-east, Sigrium (now Sigrî) on the west, and Mælea (now Maria) on the south-east, and a deep gulf, the Euripus Pyrrhæus, now the port of Calloni, runs far into its western side between Sigrium and Mælea. The surface is mountainous, but the soil is in spite of this exceedingly fertile; the wine, oil, and grain of Lesbos were well known in ancient times. The climate is perhaps more delightful than that of any other part of the *Ægean*, the breezes and the sea temper the heat of summer, and the winter is not severe. Earthquakes were often experienced in the island, the latest, that of 1861, is still remembered as one of the severest known in a country of earthquakes.

The oldest inhabitants are said to have been Pelasgians; and two generations before the Trojan war came Ionians under Mæcæus. These two races may be said to represent respectively the first period of primitive barbarism, and the second period, when navigation brought to the island the commerce and intercourse of more advanced races; it deserves notice that the name Mæcæus, the Phœnician Melkart, is taken by Curtius as a sign of the presence of Phœnician traders. But the island begins to be important in history from the time of the *Æolian* immigration, which is said to have commenced one hundred and thirty years after the Trojan war; from this time it continued long to be one of the chief homes of Hellenic civilization. Homer refers to its wealth and its populous cities, its chief fame lies in its connexion with the earliest development of Greek poetry and literature. Lesches the cyclic poet, Terpander, Arion, Hellanicus, Pittacus, Alceus, and Sappho were all natives of Lesbos. Probably no district of Greece can boast of so many names, most of them associated with some marked advance in literature, as Lesbos can enumerate between 700 and 800 A.C.

The chief city of Lesbos was Mytilene or Mitylene, the latter spelling being general in literature while the former is the official spelling used on coins. It was originally built on an island close to the western coast of Lesbos; afterwards when the limits of the island were too narrow it was joined to Lesbos by a causeway, and the city spread

out along the coast. On each side of this isthmus was a harbour; not far from the city was a place called Malœio, but it does not appear that this name was, as some have said, given to the northern harbour. The city has always been known for its delightful and healthy climate. With the advantage of its strong situation and good harbour it soon became one of the most powerful Greek cities of Asia Minor. It was the only *Æolian* city that possessed a strong navy. Its colonies were spread along Asia Minor and Thrace, and in the 6th century it maintained a long though finally unsuccessful contest with Athens for the possession of Sigeum. About its internal government little is known. After the kingly period there was a time when oligarchical and democratical factions contended with one another. The noble family of the Pentelidæ, descended from Penthius, son of Orestes, played a great part in these contentions. Its Pelopid descent may be compared with various legends that connect Pelops with the island of Lesbos. The city fell under the Persian power after the defeat of Cressus. A tyrant Coes ruled it soon after, but was expelled when the island joined the Ionic revolt in 500 B.C. It was freed from the Persian yoke after the battles of Platea and Myræa, and was a member of the Delian confederacy. It revolted from Athens 429 B.C., and was reduced after a long siege. The story of the cruel revenge which the Athenian assembly at first resolved on, and of the second meeting and the more merciful resolution, and of the arrival of the second despatch vessel barely in time to prevent the massacre of the whole male population, has been told by Thucydides. The territory of Mytilene was, however, divided among Athenian *κλῆροῦχοι*.

The harbour was the scene of a great battle between Callicratidas and Conon in the latter part of the Peloponnesian war; but it is impossible here to trace all the vicissitudes of its history, which are coincident with the history of Greece in the East. It continued to be a rich and prosperous city throughout ancient history, and its name came during the Byzantine period to be applied to the whole island. It was long a stronghold of the Venetians during the Middle Ages, but has belonged to the Turkish empire since 1430.

The other chief towns besides Mytilene were Methymna, Antissa, Eresus, and Pyrrha; hence the island is sometimes called a Pentapolis. There was also a town called Arisbe, which was destroyed by an earthquake before the time of Herodotus; Conza finds its site inland at Palaïokastro, north-east of the port of Calloni. Pyrrha lay on the south-east coast of this port, at a place also called Palaïokastro. Antissa, near Sigrium, was destroyed by the Romans in 163 B.C., as having sided with Parseus in the Macedonian war. Eresus, now Eresî, was also near Sigrium. Of these five cities, Mitylene was the chief; Pyrrha, Eresus, and Antissa were under its influence, and seem almost always to have followed its lead. But Methymna on the north coast, though it had not such a fine situation as Mitylene, was a very strong place, it was therefore able to maintain a constant quarrel with the more powerful city, and was always ready to side with its enemies. Molyvo, still the second city of the island, occupies the site of the old Methymna. The name Methymna or Mathymna is derived from the wine for which it was famous (Virg., *Georg.*, ii. 90).

See Conza, *Reise auf der Insel Lesbos*; Plehn, *Lesbos*; Böttner, *Archæol. d. Miletens. Seeländ. et. d. Lesbos*, v. (according to Conza not very trustworthy); Zanders, *Beitr. z. Kunde d. Insel Lesbos*; Newton, *Travels*; and for the geography Grauert, *Descr. of Asia Minor*, and Forbiger, *Alt. Georg.* The best maps are the English admiral's charts, and those in Conza's work.

LESCHIANS, or LESCHIS (from the Persian *Lekhi*, called Lekî by the Græcians or Georgians, Armenians, and Ossetians), a number of tribes in the Caucasus forming

along with the Tchetchenians (about 165,000) the East Caucasian group, and spreading southward over the borders of Daghestan, the country which they have occupied from time immemorial, into the Transcaucasian circles Kuba, Shemakha, Nukha, and Sakatsky. They are mentioned as Ἀλῆαι by Strabo and Plutarch along with the Ἰβλῆαι (perhaps the modern Gaigai, a Tchetchenian tribe), and their name occurs with great frequency in the old chronicles of the Georgians, whose territory was exposed to their raids for centuries, until through the fall of Shamyl they were brought under subjection to Russia. Moses of Chorene mentions a battle in the reign of the Armenian King Baba (370–377 A.D.), in which Shagir, king of the Lekians, was slain. Among the Lezgians the chief place, both on account of numbers and importance, is due to the Avars (155,194) and the closely related Andians (35,511), to whom may be attached the Dido (9074) and a number of small tribes, confined to a few villages or even to one, and speaking different though intimately connected languages. The Avars, extending from the Sulak and the Kumyk steppes right through Daghestan to the Alasan in the Sakatsky circle, were once the dominant people as their language is still the dominant language of all this district. Their neighbours the Kasumukhians (35,139), who call themselves Lakians, have a language of their own, and are well known as traders not only through all Transcaucasia but also in European Russia; beside them a small fragment of another race occupies the village Aitchi (592 inhabitants) in a separate mountain valley. Towards the Caspian Sea the Lukians are bordered by the Darghians (88,045) and the Tabassaranians (16,350), who in the matter of dialect are strongly marked off from each other. To the north and south of the basin of the Samur (which consequently bears the native name Kul-an-az or "middle river") lives another of the leading tribes of Daghestan, the Kurinians or Lezgians *par excellence*, who by themselves alone occupy the circles of Kuri and Samur, as well as the greatest part of Kuba, and parts of Shemakha, Nukha, &c. Their language (investigated like other Caucasian tongues by Baron Ussler) is there spoken by 130,873 individuals; and closely related to it apparently are the languages of the neighbouring Agulians (5357), Rutulians (11,803), Zakhurians (4561). According to the specimens collected by Von Seidlitz in 1830 during a visit to their country, which lies round the snowy peak of the Shakh Dagh in the Kuba circle, the Djekians, Haputians, and Krysiens speak what seem to be dialects of Kurinian; but he cannot connect with any other tongue the language spoken by the peculiar-looking inhabitants of the neighbouring village of Khinalugh (2196). The Udiniens (9668) are another Lezgian tribe, which, though at present it only occupies a few villages in the Nukha circle, was formerly widely distributed over the plain of the Kura, and may possibly be the wretched remnant of the Albanians, mentioned by Strabo and others as a people of similar importance with the Grusnians and Armenians.

All these Lezgians are more or less tall, good-looking and powerful, sometimes fair sometimes dark, bold, enduring, and intelligent—in one word, excellent material for the work of civilization as soon as their country is opened up by roads and the railway just projected from Vladikavkas by Petrovsk to Baku. Smith-work and cutlery are skilfully wrought among the Lezgians in general; the women weave excellent shawls (which vary in style according to locality); and the felt cloaks of Andi are known throughout the Caucasus.

See Von Seidlitz, "Etnographie des Kaukasus," in Petermann's *Mittheilungen*, 1830.

LESLEY, JOHN (1527–1596), bishop of Ross, Scottish historian and statesman, was born in 1527. His father

was Gavin Lesley, parson of Kingsnise. He was educated at the university of Aberdeen, where he took the degree of M.A. In 1538 he obtained a dispensation permitting him to hold a benefice, notwithstanding his being a natural son, and in June 1546 he was made an acolyte in the cathedral church of Aberdeen, of which he was afterwards appointed a canon and prebendary. He also studied at Poitiers, at Toulouse, and at Paris, where he was made doctor of laws. In 1558 he was appointed official of Aberdeen, and in 1559 he was inducted into the parsonage and prebend of Oyne. At the Reformation Lesley became a champion of the Romish faith, and appeared on that side at the disputation held in Edinburgh in 1561, when Knox was one of his antagonists. He was one of the commissioners sent the same year to bring over the young Queen Mary to take the government of Scotland. He returned in her train, and was appointed a privy councillor, and in 1564 one of the senators of the college of justice. Shortly afterwards he was made abbot of Lindores, and in 1565 bishop of Ross. He was one of the sixteen commissioners appointed to revise the laws of Scotland, and the volume of the Acts of Parliament known as the Black Acts was, chiefly owing to his care, printed in 1566.

The bishop was one of the most steadfast friends of Queen Mary.¹ After the failure of the royal cause, and whilst Mary was a captive in England, Lesley continued to exert himself on her behalf. He was one of the commissioners at the conference at York in 1568. He appeared as her ambassador at the court of Elizabeth to complain of the injustice done to her, and when he found he was not listened to he laid plans for the escape of the queen. He also projected a marriage for her with the duke of Norfolk, which ended in the execution of that nobleman. For this he was put under the charge of the bishop of Ely, and afterwards imprisoned in the Tower of London. During his confinement he collected materials for his history of Scotland, with which his name is now chiefly known. In 1571 he presented the latter portion of this work, written in his own vernacular tongue, to Queen Mary to amuse her in her captivity. He also wrote for her use his *Pis Consolations*, and the queen devoted some of the hours of her captivity to translating a portion of it into French verse.

In 1573 he was liberated from prison, but was banished from England. For two years he attempted unsuccessfully to obtain the assistance of Continental princes in favour of Queen Mary. While at Rome in 1578 he published his history *De Origine, Moribus, et Rebus Gestis Scottorum*, the Latinity of which is held only second to that of Buchanan. In 1579 he went to France, and was made suffragan and vicar-general of the archbishopric of Rouen by the Cardinal de Bourbon. Whilst visiting his diocese, however, he was thrown into prison, and had to pay 3000 pistoles to prevent his being given up to Elizabeth. During the remainder of the reign of Henry III. he lived unmolested, but on the accession of the Protestant Henry IV. he again fell into trouble. In 1590 he was thrown into prison, and had to purchase his freedom at the same expense as before. In 1593 he was made bishop of Coutances in Normandy, and had licence to hold the bishopric of Ross till he should obtain peaceable possession of the former see. Being tired of life, he retired at last to a monastery at Gurtzburg near Brussels, where he died in 1596.

The works of Lesley are as follows:—*A defence of the Honour of Marie Queen of Scotland*, by *Euastius Dauphiale*, 8vo, London, 1609; *A treatise concerning the defence of the Honour of Marie Queen of Scotland*, made by *Morgan Philipps*, bachelor of divinity,

¹ An interesting account of his care of her during her illness at Jostburgh is given in *Proc. Roy. Soc. Ant. Scot.*, vol. xv. p. 210.

8vo, Lugo, 1570-71, *Pro effluviis annis consolatones, ad Marianum Scot. Reg.*, 8vo, Paris, 1574, *Pio libello impubanda Orazio, ad Elizabetham*, 8vo, Paris, 1574, *De origine, moribus, et rebus gestis Rectorum, libri decem*, 4to, Rome, 1573 and 1575, *De illustrium personarum in republica administranda auctoritate libellus*, 4to, Rheims, 1580, *De titulo de jure Marianus Scot. Reg. quo regna Anglie successione sua jure vindicant*, 4to, Rheims, 1580; *A treatise touching the right of Maria Queen of Scotland, and of King James her graces issue to the succession of the crown of England*, 8vo, 1581, *Congratulatio Alberto Archiduci Austrie de eius adventu ad sequens provinciarum inferiorum Germaniam*, 8vo, Brussels, 1580; *The History of Scotland from 1480 to 1561*, edited for the Bannatyne Club by Thomas Thomson from a MS. in the possession of the earl of Leven and Melville, 4to, Edinburgh, 1830. Several of Lesley's works, of which the originals are very rare, will be found reprinted in Anderson's *Collections relating to the History of Queen Mary*, and in Jebb, *De vite Marianæ Reg. Scot. vita*.

LESLIE, ALEXANDER. See LIVEN, EARL OF.

LESLIE, or LESLEY, CHARLES (1650-1722), a prominent nonjuror, famous as the author of *A Short and Easy Method with the Deists*, was born in 1650 in Ireland, where his father, Dr John Leslie, was bishop of Raphoe and subsequently of Clogher. His early education was received at Inniskilling, Fermanagh, and in 1664 he was admitted a fellow commoner in Trinity College, Dublin, where he continued until he commenced master of arts. On his father's death in 1671, removing to England, he entered himself as a student of law at the Temple, but soon afterwards turned his attention to theology, and took orders in 1680. Seven years later he became chancellor of the cathedral of Connor and a justice of the peace, and began a long career of public controversy by responding in public disputation at Monaghan to the challenge of the Roman Catholic bishop of Clogher. Although an eager and uncompromising opponent of Roman Catholicism, Leslie was a firm supporter of the Stuart dynasty, and, having declined at the Revolution to take the oath to William and Mary, he was on this account deprived of his benefice. In 1689 the growing troubles in Ireland induced him to withdraw to England, where he employed himself for the next twenty years in writing various controversial pamphlets in favour of the nonjuring cause, and in numerous polemics against the Quakers, Jews, Socinians, and Papists, and especially in that against the Deists with which his name is now most commonly associated. A warrant having been issued against him in 1710 for his pamphlet *The Good Old Cause, or Lying in Truth*, he in that year resolved to quit England and to accept an offer made by the Pretender (with whom he had previously been in frequent correspondence) that he should reside with him at Bar-le-Duc. After the failure of the Stuart cause in 1715, Leslie accompanied his patron into Italy, where he remained until 1721, in which year, having found his sojourn amongst Roman Catholics extremely unpleasant, he sought and obtained permission to return to his native country. He died at Ghalongh, Monaghan, on April 13, 1722.

The *Theological Works* of Leslie were collected and published by himself in 2 vols. folio, 1721; a later edition, slightly enlarged, appeared at Oxford in 1832 (7 vols. 8vo). They handle the controverted points of which they treat with considerable force of argument and rigour of style; he had the somewhat rare distinction of making several converts by his reasonings, and probably persons might still be found who are prepared to concur in Dr Johnson's dictum that "Leslie was a reasoner, and a reasoner who was not content to be reasoned against." But the questions in dispute are no longer discussed on the basis which seems to have been pretty unanimously accepted by the orthodox theologians of that age. This is sufficiently seen when the promise given in the title of his best-known work is contrasted with the actual performance. The book professes to be *A Short and Easy Method with the Deists, wherein the reasonableness of the Christian Religion is demonstrated by Infallible Proof from Four Titles, which are incompatible to any suppositors which can yet have been, or that can possibly be* (1697). The four rules which, according to Leslie, have only to be rigorously applied in order to establish not the probability merely but the absolute certainty of the truth of Christianity are simply these:—(1) that the

matter of fact be such as that men's outward senses, their eyes and ears, may be judges of it, (2) that it be done publicly, in the face of the world, (3) that not only public monuments be kept up in memory of it, but some outward actions be performed, (4) that such monuments and such actions or observances be instituted and do commence from the time that the matter of fact was done. Other publications of Leslie are *The Snake in the Grass* (1696), against the Quakers, *A Short Method with the Jews* (1689), *The Socinian Controversy Discussed* (1697); *The True Notion of the Catholic Church* (1703); and *The Case Stated between the Church of Rome and the Church of England* (1713).

LESLIE, CHARLES ROBERT (1794-1859), one of the most popular of English genre-painters, was born in London on the 19th of October 1794. His parents were American, and when he was five years of age he returned with them to their native country. They settled in Philadelphia, where their son was educated and afterwards apprenticed to a bookseller. He was, however, mainly interested in painting and the drama, and when George Frederick Cooke visited the city he executed a portrait of the actor, from recollection of him on the stage, which was considered a work of such promise that a fund was raised to enable the young artist to study in Europe. He left for London in 1811, bearing introductions which procured for him the friendship of West, Beechey, Allston, Coleridge, and Washington Irving, and was admitted as a student of the Royal Academy, where he carried off two silver medals. At first, influenced by West and Fuseli, he essayed "high art," and his earliest important subject depicted Saul and the Witch of Endor; but he soon discovered his true aptitude and became a painter of cabinet-pictures, dealing, not like those of Wilkie, with the contemporary life that surrounded him, but with scenes from the great masters of fiction, from Shakespeare and Cervantes, Addison and Molière, Swift, Sterne, Fielding, and Smollett. Of individual paintings we may specify Sir Roger de Coverley going to Church, 1819; May-day in the Time of Queen Elizabeth, 1821; Sancho Panza and the Duchess, 1824; Uncle Toby and the Widow Wadman, 1831, *La Malinade Imaginaire*, act iii. sc. 6, 1843; and the Duke's Chaplain Enraged leaving the Table, from *Don Quixote*, 1840. Many of his more important subjects exist in varying replicas. He possessed a sympathetic imagination, which enabled him to enter freely into the spirit of the author whom he illustrated, a delicate perception for female beauty, an unflinching eye for character and its outward manifestation in face and figure, and a genial and sunny sense of humour, guided by an instinctive refinement which prevented it from overstepping the bounds of good taste. In 1821 Leslie was elected A.R.A., and five years later full academician. In 1833 he left for America to become teacher of drawing in the military academy at West Point, but the post proved an irksome one, and in some six months he returned to England, where he practised his profession with unflinching assiduity till his death on the 5th of May 1859.

In addition to his skill as an artist, Leslie was a ready and pleasant writer. His *Life of his friend Constable*, the landscape painter, appeared in 1845, and his *Handbook for Young Painters*, a volume embodying the substance of his lectures as professor of painting to the Royal Academy, in 1846. In 1860 Tom Taylor edited his *Autobiography and Letters*, which contain interesting reminiscences of his distinguished friends and contemporaries.

LESLIE, SIR JOHN (1766-1839), geometrical and physicist, was born of humble parents at Largo, Fifeshire, on April 16, 1766, received his early education there and at Leven, and in his thirteenth year, encouraged by friends who had even then remarked his aptitude for mathematical and physical science, entered the university of St Andrews. On the completion of his arts course, he nominally studied divinity at Edinburgh until 1787; in 1788-89 he spent rather more than a year as private tutor in a Virginian family, and from 1790 till the close of

1792 he held a similar appointment in Staffordshire, employing his spare time in experimental research and in preparing a translation of Buffon's *Natural History of Birds*, which was published in nine 8vo vols. in 1793, and brought him some money. For the next twelve years (passed chiefly in London or at Largo, with an occasional visit to the Continent) he continued his physical studies, which resulted in numerous papers contributed by him to Nicholson's *Philosophical Journal*, and in the publication (1804) of the *Experimental Inquiry into the Nature and Propagation of Heat*, a work which gained for its author the Rumford Medal of the Royal Society of London. In 1805 he was elected to succeed Playfair in the chair of mathematics at Edinburgh, not, however, without violent though unsuccessful opposition on the part of a narrow-minded clerical party who accused him of heresy in something he had said as to the "unsophisticated notions of mankind" about the relation of cause and effect. During his tenure of this chair he published two volumes of a *Course of Mathematics*—the first, entitled *Elements of Geometry, Geometrical Analysis, and Plane Trigonometry*, in 1809, and the second, *Geometrical Analysis, and Geometry of Curve Lines*, in 1821, the third volume, on "Descriptive Geometry" and the "Theory of Solids" was never completed. With reference to his invention (in 1810) of a process of artificial congelation, he published in 1813 *A Short Account of Experiments and Instruments depending on the relations of Air to Heat and Moisture*, and in close connexion with the subject of this treatise he also wrote a paper on the æthiopscope, which appeared in 1818 in the *Transactions of the Royal Society of Edinburgh*. In 1819, on the death of Playfair, he was promoted to the more congenial chair of natural philosophy, which he continued to hold until his death, and in 1823 he published, chiefly for the use of his class, the first volume of his never-completed *Elements of Natural Philosophy*. Leslie's main contributions to physics were made by the help of the "differential thermometer," an instrument whose invention was contested with him by Count Rumford. By adapting to this instrument various ingenious devices he was enabled to employ it in a great variety of investigations, connected especially with platiometry, hygrometry, and the temperature of space. In 1820 he had been elected a corresponding member of the Royal Institute of France, the only distinction of the kind which he valued, and early in 1832 he was, on the recommendation of Lord Chancellor Brougham, created a knight of the Guelphic order. He died at Coates, a small property which he had acquired near Largo, on November 3 of the same year.

LESLIE, THOMAS EDWARD CLIFFE (1827–1882), one of the ablest and most original English economists of the present century, was born in the county of Wexford (as is believed) the year 1827. He was the second son of the Rev. Edward Leslie, prebendary of Dromore, and rector of Annahilt, in the county of Down. His family was of Scotch descent, but had been connected with Ireland since the reign of Charles I. Amongst his ancestors were that accomplished and energetic prelate, John Leslie, bishop first of Raphoe and afterwards of Clogher, who, when holding the former see, offered so stubborn a resistance to the Cromwellian forces, and the bishop's son Charles, the well-known conjurer. Cliffe Leslie received his elementary education from his father, who resided in England, though holding church preferment as well as possessing some landed property in Ireland; by him he was taught Latin, Greek, and Hebrew, at an unusually early age; he was afterwards for a short time under the care of a clergyman at Clapham, and was then sent to King William's College, in the Isle of Man, where he remained until, in 1842, being then only fifteen years of age, he entered Trinity College,

Dublin. He was a distinguished student there, obtaining, besides other honours, a classical scholarship in 1845, and a senior moderatorship (gold medal) in mental and moral philosophy at his degree examination in 1846. He became a law student at Lincoln's Inn, was for two years a pupil in a conveyancer's chambers in London, and was called to the English bar. But his attention was soon turned from the pursuit of legal practice, for which he seems never to have had much inclination, by his appointment, in 1853, to the professorship of jurisprudence and political economy in Queen's College, Belfast. The duties of this chair requiring only short visits to Ireland in certain terms of each year, he continued to reside and prosecute his studies in London, and became a frequent writer on economic and social questions in the principal reviews and other periodicals. In 1870 he collected a number of his essays, adding several new ones, into a volume entitled *Land Systems and Industrial Economy of Ireland, England, and Continental Countries*. J. S. Mill gave a full account of the contents of this work in a paper in the *Fortnightly Review*, in which he pronounced Leslie to be "one of the best living writers on applied political economy." Mill had sought his acquaintance on reading his first article in *Macmillan's Magazine*; he admired his talents and took pleasure in his society, and treated him with a respect and kindness which Leslie always gratefully acknowledged.

In the frequent visits which Leslie made to the Continent, especially to Belgium and some of the less-known districts of France and Germany, he occupied himself much in economic and social observation, studying the effects of the institutions and system of life which prevailed in each region, on the material and moral condition of its inhabitants. In this way he gained an extensive and accurate acquaintance with Continental rural economy, of which he made excellent use in studying parallel phenomena at home. The accounts he gave of the results of his observations were among his happiest efforts; "no one," said Mill, "was able to write narratives of foreign visits at once so instructive and so interesting." In these excursions he made the acquaintance of several distinguished persons, amongst others of M. Léonce de Lavergne and M. Émile de Laveleye. To the memory of the former of these he afterwards paid a graceful tribute in a biographical sketch (*Fortnightly Review*, February 1881); and to the close of his life there existed between him and M. de Laveleye relations of mutual esteem and cordial intimacy.

Two essays of Leslie's appeared in volumes published under the auspices of the Cobden Club, one on the "Land System of France" (2d ed., 1870), containing an earnest defence of *la petite culture* and still more of *la petite propriété*; the other on "Financial Reform" (1871), in which he exhibited in detail the impediments to production and commerce arising from indirect taxation. Many other articles were contributed by him to reviews between 1875 and 1879, including several discussions of the history of prices and the movements of wages in Europe, and a sketch of life in Auvergne in his best manner, the most important of them, however, related to the philosophical method of political economy, notably a memorable one which appeared in the Dublin University periodical, *Hermathena*. In 1879 the provost and senior fellows of Trinity College published for him a volume in which a number of these articles were collected under the title of *Essays in Political and Moral Philosophy*. These and some later essays, which ought one day to be united with them, together with the earlier volume on *Land Systems*, form the essential contribution of Leslie to our economic literature. He had long contemplated, and had in part written, a work on English economic and legal history, which would have been his *magnum opus*—a more substantial fruit of his genius and

his labours than anything he has left to us. But the MS. of this treatise, after much pains had already been spent on it, was unaccountably lost at Nancy in 1872; and, though he hoped to be able speedily to reproduce the missing portion and finish the work, it is feared that but a small part of it, if any, was never left in a state fit for publication. What the nature of it would have been may be gathered from an essay on the "History and Future of Profit" in the *Fortnightly Review* for November 1881, which is believed to have been in substance an extract from it.

That he was able to do so much may well be a subject of wonder when it is known that his labours had long been impeded by a painful and depressing malady, from which he suffered severely at intervals, whilst he never felt secure from its recurring attacks. To this disease he in the end succumbed at Belfast, whither he had gone to discharge his professorial duties, on the 27th of January 1882, in the fifty-fifth year of his age.

Leaie's work may be distributed under two heads, that of applied political economy, and that of discussion on the philosophical method of the science. The *Land System* belonged principally to the former division. The author perceived the great and growing importance for the social welfare of both Ireland and England of what is called "the land question," and treated it in this volume at once with breadth of view and with a rich variety of illustrative detail. His general purpose was to show that the territorial systems of both countries were so encumbered with elements of feudal origin as to be altogether unfitted to serve the purposes of a modern industrial society. This policy he recommended is summed up in the following list of requirements, "a simple jurisprudence relating to land, a law of equal intestate succession, a prohibition of entail, a legal security for tenants' improvements, an open registration of title and transfer, and a considerable number of peasant properties." The volume is full of practical good sense, and exhibits a thorough knowledge of home and foreign agricultural economy; and in the handling of the subject is everywhere shown the special power which its author possessed of making that which is most interesting as well as instructive. The way in which sagacious observation and shrewd comment are constantly intermingled in the discussion not seldom reminds us of Adam Smith, whose manner was more congenial to Leaie than the sternest and arid style of Ricardo.

But what, more of the latter style, makes him an original thinker, and gives him a place apart among contemporary economists, is his exposition and defence of the historical method in political economy. Both at home and abroad there has for some time existed a profound and growing dissatisfaction with the method and many of the doctrines of the hitherto dominant school, which, it is alleged, under a "fictitious completeness, symmetry, and exactness" "disguise a real hollowiness and discordance with fact. It is urged that the attempt to deduce the economic phenomena of a society from the so-called universal principle of "the desire of wealth" is illusory, and that they cannot be fruitfully studied apart from the general social conditions and historic development of which they are the outcome. Of this movement of thought Leaie was the principal representative, if not the originator, in England. There is no doubt, for he has himself placed it on record, that the first influence which impelled him in the direction of the historical method was that of the German Master whose personal teaching of jurisprudence, as well as by the example of his writings, he was led "to look at the present economic structure and state of society as the result of a long evolution." The study of those German economists who represent similar tendencies doubtless confirmed him in the new line of thought on which he had entered, though he does not seem to have been further indebted to any of them except, perhaps, in some small degree to Roscher. And the writings of Comte, whose "prodigious genius," as exhibited in the *Philosophie Positive*, he admired and proclaimed, though he did not accept his system as a whole, must have powerfully co-operated to form in him the habit of regarding economic science as only a single branch of sociology, which should always be kept in close relation to the others. The earliest writing in which Leaie's revolt against the so-called "orthodox school" distinctly appears is his *Essay on Wages*, which was first published in 1868, and was reproduced as an appendix to the volume on *Land Tenure*. In this, after exposing the narrowness of the theory of the wage-fund, and showing the utter want of agreement between its results and the observed phenomena, he concludes by declaring that "political economy must be content to take rank as an inductive, instead of a purely deductive science," and that, by this change of character, "it will gain in utility, interest, and real truth far more than a full compensation for the forfeiture of a fictitious title to mathematical exactness and certainty." But it is

in the essays collected in the volume of 1879 that his attitude in relation to the question of method is most decisively marked. In one of these, on "the political economy of Adam Smith," he exhibits in a very interesting way the co-existence in the *Wealth of Nations* of historical-inductive investigation in the manner of Montesquieu with *a priori* speculation founded on theological-metaphysical bases, and points out the error of ignoring the former element, which is the really characteristic feature of Smith's social philosophy, and places him in strong contrast with his *so-disputed* followers of the school of Ricardo. The essay, however, which contains the most brilliant polemic against the "orthodox" school, as well as the most luminous account and the most powerful indication of the new direction, was that of which we have above spoken as having first appeared in *Hornet*. It may be recommended as supplying the best extant presentation of one of the two contending views of economic method. On this essay mainly rests the claim of Leaie to be regarded as the founder and first head of the English historical school of political economy. How far his opinions on the philosophical constitution of the science are destined to prevail must for the present remain doubtful. Those who share his views on that subject regard the work he did, notwithstanding its unsystematic character, as in reality the most important done by any recent English economist. But even the warmest partisans of the older school are ready to acknowledge that he has done excellent service by insisting on a kind of inquiry, hitherto too much neglected, which is of the highest interest and value, in whatever relation it may be supposed to stand to the establishment of economic truth. The members of both groups alike recognize his great learning, his patient and conscientious habits of investigation, and the large social spirit in which he treated the problems of his science. (J K I)

LESSING, GOTTHOLD EPHRAIM (1729-1781), was born at Kamenz, in Upper Lusatia, Saxony, on the 22d of January 1729. He was descended from Clemens Lessing, a Saxon clergyman, whose name is found attached to an ecclesiastical document of 1580. Lessing's father, Johann Gotthard, born in 1693, was the son of Theophilus Lessing, the burgo-master of Kamenz, who died at the age of eighty-nine, when Lessing was between six and seven years old. At the time of Lessing's birth his father was one of the clergymen of Kamenz, where, a few years afterwards, he became pastor primarius, or head pastor. He was a man of high character, rather inascible, but earnest in the fulfilment of his pastoral duties, and universally beloved for his kindness to the poor. Throughout life he continued the studies in theology and church history which he had successfully begun at the university of Wittenberg, and he made some reputation as an original writer and as a translator of Tillotson. Of the Frau Pastorin we do not know much except that she was a faithful and affectionate wife and mother. They had twelve children, of whom Lessing was the second who survived infancy. He seems to have been an exceedingly happy child, healthy and playful, and already remarkable for his fondness for reading. After attending the Latin school of Kamenz, he was sent in 1741 to the great school of St. Afra at Meissen, where he was maintained free of charge. Here he made such rapid progress in classical and mathematical study that, towards the end of his career as a pupil, he was described by the rector as "a steed that needed double fodder." Work which was oppressive to others, added the rector, was to Lessing "as light as a feather." He had the reputation of being one of the most sarcastic, but at the same time one of the most loyal and generous, boys in the school. In 1746 he left St. Afra's and went to the university of Leipzig, nominally for the purpose of studying theology. To theology, however, he did not give the slightest attention. Under Professors Christ and Ernesti he continued his classical studies, and he also attended the philosophical disputations presided over by his friend Kastner, a young professor of mathematics. For some time Lessing was shy and retired amid his new surroundings, but being of an eminently social disposition he soon became tired of this kind of life, and began to form friends among his fellow-students, and strove to acquire the manners of a free and polished man of the world. His

principal friend was Weisse, who afterwards attained a respectable position as a man of letters. He also became intimate with Mylius, who was considerably older than himself, and had made a certain mark as a literary and scientific writer. There was at this time in Leipzig an excellent actress, Frau Neuber, who had gathered around her a number of respectable players, and Lessing, in company with Weisse, was one of the most regular attenders at her theatre. At St. Afra's he had begun a comedy, *Der Junge Gelehrte*, and this he now completed. Frau Neuber immediately accepted it, and it was received with much favour by the public of Leipzig.

Alarmed by reports of what was supposed to be his dissolute life, the elder Lessing summoned him to Kamenz, where he remained for some months. He soon succeeded in overcoming the fears of his parents, who allowed him to return to Leipzig on condition that he would devote himself to the study of medicine. Some medical lectures he did attend, but his ambition was to become a great dramatist, and as long as Frau Neuber's company kept together he occupied himself almost exclusively with the theatre, being frequently present at rehearsal during the day as well as at the performance in the evening.

In 1748 the company broke up, and Lessing, finding nothing to interest him in Leipzig, went to Wittenberg, and afterwards, towards the end of the year, to Berlin, where his friend Mylius had established himself as a journalist and man of science. In Berlin Lessing now spent three years, maintaining himself chiefly by literary work. He translated two volumes of Rollin's history, wrote some of the best of his early plays, and, in association with Mylius, started a periodical (which soon came to an end) for the discussion of matters connected with the drama. Early in 1751 he accepted the office of literary critic to the *Voss Gazette*, and in this position he reviewed some of the most important German and French books of the day, manifesting already to some extent the learning, judgment, and wit which were to make him the greatest critic of modern times. His father had been bitterly opposed to his scheme of life, and in 1751 urged him to complete his studies at the university of Wittenberg. Feeling the need of further thought and research, Lessing at last consented, and at the close of the year left Berlin. It is worthy of note that he had been brought into slight contact with Voltaire, for whom he had translated some documents relating to the Hirsch trial. Voltaire's secretary having lent him a volume of the *Siecle de Louis XIV.*, which had not yet been published, he took it with him to Wittenberg. This came to the ears of Voltaire, who assumed that Lessing intended to print either a pirated edition or an unauthorized translation. The affair led to an angry correspondence, and was a subject of much talk in Berlin.

Lessing remained about a year in Wittenberg, where he passed most of his time in the university library, every volume in which, he afterwards declared, had passed through his hands. Having taken the degree of master of arts, he returned to Berlin, determined to make literature his profession; and the next three years were among the busiest of his life. Besides translating for the booksellers, he issued several numbers of the *Theatralische Bibliothek*, a periodical essentially the same as that which he had begun with Mylius. He also resumed his labours as critic to the *Voss Gazette*. For many years the most influential writer in Germany had been Gottsched, the Leipzig professor, who continually proclaimed the necessity of rigid adherence, in the drama and in poetry, to French rules. In his articles for the *Voss Gazette*, Lessing made it his principal object to ridicule the pretensions of Gottsched and his school, and in a short time there was no writer of whom

they were so much afraid. In 1754 he produced a deep impression by *Ein Vade Mecum für den Herrn Sam. Gottl. Lange*, in which he exposed with bitter satire Lange's errors in his popular translation of Horace. During these three years Lessing took a definite position in contemporary literature by issuing, in six small volumes, those of his writings which he considered worthy of preservation. They included his lyrics and epigrams, some of the latter being in German, others in Latin. Most of his lyrics were written in Leipzig, and had already appeared, during his first residence in Berlin, in a volume of *Kleinigkeiten*, published without his name. Although they do not, like Goethe's lyrics, touch deep sources of natural feeling, they have the merit of being bright, gay, and musical, and some of them are still sung by German students. The epigrams, many of which were produced in Wittenberg, are in the style of Martial, and give evidence, like Lessing's critical writings, of a keen and biting humour. Among his collected writings there was also a remarkable series of *Letters*, in which, for the first time in German literature, some of the results of extensive learning were presented in a free and vivid style. Even more important, perhaps, were the papers entitled *Rettungen*, in which he undertook to vindicate the character of various writers who had been misunderstood by preceding generations. One of the best of these *Rettungen* is on Horace, whom he defends against the critics who charge him with sensuality and cowardice. In another, almost equally good, he shows that Cardan, instead of being an atheist, did full justice to the evidences for Christianity, as they were understood in his time, while he did rather less than justice to other religions. This essay contains a powerful argument in favour of Mohammedanism, developed from the point of view of an intelligent believer in the Prophet. In addition to these varied contents, Lessing published in the six volumes of his *Schriften* his early plays and *Miss Sara Sampson*. Of the former the chief are *Der Junge Gelehrte*, already mentioned, *Der Freidenker*, *Das Judentum*, and *Der Misogyn*. Although superior to any other German comedies produced at the same time, they cannot be said to reveal a high dramatic faculty. In the arrangement of his plots and the balancing of his characters, Lessing follows closely the methods of contemporary French comedy, and in the dialogue there is often a too obvious straining after effect. *Miss Sara Sampson*, written in 1755, marks a wholly different stage of his development. It has many faults both in conception and in execution, but it exercised a powerful influence by indicating to the dramatists of Germany that materials for tragedy are to be found in the experiences of ordinary men and women as well as in those of "the great." Lessing attributed much importance to this principle, which had been suggested to him chiefly by the study of Richardson, whose *Clarissa* is almost exactly reproduced in the heroine of *Miss Sara Sampson*.

This tragedy, when represented in Frankfurt-on-the-Oder, was received with so much applause that he resolved to devote himself to the drama; and in fulfilment of his design he suddenly quitted Berlin in October 1755, and went to Leipzig, where a good theatre had been lately established. During his second residence in Berlin he had made his name widely known, and he had secured several friends, whose affection he retained during the rest of his life. The chief of these was Moses Mendelssohn, in association with whom, in 1755, he wrote an admirable treatise, *Pope ein Metaphysiker*, tracing sharply the lines which separate the poet from the philosopher. The Berlin Academy of Sciences had offered a prize for the best essay on Pope's doctrine that "Whatever is, is right," as compared with the optimism of Leibnitz. The treatise of the two friends was written to show that there cannot be a

true comparison between a poetic and a philosophic conception, and they threw much light on the aims both of Leibnitz and of Pope. Other Berlin friends of Lessing were Nicolai, the bookseller, and Ramler, the author of many well-known odes. He had also made the acquaintance of Gleim, the Halberstadt poet, and Ewald Christian von Kleist, a Prussian officer, whose fine poem, *Der Frühling*, had won for him Lessing's warm esteem.

In Leipzig, Lessing was asked by Winkler, a wealthy young merchant, to accompany him in a foreign tour, which was to last three years. As he offered liberal terms, Lessing consented; and early in the summer of 1756 they started for England. They did not, however, get beyond Amsterdam, for after the outbreak of the Seven Years' War they heard that Winkler's house was occupied by the Prussian commandant, and he deemed it necessary to hasten back. After some time Winkler was offended by Lessing's intimacy with certain Prussian officers, and suddenly announced to him that he must consider their engagement at an end. Lessing demanded compensation, and in the end the courts decided in his favour, but not until the case had dragged on for about six years. In the meantime it detained him in Leipzig, and, as there was little opportunity for earning money by literature in a city occupied by foreign troops, he went through a period of extreme hardship. During these anxious months he began the study of mediæval poetry, in which some interest had been awakened by the Swiss school of critics; he also translated several English writings, and worked occasionally for the *Bibliothek*, a periodical edited by Nicolai. Fortunately he had an opportunity of developing his friendship with Kleist, who happened to be stationed in Leipzig. Kleist, a man of truly heroic temper, with the simplicity of a child, was powerfully attracted by Lessing's frank and noble nature, and Lessing loved him with an ardour which was excited by no other friend, not even by Mendelssohn. Kleist's regiment being ordered to new quarters early in 1758, Lessing decided not to remain behind him, and, saying farewell to his friend (who was mortally wounded in the following year at the battle of Kunersdorf), he returned once more to Berlin.

His third residence in Berlin was made memorable by the *Literaturbriefe*, a series of critical essays (written in the form of letters to a wounded officer) on the principal works that had appeared since the beginning of the Seven Years' War. The scheme was suggested by Nicolai, by whom the letters were published. Those written by Lessing manifested far higher intellectual power than anything he had yet accomplished. The critical principles set forth in the *Literaturbriefe* are now universally recognized, but they were then new, and even at the present day they seem to derive fresh vitality from the force, precision, and animation with which he expresses them. He insisted especially on the necessity of truth to nature in the imaginative presentation of the facts of life, and in one letter he boldly proclaimed the superiority of Shakespeare to Corneille, Racine, and Voltaire. At the same time he marked the immutable conditions to which even genius must submit in order to move enduring sympathies. While in Berlin at this time, he edited with Ramler a selection from the writings of Logau, a vigorous epigrammatist of the 17th century, and introduced to the German public *The War Songs of a Grenadier*, by Gleim. He admired the vigour of these songs, but in several private letters protested against the vehemence of the author's patriotism—patriotism being a virtue which, he thought, he "could do very well without." In 1759 he published *Philotas*, a prose tragedy; and in the same year appeared a complete collection of his fables, with an essay on the essential idea of the fable. The latter is one of his

best essays in criticism, defining with perfect lucidity what is meant by "the action" in works of imagination, and distinguishing the action of the fable on the one hand from that of the epic and the drama on the other. His theory prevented him from lending poetic interest to his own fables, but they surpass the works of all other German fabulists in the depth and variety of the moral truths which they are intended to enforce.

In 1760, weary of incessant writing, and feeling that change of scene and work was necessary for his health, Lessing went to Breslau to apply for the post of secretary to General Tauentzien, to whom Kleist had introduced him in Leipzig. Tauentzien was not only a general in the Prussian army, but governor of Breslau, and director of the mint. He willingly granted the vacant office to Lessing, who retained it for more than four years. He thus found himself in circumstances wholly different from those to which he had been hitherto accustomed. He associated chiefly with Prussian officers, went much into society, and became passionately fond of the gaming table, where he played for such high stakes that even General Tauentzien expostulated with him. While, however, he seemed to be wasting his energies, he never lost sight of his true goal. He gradually collected a library of about 6000 volumes (which he was ultimately obliged to sell); and after the conclusion of the Seven Years' War in 1763 he resumed more enthusiastically than ever the studies which had been partly interrupted. In investigating the early history of Christianity, he obtained a profound knowledge of the fathers; and a remarkable letter to Mendelssohn shows that he had penetrated more deeply than any contemporary thinker into the significance of the philosophy of Spinoza. In 1764 he was prostrated by a severe illness, during which he reviewed, in a rather sorrowful spirit, his past life, and formed many serious resolutions for the future. Before this time he had worked hard at *Lacoon*, and in fresh spring mornings he had sketched in a garden the plan of *Mimna von Barnhelm*. His parents were now in exceedingly straitened circumstances, and often appealed to him for aid. He responded generously to their demands, but they greatly overrated his power to help them, as they assumed that he intended to remain permanently in General Tauentzien's service. In reality, he had always regarded the engagement as a temporary one, and in 1766 he resigned his office, and left Breslau.

It seemed not improbable that he might find a suitable appointment in Dresden, but he was again compelled, much against his will, to become a resident of Berlin, whither he went after a brief visit to Kamenz and Leipzig. His friends exerted themselves to obtain for him the office of keeper of the royal library, but Frederick had not forgotten Lessing's quarrel with Voltaire, and declined to consider his claims, although, about the time when Lessing went to Breslau, he had confirmed his election as a foreign member of the Berlin Academy of Sciences. During the two years which Lessing now spent in the Prussian capital he was restless and unhappy, yet it was during this period that he published two of his greatest works—*Lacoon* in 1766, and *Mimna von Barnhelm* in 1767. *Lacoon* ranks as a classic not only in German but in European literature, and its style alone, which is as near perfection as anything Lessing ever wrote, would almost entitle it to this position. His central aim is to define by analysis the limitations of poetry and the plastic arts. Many of his conclusions have been corrected and extended by later criticism; but he indicated more decisively than any of his predecessors the fruitful principle that each art is subject to definite conditions, and that it can accomplish great results only by limiting itself to its special function. The most valuable parts of the work are those which relate to poetry, of which he had a

much more intimate knowledge than of sculpture and painting. His exposition of the methods of Homer and Sophocles is especially suggestive, and he may be said to have marked an epoch in the appreciation of these writers, and of Greek literature generally. He invariably starts from the consideration of doctrines set forth by other scholars (chiefly Winkelmann, Caylus, and Spence); but he is never satisfied until he arrives at positive principles, and he leads us towards them gradually by the paths he himself has trodden, glancing at many side issues by the way. He was unable in later years to complete his scheme, but even in its fragmentary form, as Goethe testifies in *Wahrheit und Dichtung*, *Lacoon* was welcomed with gratitude by the most active minds of the age. The power of *Minna von Barnhelm* was also immediately recognized. This is, on the whole, the best of Lessing's purely dramatic writings. The hero, Tellheim, is an admirable study of a manly and sensitive soldier, with somewhat exaggerated ideas of conventional honour; and Minna, the heroine, is one of the brightest and most attractive figures in the dramatic literature of Germany. The subordinate characters are conceived with the same force and vividness, and the plot, which reflects precisely the struggles and aspirations of the period that immediately followed the Seven Years' War, is simply and naturally unfolded. This beautiful play is valued by the Germans, not only as a work of art, but as one of the earliest and most striking manifestations of the growing spirit of German nationality.

In 1767 Lessing settled in Hamburg, where he had been invited to take part in the institution of a national theatre. The scheme promised well, and, as he associated himself with Bode, a literary man whom he respected, in starting a printing establishment, he hoped that he might at last look forward to a peaceful and prosperous career. The theatre, however, being mismanaged, was soon closed, while the printing establishment failed, and was left behind it a heavy burden of debt. Many of Lessing's letters from Hamburg breathe almost a spirit of despair, and towards the end of his residence there he determined to quit Germany, believing that in Italy he might find congenial labour that would suffice for his wants. Even in Hamburg he made splendid contributions to enduring literature, the chief being his *Hamburgische Dramaturgie*. It consists of criticisms of some of the plays represented in the Hamburg theatre; but in these criticisms he offers a complete theory of the laws of dramatic art. In the main his theory is that of Aristotle, but it is maintained on independent grounds and applied in new ways. By this powerful work he delivered German dramatists for ever from the yoke of the classic tragedy of France, and directed them to the Greek dramatists and to Shakespeare as the poets who have opened most truly the fountain of tragic feeling. Another result of his labours in Hamburg was the *Antiquarische Briefe*, a series of masterly letters in answer to Klotz, a pedantic writer who, after flattery Lessing, had attacked him, and sought to establish a kind of intellectual despotism by means of critical journals which he directly or indirectly controlled. In connexion with this controversy, Lessing wrote his brilliant little treatise, *Wie die Alten den Tod gebildet*, contrasting the mediæval representation of death as a skeleton with the Greek conception of death as the twin-brother of sleep.

Instead of going to Italy as he intended, Lessing accepted, in 1770, the office of librarian at Wolfenbützel, a post which was offered to him by the hereditary prince of Brunswick. In this position he passed his remaining years. For a time he was not unhappy, but by and by he was rendered miserable by his inability to pay the debts which he had contracted in Hamburg. He missed, too, the society of his friends, and his health, which had

hitherto been excellent, gradually gave way. In 1778 he travelled for nine months in Italy with Prince Leopold of Brunswick; and in the following year he married Eva Koenig, the widow of a Hamburg merchant, with whom he had been on terms of intimate friendship. She was in every way worthy of Lessing, and their correspondence during his lonely years in Wolfenbützel forms one of the most attractive elements of his biography. Their happiness in each other was perfect, but it lasted only for a brief period, in 1778 she died in childbirth. After her death Lessing found one of his chief sources of consolation in the love of his four step-children, to whom he was tenderly attached.

Meanwhile he had extended his fame by several important writings. Soon after settling in Wolfenbützel he found in the library an ancient manuscript, which proved to be a treatise of Berengarius of Tours on transubstantiation in reply to Lanfranc. Lessing was thus induced to write an essay on Berengarius, vindicating his character as a serious and consistent thinker. The essay was much admired by the leading theologians of Germany, and it is, on the whole, the ablest and most interesting of his *Religionen*. In 1771 he published his *Verstreute Anmerkungen über das Epigramm, und einige der vornehmsten Epigrammatisten*—a work which Herder described as "itself an epigram." Lessing's theory of the origin of the epigram is somewhat fanciful, but no other critic has offered so many pregnant hints as to the laws of epigrammatic verse, or defended with so much force and ingenuity the character of Martial. In 1772 lovers of the drama were delighted by the appearance of *Emilia Galotti*, a tragedy which he had begun many years before in Leipzig. The subject was suggested by the Roman legend of Virginia, but the scene is laid in an Italian court, and the whole play is conceived in accordance with the modern spirit. Its defect is that its tragic conclusion does not seem to be absolutely inevitable, but there is high imaginative power in the character of the prince of Gaetana, and in that of Marcell, his chamberlain, who weaves the intrigue from which Emilia escapes by death. The diction of *Emilia Galotti* is at once refined and vigorous, and there are scenes in which some of the deepest passions of human nature are sounded with perfect art. Having completed *Emilia Galotti*, Lessing occupied himself for some years almost exclusively with the treasures of the Wolfenbützel library. The results of his researches (some of them of high value) he embodied in a series of volumes, *Zur Geschichte und Literatur*, the first being issued in 1773, the last in the year of his death.

The concluding period of Lessing's life was devoted chiefly to theological controversy. Reimarus, professor of Oriental languages in Hamburg, who commanded general respect as a scholar and thinker, wrote a book entitled *Apologie oder Schutzschrift für die vernünftigen Verehrer Gottes*. The standpoint of Reimarus was that of the English deists, and he investigated, without hesitation, the evidence for the miracles recorded in the Bible. The manuscript of this work, after the author's death in 1767, was entrusted by his daughter, Elise Reimarus, to Lessing, who published extracts from it in his *Zur Geschichte und Literatur*, in 1774-78. These extracts, the authorship of which was not publicly avowed, were known as the "Wolfenbützel Fragments." They created profound excitement among orthodox theologians, and evoked many replies, in which Lessing was bitterly condemned for having issued writings of so dangerous a tendency. Lessing delighted at all times in the stir of combat, and prepared to offer a full and vigorous defence. His most formidable assailant was Pastor Goese, of Hamburg, a sincere and earnest theologian, but utterly unscrupulous in his choice of weapons against

an opponent. To him, therefore, Lessing addressed his most elaborate answers, — *Ense Parabel, Axiomata*, eleven letters with the title *Anti-Goeze*, and two pamphlets in reply to an inquiry by Goeze as to what Lessing meant by Christianity. These papers are not only full of thought and learning; they are written with a grace, vivacity, and energy that make them hardly less interesting to-day than they were to Lessing's contemporaries. He does not undertake to defend the conclusions of Reimarus; his immediate object is to claim the right of free criticism in regard even to the highest subjects of human thought. The argument on which he chiefly relies is that the Bible cannot be considered necessary to a belief in Christianity, since Christianity was a living and conquering power before the New Testament in its present form was recognized by the church. The true evidence for what is essential in Christianity, he contends, is its adaptation to the wants of human nature, hence the religious spirit is undisturbed by the speculations and researches of the boldest thinkers. The effect of this controversy was to secure wider freedom for writers on theology, and to suggest new problems regarding the growth of Christianity, the formation of the canon, and the essence of religion. On one subject, the origin of the gospels, Lessing poured a flood of fresh light in a treatise, published after his death, presenting "A New Hypothesis concerning the Evangelists, regarded as merely human writers." The Brunswick Government having, in deference to the consistory, confiscated the "Fragments" and ordered Lessing to discontinue the controversy, he resolved, as he wrote to Elise Reimarus, to "try whether they would let him preach undisturbed from his old pulpit, the stage." In *Nathan der Weise*, written in the winter of 1778-79, he gave poetic form to the ideas which he had already developed in prose. Its governing conception is that noble character may be associated with the most diverse creeds, and that there can, therefore, be no good reason why the holders of one set of religious principles should not tolerate those who maintain wholly different doctrines. This element of *Nathan der Weise* receives so much attention from its critics that many of them overlook the high artistic qualities of the work. As a play it has serious imperfections, but as a dramatic poem it is one of the finest creations of the 18th century. The characters possess true vitality, and several passages (including, of course, the famous passage setting forth the parable of the three rings) have both the depth and the spontaneity which are the unmistakable notes of genius. In 1780 appeared *Die Erziehung des Menschengeschlechts*, the first half of which he had published in 1777 with one of the "Fragments." This work, composed of a hundred brief paragraphs, was the last, and is, perhaps, the most suggestive, of Lessing's writings. The doctrine on which its argument is based is that no dogmatic creed can be regarded as final, but that every historical religion has played a great part in the development of the spiritual life of mankind. Lessing also maintains that history reveals a definite law of progress, and that occasional retrogression may be necessary for the advance of the world towards its ultimate goal. These ideas afterwards became familiar, but they offered a striking contrast to the principles both of orthodox and of sceptical writers in Lessing's day, and gave a wholly new direction to religious philosophy. Another work of Lessing's last years, *Ernst und Falk* (a series of five dialogues, of which the first three were published in 1777, the last two in 1780), also indicated in a fascinating style many new points of view. Its nominal subject is freemasonry, but its real aim is to plead for a humane and charitable spirit in opposition to a narrow patriotism, an extravagant respect for rank, and exclusive devotion to any particular church.

Lessing's theological opinions exposed him to much petty persecution, and he was in almost constant straits for money. Nothing, however, broke his manly and generous spirit. To the end he was always ready to help those who appealed to him for aid, and he devoted himself with growing ardour to the search for truth. He formed many new plans of work, but in the course of 1780 it became evident to his friends that he would not be able much longer to continue his labours. His health had been undermined by excessive work and anxiety, and after a short illness he died at Brunswick on the 22d of January 1781.

He was rather above the middle height, and during the greater part of his life maintained an appearance of vigour and elasticity. Luther himself was not of a more fearless and independent character. In an age when men of letters were fond of grouping themselves in sects and coteries, Lessing pursued his own way, unmoved by clamour, and indifferent to popular favour. Yet no man was ever more warmly loved by friends, and he had the satisfaction of knowing that the younger generation of writers looked up to him with confidence and reverence. Jacobi wished for many years to make his acquaintance, but was deterred from addressing him, as he explained to Lessing, by a profound consciousness of the difference between himself and one whom he regarded as "a king among minds." "We lose much, much in him," wrote Goethe after Lessing's death, "more than we think." It may be questioned whether there is any other writer to whom the Germans owe a deeper debt of gratitude. He was succeeded by poets and philosophers who for a time gave Germany the first place in the intellectual life of the world, and it was Lessing, as they themselves acknowledged, who prepared the way for their achievements. Without attaching himself to any particular system of philosophical doctrine, he fought incessantly against error, and in regard to art, poetry, the drama, and religion, suggested ideas which kindled the enthusiasm of aspiring minds, and stimulated their highest energies. While his work was thus effective in its own day, it has lost little of its value for later ages. His great dramas have imaginative qualities which appeal to every generation, and an unfading charm is conferred on his critical and theological writings by the power and classical purity of his style.

The first edition of his collected works appeared, in 8 vols., in 1771-94. A critical edition by Lachmann, in 18 vols., was issued in 1838-40, and this edition was revised, with additions, by Maltzahn in 1863-57. In 1868-77 Lessing's works, edited by several competent scholars, were published in 20 vols. by Hempel, and there is an illustrated edition in 8 vols. (Grote, 1876-70). See *Lessing's Leben*, 1793, by Karl G. Lessing (his brother); Daniel, *G. E. Lessing, sein Leben und seine Werke*, 1850 (completed by Gubauer, 1858-59); Stahl, *G. E. Lessing, sein Leben und seine Werke*, 1859; H. Duncker, *Lessing's Leben*, 1882; and in English, J. Sims, *Lessing*, 1877, and H. Zimmer, *Goethold Zeyher's Lessing*, 1878. (J. SL.)

L'ESTRANGE, SIR ROBERT (1616-1704), an indefatigable pamphleteer on the royalist and court side during the Restoration epoch, but principally remarkable as the first Englishman of letters of any distinction who made journalism a profession, was born at Hunstanton in Norfolk, December 17, 1616. In 1644, during the civil war, he headed a conspiracy to seize the town of Lynn for the king, under circumstances which led to his being condemned to death as a spy. The sentence, however, was not executed, and after four years' imprisonment in Newgate he escaped to the Continent. He was excluded from the Act of Indemnity, but in 1653 was pardoned by Cromwell upon his personal solicitation, and lived quietly until the Restoration, when after some delay his services and sufferings were acknowledged by his appointment as licenser of the press. This office was administered by him in the

spirit which might be expected from a zealous cavalier. He made himself notorious, not merely by the severity of his literary censorship, but by his vigilance in the suppression of clandestine printing. The monstrosity of this course with his actions and professions when himself opposed to the party in power naturally aggravated the unpopularity inevitably attaching to his office. Few men have been more heartily abused than L'Estrange, and it is undoubtedly true that the rights of free speaking and printing, the indispensable conditions of civil and religious liberty, have seldom had a more determined or more dangerous opponent. At the same time there is no ground for questioning his integrity, and he was probably no more intolerant than any similar official of any Government in that day, inspired by an equal strength of conviction, would have been in his place. The representation of him in Grant's *History of the Newspaper Press* as a mere political hireling is entirely contrary to truth. He was a militant loyalist, who used the pen as he had been wont to use the sword, and proved his zeal for his party by the production of a mass of pamphlet literature, above the ordinary standard of the time in ability, and quite on a par with it in virulence and coarseness. These productions still possess an historical value, but their titles are not worth enumerating here. His memory is more honourably preserved by his connexion as an author with the journalism which as a licenser he laboured to cripple and amputate. In 1663 he commenced the publication of *The Public Intelligencer and the News*, succeeded in February 1665 by *The London Gazette*, not to be confounded with the official journal still existing, which appeared for the first time at the close of that year, and was at first printed at Oxford. In 1679 he established *The Observer*, a journal specially designed to vindicate the court from the charge of a secret inclination to popery. This line of political controversy, and it may be hoped some natural humanity and good sense as well, obliged him to discredit the Popish Plot, and he manfully resisted the delusion by which many wiser and better men were carried away. The suspicion he thus incurred was increased by the conversion of his daughter to Romanism, but there seems no reason to question the sincerity of his own attachment to the Church of England. In 1687 he gave a further proof of independence by discontinuing *The Observer* from his unwillingness to advocate James II.'s Edict of Toleration, although he had previously gone all lengths in support of the measures of the court. The Revolution cost him his office as licenser, and the remainder of his life was spent in obscurity. He died in 1704. L'Estrange's place is rather in history than in literature. The importance of the part he played as licenser would be more exactly known if it could be more accurately ascertained how much literature he may have been the means of suppressing. The post he held so long was in itself an unmitigated mischief, but at the same time an evil which men of all parties, with the rare exception of men so far in advance of their time as Milton, then deemed necessary; and no obloquy should attach to L'Estrange for having discharged its functions with zeal and efficiency. As a pamphleteer he is but slightly above mediocrity, and he labours under a special imputation of having contributed to corrupt his native language. The same charge is brought against journalists in all ages, and there are obvious reasons why it should be true to a certain extent. The practice of daily writing for the press is undoubtedly one of the numerous forces which tend to wear down and degrade a language, but it also keeps the diction of the cultivated classes in contact with the speech of the people, and prevents the absolute divorce between them which seems to have existed in ancient times. It is to L'Estrange's credit that among the agitations of a busy

political life he should have found time for much purely literary work as a translator of Josephus, Cicero, Seneca, Quevedo, and other standard authors. (R. G.)

LESUEUR, JEAN FRANÇOIS (1763-1837), was born near Abbeville in 1763, and studied music under Roze at the college of Amiens. Appointed choirmaster of a church in Paris in 1784, he completed his musical education under Sacchini. In 1780 Lesueur obtained by open competition the musical directorship of Notre-Dame, where he gave successful performances of sacred music with a full orchestra. This place he resigned in 1788; and, after a retirement of five years in a friend's country house, he produced *La Caverne* and two other operas at the theatre Feytaud in Paris. At the foundation of the Paris Conservatoire (1795) Lesueur was appointed one of its inspectors of studies, but was dismissed in 1802, owing to his disagreements with Mehul. On the recommendation of Paisiello, Lesueur succeeded this celebrated composer as *Maestro di cappella* to Napoleon, and produced (1804) his *Ossian* at the Opera. He also composed for the emperor's coronation a mass and a Te Deum. Louis XVIII., who had retained Lesueur in his court, appointed him (1818) professor of composition at the Conservatoire, and at this institution he had, among many other pupils, Hector Berlioz, Ambroise Thomas, Bazzani, and Gounod. He died October 6, 1837. Lesueur composed eight operas and several masses, and other sacred music. All his works are written in a style of rigorous simplicity; and to this may be ascribed their want of popularity at the present time.

LETHE (Λήθη, oblivion) is sometimes used as the name of a river in the infernal regions. It seems to have been an idea current in the religion of the mystics that there were in the lower world two streams, one of memory and one of oblivion. The initiated were taught to distinguish between them, and directions for this purpose written on a gold plate have been found in a tomb at Pettia, buried doubtless with some initiated person. So beside Lethæ, at the oracle of Trophonius, which was counted an entrance to the lower world, the two springs Mnemosyne and Lethe were shown. This thought begins to appear in literature in the end of the 5th century a.c., when Aristophanes (*Frogs*, 186) speaks of the plain of Lethæ. Plato (*Rep.*, x.) embodies the idea in one of his finest myths of the future life. It is difficult to find any passage in the earlier writers showing acquaintance with this idea. Hesiod makes Lethe one of the children of Eris, along with Toil, Hunger, Pain, &c.; but his meaning probably is that ingratitude and forgetfulness spring from strife. In the epitaph on Anacreon attributed to Simonides, but reckoned by Bergk spurious, the expression Λήθη ἔδωκε occurs; but even if the epigram be an early one it is not certain that the words have any mythological sense.

LETRONNE, JEAN ANTOINE (1787-1848), French archaeologist, was born at Paris on January 2, 1787. His father, a poor engraver, having chosen the profession of an artist for him, sent him to the studio of David, but his own tastes drew him towards literature, and he became a student in the Collège de France, where it is said he used to exercise his already strongly developed faculty of critical divination by correcting for his own amusement old and bad texts of Greek authors, afterwards comparing the results he had thus obtained with the latest and most approved editions. From 1810 to 1812 he travelled in France, Switzerland, and Italy, and on his return to Paris published an *Essai critique sur la topographie de Syracuse* (1812), designed to elucidate Thucydides; two years later appeared his *Recherches géographiques et critiques on the De Mensura Cruiis Terre* of Dicaul, along with a restored text. In 1815 he was appointed by Government to com-

plete the translation of Strabo (1805-1819) which had been begun by Laporte-Dutheil, and in March 1816 he was one of those who were admitted to the Academy of Inscriptions by royal ordinance, having previously contributed a *Mémoire*, "On the Metrical System of the Egyptians," which had been crowned. Further promotion came rapidly; in 1817 he was appointed director of the École des Chartes, in 1819 inspector-general of the university, and in 1831 professor of history in the Collège de France. Thus chair he exchanged in 1838 for that of archaeology, and in 1840 he succeeded Daunou as keeper of the national archives. Meanwhile he had published, among other works, *Considérations générales sur l'évaluation des monnaies grecques et romaines et sur la valeur de l'or et de l'argent avant la découverte de l'Amérique* (1817), *Recherches pour servir à l'histoire d'Égypte pendant la domination des Grecs et des Romains* (1823), and *Sur l'origine Grecque des zodiaques prétendus égyptiens* (1837); by the last-named he finally exploded a fallacy which had up to that time vitiated the chronology of contemporary Egyptologists. His *Diplômes et chartes de l'époque Mérovingienne sur papyrus et sur velin* were published in 1844. The most important work of Letronne is the *Recueil des inscriptions grecques et latines de l'Égypte*, of which the first volume appeared in 1842, and the second in 1848. He died at Paris on December 14, 1848.

LETTRES DE CACHET are really *lettres closes*, that is, letters sealed in such a way that they cannot be opened without breaking the seal, and which were originally always addressed to individuals, in contradistinction to *lettres patentes*, or letters patent, beginning "know all men by these presents." Lettres closes interfering with the administration of justice or the liberty of the subject were forbidden by numerous edicts in the 14th, 15th, and 16th centuries, and the term *lettres de cachet*, as synonymous with *lettres closes*, is first found in the ordinance of Orleans in 1660. The convenience of such a means to consign one's enemies to prison was seen by Richelieu and Mazarin, who followed the Guise Government in using them frequently, despite numerous protestations on the part of the parlements, of which the most notable was when in 1648 an ordinance was registered that no man should be kept in prison three days without interrogation. When once Louis XIV. had begun to rule, he made frequent use of *lettres de cachet* both for state purposes and to control and disorganize his nobility, and he boldly justified their use in an edict of 1705. But the most marked justification is to be found in the circular letter addressed to the parlements of France in reply to protests against arbitrary imprisonment in 1769, in which the king says that "he reserves arbitrary orders—in other words, *lettres de cachet*—for occasions wherein they may be necessary for the public good and the interests of families." In this remark he distinguishes between the two purposes for which such letters were granted. He first alleges state reasons why he should have power to arrest arbitrarily—a power no one would deny to the executive on occasions of emergency, if used under proper restrictions. Secondly, he says that they are issued in the interest of families, and here he touches the great source of their injustice and unpopularity. It was the custom for the king to sign a number of blank *lettres de cachet* which his ministers gave away to whoever they pleased. Thus they often fell into hands of people who used them to gratify private hate; fathers obtained them and inserted the names of their sons, wives inserted the names of their husbands, opera dancers those of lovers who had spurned them. The evil grew to such a height that Turgot and Lamignon de Maloherbes refused to enter the ministry of Louis XVI. unless they might see the contents of the orders they countersigned,

and see the causes for which men were to be imprisoned. It is needless to say that when the cahiers of the primary assemblies were prepared, to instruct the deputies to the states-general in the wishes of their constituents, abolition of *lettres de cachet* was demanded in almost all the cahiers of the noblesse and tiers état. The subject was mentioned in the early debates of the Constituent Assembly, but *lettres de cachet* were not formally abolished till January 16, 1790, and on March 13 of the same year all imprisoned under them were ordered to be set at liberty. The great authority for the history and injustice of *lettres de cachet* is Mirabeau's *Enquêtes concernant Lettres de Cachet and State Prisons*, written in the dungeon at Vincennes into which his father had thrown him by a *lettre de cachet*. It is one of the ablest and most eloquent of his works, had an immense circulation, and was translated into English with a dedication to the duke of Norfolk in 1788. See also Mercier's *Tableaux de Paris* (ed. 1783), vol. vii. chap. 588, and numerous stories in Linguet's *Bastille*, and especially in the *Bastille dévoilée* (1790).

LETNIS. See LETHYANIANS

LEUCADIA. See SANTA MAURA.

LEUCIPPUS, the founder of Atomism in Greek philosophy, flourished about the middle or latter half of the 5th century B.C. Almost nothing is known of his life. His birthplace is variously given as Elea, Abdera, or Miletus. It is disputed whether he left any writings. Empedocles of Agrigento and Anaxagoras of Clazomenae were his contemporaries, while Zeno the Eleatic is said to have been his teacher. As pupil and associate he had Democritus of Abdera, beside whose greater fame his own work has been thrown into the background. Thus Epicurus would not look upon him as a philosopher at all; Lucretius ignored him; and he is barely mentioned by Lange, the modern historian of materialism. But the references of Aristotle, as well as of later authorities, leave no doubt that the leading principles of the Atomic theory are due to him. He eluded the Eleatic criticism of plurality and motion by postulating the reality of that which is not, the empty or space. Empty space and atoms are, he held, the ultimate constituents of all things. The former is infinite in magnitude; the latter are infinite in number, indivisible, and with only quantitative differences amongst one another. Nor is there any such thing as qualitative change; but all growth and decay are merely the compounding and separation of atoms. The atoms are always in activity or motion, and all things happen of necessity. Worlds, infinite in number, are produced by the atoms, variously shaped and of different weight, falling in empty space and giving rise to an eddying motion by their mutual impact. In this way worlds are being for ever produced and again destroyed. In the notices of Leucippus handed down to us there are additional traces of a cosmology, differing slightly from that of Democritus, and of a psychology which identified the soul with spherical atoms, and explained sensation and thought by a change brought about in it mechanically through the entrance of external images. The further development of the Atomic philosophy was the work of Democritus.

See Diog. Laert., *De Vita*, lib. ix. c. 6; Ritter and Preller, *Hist. Phil.*, pp. 111 sq.; Zeller, *Phil. d. Griechen*, 4th ed., i. 780 sq.

LEUK, or LÖCHEN LA VILLE, a village of Switzerland, at the head of a district in the canton of Valais, 15 miles by rail east of Sion, on the right bank of the Rhone. The population has increased from 1220 in 1870 to 1411 in 1880. About 5 miles to the north, in the valley of the Dala, at a height of 6462 feet above the sea, and overshadowed by the immense cliffs of the Gemmi, lie the Baths of Leuk, Leukerbad, or Leokoche-Bains, a place of only 650 permanent inhabitants, but largely frequented during

its brief summer season by French, Swiss, and Italian visitors, attracted by the hot mineral springs. These springs are twenty-two in number, and vary considerably in chemical composition and temperature. The hottest and strongest is the Lorenz spring, the water of which, registering 124° Fahr., has to be allowed to cool over night before it is used. The patients remain for hours up to their necks in the bath, talking, reading, and otherwise amusing themselves in the most sociable style. Most of the hotels are open only from June to September. The little village has several times been destroyed by avalanches (1618, 1719, 1768), and a strong embankment has been erected on the eastern side to protect it from similar catastrophes.

LEUTSCHAU (Hungarian, *Locse*; Latin, *Leutsovia*; Slovakian, *Levoča*), capital of the Cis-Tisian county of Szepes, Hungary, and until 1876 a royal free town, lies in an elevated position surrounded by mountains, and near the railway from Kassá (Kaschau) to Oderberg, about 120 miles north-east from Budapest, in 49° 1' N. lat., 20° 35' E. long. Leutschau is the seat of the county administration, and of a royal court of law, and has many fine old buildings, of which the most interesting is the church of St James, a Gothic structure of the 13th century, with richly carved altar, several monuments, and a celebrated organ erected in 1623, and long reputed the largest in Hungary. The educational establishments comprise a royal upper gymnasium (founded 1620), a state upper real school (1868), a collegiate institute for girls, and a Minorite convent. The soil of the surrounding country is generally stony and sandy, and the climate from October to April severe, but the inhabitants nevertheless succeed in raising barley, wheat, oats, flax, and a large quantity of garden produce, especially beans and peas, which are considered the best in Hungary. Other sources of occupation are mining, foresting, horse, sheep, and cattle breeding, bee-keeping, and the preparation of wax, honey, and mead, for which last the town has long been noted. The number of beehives in 1881 was seven hundred. In December 1881 the population was 6900, mostly Germans and Slovaks by nationality, and Roman Catholics and Lutherans by creed.

Founded by Saxon colonists in 1245, Leutschau had by the early part of the 16th century attained a position of great relative importance. In 1599 a conflagration laid the greater part of the town in ashes, and during the 17th century it suffered repeatedly at the hands of the Transylvanian princes and leaders. In 1846, at the time of the revolutionary war, nearly half the houses were destroyed by fire.

LEVEN, ALEXANDER LESLIE, EARL OF, one of the most distinguished soldiers of his time, was born about the close of the 16th century. He was descended from a younger son of the ancient Scottish family of Balguthain. His father was George Leslie of Balgonie, commander of the castle of Blair, and his mother was Anne, daughter of Stewart of Ballechin. At his first outset in life he acted as a volunteer in Lord Vere's regiment in Holland, fighting with the Dutch against the encroachments of Spain, where he rose to the rank of captain. He then entered the service of Gustavus Adolphus of Sweden, and became field-marshal. In 1628, when the town of Stralsund was besieged by Wallenstein, and reduced almost to the last extremity, the king of Sweden sent Leslie to take the command of the garrison, and he acted with such resolution that he obliged the count to raise the siege. For this service medals were struck in his honour. In 1630 he drove the imperialists out of the island of Rugen, and continued to serve with great distinction in the Swedish armies till the troubles in Scotland brought him home. In 1639 he was invited by the Covenanters to take the command of their army. One of his first exploits was to take the castle of Edinburgh by

surprise, without the loss of a man. He commanded the Scottish army at Dunse Law in May of that year, and in 1640 he invaded England, and defeated a party of the king's troops at Newburn, which gave him possession of Newcastle and other towns. At the treaty with the king at Ripon, Leslie was one of the commissioners of the parliament, and Charles was so well pleased with his behaviour that he created him Lord Balgonie and Earl of Leven, by patent dated 1641.

After suppressing an insurrection in Ireland in 1642, he was in 1643 appointed to the command of the Scottish army sent to assist the parliamentary party against King Charles, but after the execution of that prince he warmly espoused the cause of his son, and served as a volunteer against Cromwell at the unfortunate battle of Dunbar in 1650. Next year, however, a gathering at Aylth of Angus royalists, of whom Leslie was one, was surprised and captured by the troops of General Monk, who was then besieging Dundee. The earl with some others was sent to London and confined in the Tower, where he remained incarcerated for some time, till by the intercession of the queen of Sweden he obtained his liberty. After visiting the queen, and thanking her in person for this service, he retired to his seat at Balgonie in Fifeshire and died there at an advanced age in 1681. He is said to have been of a diminutive size, and deformed in person, but prudent, vigilant, and expert in war. He acquired considerable landed property, particularly Inchmarlin in the County of Gowrie, which he called Inchleslie. His granddaughter married George, earl of Melville; their descendant, the present representative of the title (1882), is twelfth earl of Leven and ninth earl of Melville.

LEVER, CHARLES, novelist, was born at Dublin on the 31st of August 1806 (not 1809 as usually stated), and died at Trieste on the 1st of June 1872. The accounts of the earlier part of his life are, considering the time at which he lived, singularly meagre, confused, and conflicting. His father was an architect, and he entered Trinity College, Dublin, in 1822, taking his degree in 1827. Many of the adventures of college life recorded in *Charles O'Malley* are believed to have actually happened. Later, Lever studied at Göttingen, and obtained a degree there. At some time or other before 1832 (for in this unsatisfactory way most of the facts of this part of his life are recorded) he is said to have visited America, and to have sojourned with the Indians, adopting their dress and mode of life, and going through adventures afterwards utilized in *Con Cregan* and *Arthur O'Leary*. But it is impossible to be certain as to this period; it is only towards the cholera outbreak of 1832 that something like a firm ground offers itself to the biographer. Lever had taken up the profession of medicine, and he was appointed, first to a district of which the headquarters was Killybeg in Galway, where *Harry Lorrequer* was begun, local stories being largely embodied in it, and then to a district in Ulster, around Coleraine and Newtown Limavady, where material was gathered for *Charles O'Malley* and the *Knight of Gwynne*. He married Miss Kate Baker, but even here the mist of uncertainty which envelops him exists, and it is not clear what the real date of the marriage was. After his cholera work was done he proceeded to Brussels. It has been usual to represent him as physician to the embassy, and even Thackeray (who knew him well) has given currency to the description by a quotation in the *Book of Snobs*. But it is certain that Lever was never formally appointed physician to the embassy, though he had letters of introduction to the secretary of the English legation there, and unquestionably practised. *Harry Lorrequer* was completed at Brussels, and it began to be published in 1837. It was followed by *Charles O'Malley* and *Jack Hinton*. All these stories, but

especially the first two, were made up to a great extent of experiences through which Lever had gone, or stories which he had heard in Ireland, and of the reminiscences and oddities of English residents at Brussels, where there were then many retired English officers who had gone through the Peninsular and other campaigns of the great war. It is said in particular that Major Monsoone was almost a photograph of a well-known living character at the time, and much the same thing has been asserted of other personages. This piecing together of scraps accounts for the incoherency and absence of plot in the earlier books—defects which were increased by the author's habit of composing them in fragments, and revising them for the press with the utmost carelessness. The abundance and variety of his materials, however, his skill as a *raconteur*, and the fresh and almost boisterous good humour which blew through all his work, made him very popular, and he found a congenial illustrator in H. K. Browne. After a time proposals were made to him to undertake the editorship of the *Dublin University Magazine*, which he accepted, and held the post from 1842 to 1846. During this time his income was considerable, amounting, according to his biographer, to fully three thousand a year. He lived not in Dublin but a little way out of it, and exercised boundless hospitality to visitors. Besides this, he was an inveterate card player, and not on the whole a lucky one, and he was very fond of horses, which he kept in large numbers for himself and all his family. He was indefatigable in novel writing, *Tom Burke*, *The O'Donoghue*, *The Knight of Gwynne*, &c., following those already named. But the work of editing was irksome to him, and for the reasons just named residence in Ireland made it comparatively unprofitable. He therefore resigned his editorship in the year 1846, and went abroad, where he was always more at home than in England or even in Ireland. At first he lived at Karlsruhe, where G. P. R. James was also residing; then he pitched his tent in a castle of Tyrol, which is said to be pretty accurately described in *A Day's Ride*. Afterwards he wandered about, finally settling at Florence. This neighbourhood became especially agreeable to him, uniting as it did abundant society with the possibility of enjoying it without great expense. In November 1858 he received from Lord Derby one of the rare pieces of patronage which have fallen in modern days to the share of Englishmen of letters, by being appointed consul at Spezia. During this period of wandering or settled life on the Continent, he changed his style of novel writing. His method was, as has been hinted already, always one rather of observation and reproduction than of deliberate creation, and as he had formerly drawn on the humours of Irish life, or the oddities of Wellington's veterans, so now he dealt with those of travelling Britons abroad, and with similar subjects. *The Daltons*, *The Dodd Family Abroad*, *Davenport Dunn*, &c., belong to this time and family for the most part, though some of them rather fall under the earlier class in style and date of composition. *One of Them*, *Barrington*, *The Fortunes of Glenore*, &c., led up to the most singular of all Lever's books, *A Day's Ride*, *A Life's Romance*. This book, which was published in *All the Year Round*, was said at the time—with what truth it is not easy to say—to have positively lowered the sale of that publication, yet it contains some of Lever's best work, and displays an originality not common with him. The mixture of burlesque and sentiment was, it may be supposed, either ungenial or incomprehensible to the ordinary reader.

As he grew older, Lever, whose politics had been a rather indefinite Toryism, became more of a party man, and showed this in the papers published in *Blackwood's Magazine*, under the name of "Cornelius O'Dowd," papers of a miscellaneous kind, but often political. He is said to have

thought of engaging, or to have been invited to engage, in regular journalism, but wisely declined. In 1867 he was transferred from Spezia to Trieste, a change pecuniarily advantageous, but involving the loss of the society which he passionately loved. The last years of Lever's life were somewhat clouded. His health had never been good, and he had not lived carefully. His wife, to whom he was much attached, died before him. But he was still active with his pen, and the novels of his last period, if less lively than his earlier ones, are far better written as well as far more regular and careful in construction. Such are *Sir Brooks Footbrooke*, *That Boy of Norcott's*, *Sir Jasper Carew*, *The Brambleighs of Bishop's Folly*, and his last book, *Lord Kilgobbin*. He died, as has been said, in the summer of 1872. Novels not yet mentioned are *Roland Cushe*, *Luttrell of Arran*, *Tony Butler*, *Maurice Tierney*, *the Martins of Cro' Martin*, *St Patrick's Eve*, &c.

Lever deserves an honorable place among the secondary novelists of the 19th century, but it is not very probable that any single novel of his will have a long lease of popularity. He is one of the authors who do not take the trouble to learn the mechanism of their art until the heyday of their imaginative force is past. The defects of his earlier works have been already indicated. They are written with almost unconceivable carelessness, the same incidents occurring over and over again, and the chronology being altogether bewildering. This is especially the case with *Charles O'Malley*, which, however, owing to the liveliness of its adventures and the personage of Mickey Free the Irish servant, is still perhaps the most popular of all. With young and uncritical readers this popularity is likely to be maintained until some supplanter in the same kind arises, or until the state of manners and society becomes too obsolete for anything more than historical interest. Then Lever, like all writers whose formal excellence is not sufficient to save them, will be forgotten, for he late work, though almost always amusing and sometimes more, has little abiding interest. The authority for Lever's biography is the *Life* by Dr. W. J. Fitzgerald (London, 1879). (G. S. A.)

LEVERRIER, URBAIN JEAN JOSEPH (1811–1877), one of the greatest astronomers of modern times, was born at St Lô in Normandy, March 11, 1811. His father, who held a small post under Government, made great efforts to send him to Paris, where a brilliant examination gained him, in 1831, admittance to the École Polytechnique. The distinction of his career there was rewarded with a free choice amongst the departments of the public service open to pupils of the school. He selected the administration of tobacco, addressing himself especially to chemical researches under the guidance of Gay-Lussac, and gave striking proof of ability in two papers on the combinations of phosphorus with hydrogen and oxygen, published in *Annales de Chimie et de Physique* (1835 and 1837). His astronomical vocation, like that of Kepler, came from without. The place of teacher of that science at the École Polytechnique falling vacant in 1837, it was offered to and accepted by Leverrier, who, "docile to circumstance," instantly abandoned chemistry, and directed the whole of his powers to celestial mechanics. The first fruits of his arduous labours were contained in two memoirs presented to the Academy, September 16 and October 14, 1839. Pursuing the investigations of Laplace, he demonstrated with greater rigour the stability of the solar system, and calculated the limits within which the eccentricities and inclinations of the planetary orbits vary. This remarkable debut excited much attention, and, on the recommendation of Arago, he took in hand the theory of Mercury, producing, in 1843, tables of that planet far superior in accuracy to those hitherto available. The perturbations of the comets discovered, the one by Faye in November 1843, the other by De Vico a year later, were minutely investigated by Leverrier, with the result of disproving the supposed identity of the first with Lexell's lost comet of 1770, and of the other with Tycho's of 1586. On the other hand, he made it appear all but certain that Vico's comet was the same with one seen by Lahire in 1678.

He was once more, by the summons of Arago, recalled to planetary studies, and this time it was to Uranus that his attention was directed. Step by step, with sagacious and patient accuracy, he advanced to the great discovery which has immortalized his name. Carefully sifting all the known causes of disturbance, he showed that one hitherto unknown must be added to their number, and on the 23d of September 1846 the planet Neptune was discerned by Galle at Berlin, within one degree of the spot indicated by Leverrier. See *ASTRONOMY*, p. 813.

This memorable achievement was greeted with an outburst of public enthusiasm, and requited with a shower of public distinctions. Academies vied with each other in enrolling Leverrier among their members; the Royal Society awarded him the Copley medal; the king of Denmark sent him the order of the Dannebrog; he was named officer in the Legion of Honour, and preceptor to the Comte de Paris; a chair of astronomy was created for his benefit at the Faculty of Sciences, he was appointed adjunct astronomer to the Bureau of Longitudes. Returned to the Legislative Assembly in 1849 by his native department of Manche, he voted with the anti-republican party, but devoted his principal attention to subjects connected with science and education. After the *coup d'état* he became a senator and inspector-general of superior instruction, sat upon the commission for the reform of the Ecole Polytechnique (1854), and, on January 30, 1854, succeeded Arago as director of the Paris observatory. His official work in the latter capacity would alone have strained the energies of an ordinary man. The institution had fallen into a state of lamentable inefficiency. Leverrier placed it on a totally new footing, freed it from the control of the Bureau of Longitudes, and raised it to its due rank among the observatories of Europe. He did not, however, escape the common lot of reformers. His uncompromising measures and unconciliatory manner of enforcing them raised a storm only appeased by his removal, February 5, 1870. Three years later, on the death of his successor Delaunay, he was reinstated by M. Thiers, but with authority restricted by the supervision of a council. In the midst of these disquietudes, he executed with unflinching resolution a task the gigantic proportions of which cannot be contemplated without amazement. This was nothing less than the complete revision of the planetary theories, together with a laborious comparison of results with the most authentic observations, and the construction of tables representing the movements thus corrected. It required all his indomitable perseverance to carry through to the end a purpose which failing health continually menaced with frustration. He had, however, the happiness of living long enough to perfect his work. Three weeks after he had affixed his signature to the printed sheets of the theory of Neptune he died at Paris, in his sixty-seventh year, September 23, 1877. By his marriage with Mademoiselle Choquet, who survived him little more than a month, he left a son and daughter.

The discovery with which the memory of this great man is popularly identified was only an incident in his career. The elaboration of the scheme of the heavens traced out by Laplace in the *Mécanique Céleste* was his larger aim, for the accomplishment of which forty years of unremitting industry barely sufficed. The work once done, however, may almost be said to have been done for all time, from the extraordinary care with which errors were guarded against, and imperfections in the data allowed for. The organization of the meteorological service in France is entirely due to Leverrier, and the present system of international weather-warnings is the realization of a design which he warmly promoted. He founded the Association Scientifique, and was active in introducing a practical scientific element into public education. His inference of the existence, between Mercury and the sun, of an appreciable quantity of circulating matter (*Comptes Rendus*, 1869, i. p. 379), though unquestionably sound, has not yet been satisfactorily verified by observation. He was twice, in 1868 and 1876, the recipient of the gold medal

of the Royal Astronomical Society, London, and the university of Cambridge conferred upon him, in 1875, the honorary degree of LL.D. All his planetary tables have been adopted by the *Nautical Almanac*, as well as by the *Connaissance des Temps*.

The *Annales de l'Observatoire de Paris*, the publication of which was set on foot by Leverrier, contain, in vols. i.-vi. (*Mémoires*), 1848-51, and x.-xiv., 1874-77, his theories and tables of the several planets. In vol. i. will be found, besides his masterly report on the observatory, a general theory of secular inequalities, in which the development of the disturbing function is carried to a point hitherto unattempted. The memoirs and papers communicated by him to the Academy have been summarized in *Comptes Rendus*, 1869-76, and the more important published in full either separately, or in the *Conna. des Temps* and the *Journal des Mathématiques*. That entitled *Développemens sur différents points de la Théorie des perturbations*, 1841, has been translated in part xvii. of Taylor's *Scientific Memoirs*. For his scientific work see Professor Adams's address, *Monthly Notices*, vol. xxvii. p. 222, and M. Tisserand's review in *Ann. de l'Obs.*, tom. xv., 1869, for a notice of his life, M. Bertrand's "*Résumé Historique*," *Mém. de l'Acad. des Sciences*, tom. xli, 2^{me} série. (A. M. C.)

LEVIS, formerly POINTÉ LEVI or POINT LEVIS, the chief town of a county of the same name in Canada, on the other side of the St. Lawrence from Quebec, with which it communicates by a ferry. In the beginning of the present century Pointe Lévi was a cluster of white houses, with a church and a number of large mills, it has now become an important station on the Grand Trunk Railway, and in the extent of its river trade is surpassed by only a few places in the Dominion. In 1881 the population was 7597.

LEVITES (לְוִיִּם), or sons of Levi (לֵוִי), are defined according to the usual methods of Hebrew genealogical history as the descendants of Levi, the third son of Jacob by Leah (Gen. xxix. 34).¹ But in Hebrew genealogies we are not necessarily entitled to look upon the eponymus of a tribe as more than an ideal personality, and, without entering into the large question how far the patriarchal history may be held to furnish exceptions to this rule, it may be observed that the only narrative in which, on a literal interpretation, Levi appears as a person (Gen. xxiv.) bears internal evidence of the intention of the author to delineate under the form of personification events in the history of the tribes of Levi and Simeon which must have taken place after the sojourn of Israel in Egypt.² The same events are alluded to in Gen. xlii. 5-7, where Simeon and Levi are plainly spoken of as communities with a communal assembly (קָהָל). They were allied tribes or brothers; their onslaught on the Shechemites was condemned by the rest of Israel; it took place before the Hebrews had passed from pastoral to settled life (ver. 5, "instruments of violence are their shepherds' staves"); and its results were disastrous to the actors, when their cause was disavowed by their brethren. The Benê Hamor regained possession of Shechem, as we know from Judges ix., and both the assailing tribes were scattered through Israel, and failed to secure an independent territorial position. The details of this curious portion of the earliest Hebrew history must remain obscure; the narrative in Gen. xxiv. does not really place them in so clear a light as the briefer reference in Gen. xlii.; for the former chapter has been retold and largely added to by a late writer, who looks upon the action of the brethren in the light of the priestly legislation, and judges it much more favourably than is done in Gen. xlii. In post-canonical Judaism the favourable view of the zeal of Levi and Simeon becomes still more dominant (Judith ix. 2 sq.; *B. Sotâ*, chap. xxx;

¹ In Gen. xxix. 34 the name of Levi is connected with לֵוִי, "attach oneself to." This form, however, is that of a gentile noun, and it is most probably a "reduplication" from Leah, as suggested by Wellhausen. See also Stade in *St. f. A. Theol. Wissenschaft.*, i. 116.

² Jacob in verse 30 is not a personal but a collective idea, for he says, "I am a few men;" and the capture and total destruction of a considerable city is in the nature of things the work of two tribes rather than of two individuals.

and especially Theodotus, *ap. Polyhistor*, in *Müller's Fragmenta*, iii. 217 sq., and the curse of Jacob on the ferocity of his sons is quite forgotten.¹ In the oldest history, however, the treachery of Levi and Simeon towards a community which had received the right of *consuetudo* with Israel is represented as a crime, which imperilled the position of the Hebrews and was fatal to the future of the tribes directly involved.

But while the Levites were scattered throughout Israel their name does not disappear from the roll of the tribes. In the Blessing of Moses (Deut. xxxiii.), where Simeon is passed over, Levi still appears, not as a territorial tribe but as the collective name for the priesthood. The priesthood meant is that of the northern kingdom under the dynasty of Jehu, to which the chapter in question belongs; and in fact we know that the priests of the important northern sanctuary of Dan traced their origin to a Levite (Jud. xiv. 9), Jonathan the son of Gershom, the son of Moses (Jud. xvii. 30).² That the Judean priesthood were also known as Levites in the later times of the kingdom appears from the book of Deuteronomy, especially from x. 8 sq., xvii. 1 sq.; and we learn from Ezek. xiv. 10 sq. that the Judean Levites were not confined to the service of the temple, but included the priests of the local high places abolished by Josiah. Alike in Judah and in the north the priestly prerogative of Levi was traced back to the days of Moses (Deut. x. 8, xxxiii. 8); but in later times at least the Judean priesthood did not acknowledge the Levitical status of their northern colleagues (1 Kings xii. 31). It must, however, be observed that the prophets Amos and Hosea never speak of the northern priesthood as illegitimate, and Hosea iv. certainly implies the opposite. Presumably it was only after the fall of Samaria, and the introduction of large foreign elements into the population of the north, that the southern priests began to disavow the ministers of the sanctuaries of Samaria, most of whom can no longer have been representatives of the old priesthood as it existed before the northern captivity (2 Kings xvii. 28, comp. Amos vii. 17, Jud. xvii. 30, 2 Kings xxiii. 20, in contrast with verses 8 sq.).

In the most developed form of the hierarchical system the ministers of the sanctuary are divided into two grades. All are regarded as Levites by descent, but the mass of the Levites are mere subordinate ministers not entitled to approach the altar or perform any strictly priestly function, and the true priesthood is confined to the descendants of Aaron. In the documents which reveal to us the actual state of the priesthood in the northern and southern kingdoms before the exile, there is no trace of this distinction. Every Levite is a priest, or at least is qualified to become such (Deut. x. 8, xvii. 7). The subordinate and menial offices of the tabernacle are not assigned to members of a holy guild, in Jerusalem at least they were mainly discharged by members of the royal body-guard (the Carians and footmen, 2 Kings xi. 4, *Heb.*), or by bond slaves, the ancestors of the later Nethinim,—in either case by men who might even be uncircumcised foreigners (Ezek. xiv. 7 sq.). A Levitical priest was a legitimate priest; when the author of 1 Kings xii. 31 wishes to represent Jeroboam's priests as illegal he contents himself with saying that they were not taken from the sons of Levi. The first

historical trace of a modification of this state of things is found in connexion with the suppression of the local high places by Josiah, when their priests were brought to Jerusalem and received their support from the temple offerings, but were not permitted to minister at the altar (2 Kings xxiii. 9). The priests of the temple, the sons of Zadok, were not prepared to concede to their provincial brethren all the privileges which Deut. xvii. had proposed in compensation for the loss of their local ministry. Ezekiel, after the fall of the temple, in planning a scheme of ritual for the new temple, raises this practical exclusion from the altar to the rank of a principle. In the new temple the Levites who had ministered before the local altars shall be punished by exclusion from proper priestly work, and shall fill the subordinate offices of the sanctuary in place of the foreigners who had hitherto occupied them, but shall not be permitted to pollute Jehovah's house in future by their presence (Ezek. xiv. 7 sq.). After the exile this principle was actually carried out, priests and Levites are distinguished in the list of the Jews who returned under the decree of Cyrus (Ezra ii.; Neh. vii.); but the former, that is, the descendants of the pre-exilic priests of the royal temple, greatly outnumber the Levites or descendants of the priests of the high places. At this time other classes of temple servants, the singers, the porters, the Nethinim or slaves of the sanctuary, and the children of Solomon's slaves, whose hereditary service would, on Eastern principles, give them a pre-eminence over other slaves of the sanctuary, are also still distinguished from the Levites; but these distinctions lost their significance when the word Levite itself came to mean a subordinate minister. In the time of Nehemiah, Levites and singers, Levites and porters, are very much run into one (Neh. xi. xii, xiii.), and ultimately the absorption of the other classes of subordinate ministers into the hereditary guild of Levites is formally expressed in the shape of genealogies, deriving the singers, and even families whose heathenish and foreign names show them to have originally belonged to the Nethinim, from the ancient stock of Levi.³

The new hierarchical system found its legal basis in the Pentateuch, or rather in the so-called priestly legislation, first publicly accepted as an integral part of the Torah under Ezra and Nehemiah. Here the exclusion of the Levites from all share in the proper priesthood of the sons of Aaron is precisely formulated (Num. iii. sq.); their service is regulated from the point of view that they are essentially the servants and hereditary serfs of the priests (iii. 9), while, on the other hand, they are recognized as possessing a higher grade of holiness than the mass of the people, and are endowed with the tithes, of which in turn they pay a tithe to the priests (Num. xviii. 21 sq.). These regulations as to tithes were enforced by Nehemiah; but the subordinate position of the Levites was hardly consistent with their permanent enjoyment of revenues of such importance, and we learn from the Talmud that they were finally transferred to the priests.⁴ Another provision of the law, viz., the assignment to the Levites of certain cities with a definite measure of inalienable pasture ground (Num. xxxv.; Lev. xxv. 34), was apparently never put in force after the exile.

As the priestly legislation carried its ordinances back into the time of Moses (see PENTATEUCH), so the later developments of the Levitical service as they existed in the time of the Chronicler about the close of the 4th century

¹ According to Wellhausen's analysis (*Jahrb. f. D. Theol.*, xxi. 485 sq.), the old narrative consisted of Gen. xxiv. 8, 7*, 11, 12, 19, 28*, 29*, 30, 31, the scribe denoting that only parts of the verses marked by * are ancient. The latest and most satisfactory discussion is that of Kuenen (*Theol. Tijdschr.*, xiv. 287 sq.), in which the opposite view of Dillmann (*Genesis*, ad i.) is fully refuted.

² It is generally agreed that Moses (מֹשֶׁה) is the true reading. The later Jews corrected the name to חֲנָנִיאל by inserting the letter ח, but did not venture to do so except above the line (מֹשֶׁה־חֲנָנִיאל), so that the reading of the archetype can still be restored.

³ See the details, and the proof that the later Levites included men whose actual ancestry belonged to other tribes, in Ewald's *Geschichte*, ii. 230; Wellhausen, *Geschichte*, i. 152, 228; Graf in *Morx's Archiv*, i. 231.

⁴ See Mielke, *Massek Sheni*, chap. v. and, the *Jerusalem Gemara* (ii. 259 of Schwartz's translation); *Yebamoth*, f. 88a; *Caracur*, *App. ad Godes*, p. 224; and Hottinger, *De Doct.*, vi. 8, ix. 17.

to be referred by that author to David (1 Chron. xv, xvi, xxiii) or to Hazeleiah (2 Chron. xxix.) and Josiah (2 Chron. xxxv.). The chief point is the development of the musical service of the temple, which has no place in the Pentateuch, but afterwards came to be of the first importance, as we see from the Psalter, and attracted the special attention of Greek observers (Theophrastus, *ap* Porph., *De Abst.*, ii, 26).

While it is not difficult to trace the history of the Levites from the time of the Blessing of Moses and Aaron downwards, the links connecting the priestly tribe with the earlier fortunes of the tribe of Levi are hardly to be determined with any certainty.

According to the traditional view the scheme of the Levitical legislation, with its double hierarchy of priests and Levites, is of Mosiac ordinance. But there are many proofs that in the Pentateuch, as we possess it, divergent ordinances, dating from very different ages, and all carried back by means of a legal convention to the time of the wilderness journey. And, if the complete hierarchical theory as it existed after the exile was really the work of Moses, it is inexplicable that all trace of it was so completely lost in the time of the monarchy, that Ezekiel speaks of the degradation of the non-Zadokites Levites as a new thing and as a punishment for their share in the sin of the high places, and that no clear evidence of the existence of a distinction between priests and Levites has been found in any Hebrew writing demonstrably earlier than the exile.¹ It is indeed argued that the narrative of the rebellion of Korah, and the list of Levitical cities in Josh. xxi., imply that the precepts of the post-exile law were practically recognized by Moses and Joshua, but it is certain that the distribution spoken of in Josh. xxi. did not take place at the time of the conquest, because many of the cities named were either not conquered by the Hebrews till long afterwards, or, if conquered, were not held by Levites. The Levitical cities of Joshua are indeed largely identical with ancient holy cities (Hebron, Shechem, Mahanaim, &c.); but in ancient Israel a holy city was one which possessed a noted sanctuary (often of Canaanite origin), not one the inhabitants of which belonged to the holy tribe. These sanctuaries had of course their local priesthoods, which in this time of the monarchy were all called Levitical; and it is only in this sense, not in that of the priestly legislation, that a town like Shechem can ever have been Levitical. So again the narrative of Korah's rebellion cannot be taken as evidence of composite origin; the parts of it which represent Korah as a common Levite in rebellion against the priesthood of Aaron belong to a late date, and the original form of the history knows nothing of the later hierarchical system.²

We are thus compelled to give up the idea of carrying back the distinction of Levites and Aaronites in the later sense to the time of Moses, and are excluded from using the priestly parts of the Pentateuch and Joshua as a source for the earliest history of the tribe. It still, however, remains certain that under the monarchy the priestly consecration of Levi was referred to the time of Moses, who was himself a member of the tribe, and in Deut. x. 8 the functions of Levi are specially connected with the Mosiac sanctuary of the ark. Now we know from 1 Sam. ii. 27, that the priests of the ark in the period of the Judges claimed descent from the family of Moses; and the case of Micah's Levite shows that a descendant of Moses was regarded as a peculiarly fit priest. The whole evidence conspires to show that from the time of Moses downwards his kin had a certain hereditary prerogative in connexion with the worship of Jehovah. In the earliest times the ritual of Jehovah's sanctuary had not attained such development as to occupy a whole tribe, but it, as appears probable, the mass of the tribe of Levi was almost annihilated in the first age after Moses, the name of Levi might very well continue to be known only in connexion with those of the tribe who traced kin with Moses or remained by the sanctuary. The multiplication of Hebrew holy places was effected partly with the consent with the Canaanites, partly in other ways that had nothing to do with the Mosiac sanctuary, and so a variety of priestly guilds arose which certainly cannot have been all of Levitical descent. But, as the nation was consolidated and a uniform system of sacred law, referred to Moses as its originator, came to be administered all over the land, in the hands of the ministers of the greater sanctuaries, the various guilds must

have been drawn together and have aimed at forming such a united body as we find described in Deut. xxxiii. and this unity would find a natural expression in the extension of the name of Levites to all priesthoods recognized by the state. If this was the course of things we can hardly suppose that the term came into large use till the Israelites were consolidated under the monarchy, and in fact the integrity of the text in 1 Sam. vi. 15, 2 Sam. vi. 24, as well as 1 Kings viii. 4, is open to question. Up to the time of David and Solomon, as appears from the cases of Samuel, Zadok, Eleazar (1 Sam. vii. 1), and the sons of David (2 Sam. viii. 18), as well as from 1 Kings xii. 31, the priesthood was not essentially hereditary, but, like any occupations that required traditional knowledge, it must have tended to become more and more so, and all priests would appear as Levites by adoption if not by descent. Wellhausen (*Gench.*, i, 139) has argued from Deut. xxxiii. 9 that the northern priesthood was not an hereditary guild, but involved the surrender of all family connection; the words, however, as more naturally understood as praise of the judicial impartiality which refused to be influenced by family ties. Our data are too scanty to clear up the details of this interesting piece of history; but it can hardly be doubted that the development of a consolidated and hereditary priestly corporation in all the sanctuaries was slowly bound up with the unification of the state and the absorption of tribal organization in the monarchy. The reaction of tribal feeling against the central government, of which there are many traces in the history of Ephraim, has perhaps its counterpart in the opposition to the united priesthood which is alluded to in Deut. xxxiii. 11.

There have been many attempts on the part of recent writers from the time of Yetsé downwards to deny that Levi was one of the original tribes of Israel, but they all break down before the testimony of Gen. xlix. See especially Kuenen's refutation of the theory of Land, *Theol. Tijdsch.*, 1872, p. 628 sq., and for the latest and best summary of the case see in *Monist.*, vol. i, 4 (1895), "Zur Geschichte des Stammes Levi," Wellhausen, *Gench.*, i, p. 123 sq., Stadel, *Gench. d. V. Israel*, p. 152 sq. (W. R. S.).

LEVITICUS SEE PENTATEUCH

LEW-CHEW ISLANDS. The Lew-chew, Loocooch, Liu Kiu, or Riu Kiu Islands³ include, in the wider application of the name, the whole series extending in a north-east and south-west direction from the southern end of Kinshiu in Japan proper to the north-east of Formosa. Within the northern group lies the intersection of 130° E. long. and 30° N. lat.; and in the southern group that of 126° E. long. and 25° N. lat. The islands, however, to the north of 25° are not unfrequently considered, by Europeans as well as Japanese, to belong in part to Japan proper, and in part to constitute the separate group of the Lincshotens, Shichi-to, or Oedile Archipelago.

The following, according to Doederlein, are the recognized subdivisions and areas of the whole archipelago:—(1) *The Northern Islands* (attached to Satsuma or Kinshiu Osumi, 899 square miles); Tanaga (159 square miles), Iliaka, Yakuno (172 square miles), Take, Yau or Iwaga, Kura, Kose or Kowose, and Kudono-Eabu or Nagrobo; (2) *Shachi-to* (43 square miles) Kuchino, Gaza or Yabi, Naka-no (the largest, 13 square miles), Hiru or Fira, Suwase, Akuseki, Takara, and Yoko; (3) *Hakuba-Shoto* (515 square miles). Oshima (303 square miles), Kagurama or Katana (40 square miles), Yori, Utsu or Uru, Kital, Yokuno or Kahuruma (99 square miles), Naka Erabu, and Yoru or Yori; (4) *Chubu-Shoto* (562 square miles); Tori or Iwo, Kheya or Toboya, Isoma, Iye, Awakuni or Aguneh, Tonashu, Kume, Kewama or Amakurima, and Okinawa (520 square miles); (5) *Nambu-Shoto* or the Maakoshima Group (816 square miles). Miyako or Ty-pu-san (67 square miles), Misuna and Taruma, Ishigaki or Pa-chung-mu (47 square miles), Ihekoma or Robertson Island, Ohama or Kubah, Kuo or Bauga, Iriomoto Nahikotom or Koo-Kien-San, Azagaku or Chung-chi, Misutsuma or Hasyolan, Yonakuni or Kumi.

The area of the Lew-chews proper is thus 1425 square miles, that of the whole chain 1864 square miles. The largest islands are Okinawa (often called Great Lew-chew) and Oshima, the former being also the political centre of the whole archipelago. The Lew-chews consist in the main of crystalline rocks—gneiss, hornblende, and granite—upheaved at a very remote date, and only partially covered by severely weathered sedimentary strata seldom left in their original horizontal position. Coralline limestone is found in great abundance even on the tops of the hills, and the coasts are often fringed by coral reefs. In

¹ The recent defence of the traditional view by S. I. Courtes (*The Levitical Priest*, 1877) still assumes such evidence in 1 Kings viii. 4. But there are many evidences that the text of this part of Kings has undergone considerable editing at a pretty late date. The LXX. translators did not read the clause which speaks of "priests and Levites," and the Chremistore read "the Levite priests,"—the phrase characteristic of the Deuteronomic identification of priestly and Levitical ministry.

² See the latest researches of Kuenen, *Theol. Tijdsch.*, xii, 189 sq., where other recent discussions of the chapter are cited and examined.

³ See a curious history of the name in Li Ting Yuen's Journal.

erected in the 15th century; St John's, Southover, is of mixed architecture, but preserves some specimens of Early Norman. There are only slight remains of the old castle, occupying a picturesque situation on the height, and supposed to have been founded by Alfred and rebuilt by William de Warren. In the grounds of the old Cluniac priory of St Pancras, founded in 1078, the leaden coffins of William de Warren and Guadrada were dug up during an excavation in 1845. There is a free grammar school dating from 1512, and among the other public buildings are the county-hall, the prison, and the Fitzroy memorial library. The industries include the manufacture of agricultural implements, brewing, tanning, and iron and brass founding. The population of the urban sanitary district in 1871 was 6010, and in 1881 it was 6017, the population of the parliamentary borough (area 1087 acres) in the same years being 10,753 and 11,199. Lewes was incorporated by royal charter in 1881.

From various discoveries that have been made of Roman coins, and the traces that still remain of old mounds and tumuli, the town is believed to be of very ancient origin. It was a royal demesne of the South Saxon kings. Mints were established at it by Athelstan, which were in operation till the reign of Harold At the battle of Lewes, May 13, 1264, Simon de Montfort defeated Henry III. From the time of Edward I until 1868 the town returned two members to parliament, but now it returns only one. See, besides the histories of Sussex, Horsfield, *History of Lewes*, 2 vols., 1834-27, and several interesting papers in the *Sussex Archaeological Collection*.

LEWES, GEORGE HENRY (1817-1878), a prolific and versatile writer, born in London in 1817, was a grandson of Charles Lee Lewes, a comedian who had a considerable reputation in his day. He was educated in London, Jersey, and Brittany, and began active life by attempting business and afterwards medicine. Later he appears to have had serious thoughts of making the stage his profession. He finally fixed his choice on a literary career. His early writings belong mainly to the lighter departments of letters. He contributed a large number of critical studies to the leading quarterly and other reviews. These discuss a wide variety of subject, and, though often characterized by hasty impulse and imperfect study, betray a singularly acute critical judgment, which has been enlightened by philosophic study. Of these critical writings the most valuable are those on the drama, which were afterwards republished under the title *Actors and Acting* (1875). With this may be taken the volume on *The Spanish Drama* (1846). The combination of wide scholarship, philosophic culture, and practical acquaintance with the theatre gives these essays a high place among the best efforts in English dramatic criticism. In 1846-1848 he published *The Biographical History of Philosophy*, an attempt to depict the life of philosophers as an ever-renewed fruitless labour to attain the unattainable. In 1847-1848 he made two attempts in the field of fiction—*Ranish ope*, and *Rosé, Blanche, and Violet*—which, though displaying considerable skill both in plot, construction, and in characterization, have taken no permanent place in literature. The same is to be said of an ingenious attempt to rehabilitate Robespierre (1849). The culmination of the author's work in prose literature is the *Life of Goethe* (1855), probably the best known of his writings. Lewes's many-sidedness of mind, and his combination of scientific with literary tastes, eminently fitted him to appreciate the large nature and the wide-ranging activity of the German poet. The high position this work has taken in Germany itself, notwithstanding the boldness of its criticism and the unpopularity of some of its views (e.g., on the relation of the second to the first part of *Faust*), is a sufficient testimony to its general excellence. From about 1853 Lewes's writings show that he was occupying himself with scientific and more particularly biological work. He may be said

to have always manifested a distinctly scientific bent in his writings, and his closer devotion to science was but the following out of early impulses. Considering the author's want of the usual course of technical training, these studies are a remarkable testimony to the penetration of his intellect. The most important of these essays are collected in the volumes *Science Studies* (1858), *Physiology of Common Life* (1859), *Studies in Animal Life* (1862), and *Aristotle, a Chapter from the History of Science* (1864). They are much more than popular expositions of accepted scientific truths. They contain able criticisms of authorized ideas, and embody the results of individual research and individual reflexion. He struck out a number of impressive suggestions, some of which have since been accepted by physiologists at home and abroad. Of these the most valuable is that now known as the doctrine of the functional indifference of the nerves—that what are known as the specific energies of the optic, auditory, and other nerves are simply differences in their mode of action due to the differences of the peripheral structures or sense-organs with which they are connected. This idea has since been independently arrived at by Wundt (*Philosophische Psychologie*, 2d ed., p. 321). In 1865, on the starting of the *Fortnightly Review*, Lewes became its editor, but he retained the post for less than two years. This date marks the transition from more strictly scientific to philosophic work. He had from early youth cherished a strong liking for philosophic studies, one of his earliest essays was an appreciative account of Hegel's *Æsthetics*. Coming under the influence of positivism as unfolded both in Comte's own works and in J. S. Mill's *System of Logic*, he abandoned all faith in the possibility of metaphysics, and recorded this abandonment in the above-mentioned *History of Philosophy*. Yet he did not at any time give an unqualified adhesion to Comte's teaching, and with wider reading and reflexion his mind moved away further from the positivist's standpoint. In the preface to the third edition of his *History of Philosophy* he avowed a change in this direction, and this movement is still more plainly discernible in subsequent editions of the work. The final outcome of this intellectual progress is given to us in *The Problems of Life and Mind*, which may be regarded as the crowning work of his life. His sudden death in 1878 cut short the work, yet it is complete enough to allow us to judge of the author's matured conceptions on biological, psychological, and metaphysical problems.

The first two volumes on *The Foundations of a Creed* lay down what he regarded as the true principles of philosophizing. He here seeks to effect a rapprochement between metaphysics and science. He is still so far a positivist as to pronounce all inquiry into the ultimate nature of things fruitless. What matter, form, spirit are in themselves is a futile question that belongs to the stultic region of "metaphysics." But philosophic questions may be so stated as to be susceptible of a precise solution by scientific method. Thus, since the relation of subject to object falls within our experience, it is a proper matter for philosophic investigation. It may be questioned whether Lewes is right in thus identifying the methods of science and philosophy. Philosophy is not a mere extension of scientific knowledge; it is an investigation of the nature and validity of the knowing process itself. In any case Lewes cannot be said to have done much to aid in the settlement of properly philosophical questions. His whole treatment of the question of the relation of subject to object is vitiated by a confusion between the scientific truth that mind and body coexist in the living organism and the philosophic truth that all knowledge of objects implies a knowing subject. In other words, to use Mr. Shadworth Hodgson's phrase, he mixes up the question of the *genesis* of mental forms with the question of their *nature* (see *Philosophy of Reflection*, vol. II, pp. 40-48). Thus he reaches the "monistic" doctrine that mind and matter are two aspects of the same existence by attending simply to the parallelism between psychical and physical processes given as a fact (or a probable fact) of our experience, and by leaving out of account their relation as subject and object in the cognitive act. His identification of the two as phases of one existence is open to criticism, not only from the point of view of

philosophy, but from that of science. In his treatment of such ideas as "sensibility," "sentience," and the like, he does not always show whether he is speaking of physical or of psychical phenomena. Among the other properly philosophic questions discussed in these two volumes the nature of the causal relation is perhaps the one which is handled with most freshness and suggestiveness. The third volume, *The Physical Basis of Mind*, further develops the writer's views on organic activities as a whole. He insists strongly on the radical distinction between organic and inorganic processes, and on the impossibility of ever explaining the former by purely mechanical principles. With respect to the nervous system, he holds that all its parts have one and the same elementary property, namely, sensibility. This sensibility belongs as much to the lower centres of the spinal cord as to the brain, contributing in this more elementary form elements to the "subconscious" region of mental life. The higher functions of the nervous system, which make up our conscious mental life, are merely more complex modifications of this fundamental property of nerve substance. Closely related to this doctrine is the view that the nervous organism acts as a whole, that particular mental operations cannot be referred to definitely circumscribed regions of the brain, and that the hypotheses of nervous activity passing in the centre by an isolated pathway from one nerve-cell to another is altogether illusory. By insisting on the complete coincidence between the regions of nerve-action and sentence, and by holding that these are but different aspects of one thing, he is able to attack the doctrine of animal and human automatism, which affirms that feeling or consciousness is merely an incidental concomitant of nerve-action, and in no way essential to the chain of physical events. Lewis's views in psychology, partly opened up in the earlier volumes of the *Problems*, are more fully worked out in the last two volumes (2d series). He discusses the method of psychology with much insight. He claims against Comte and his followers a place for introspection in psychological research. In addition to this subjective method there must be an objective, which consists partly in a reference to nervous conditions, and partly in the employment of sociological and historical data. Biological knowledge, or a consideration of the organic conditions, would only help us to explain mental functions, as feeling, as feeling is, it would assist us to understand the stand differences of mental faculties as manifested in different races and stages of human development. The organic conditions of these differences will probably for ever escape detection. Hence they can be explained only as the products of the social environment. The idea of dealing with mental activity in their relation to social and historical conditions is probably Lewis's most important contribution to psychology. Among other points which he emphasizes is the complexity of mental phenomena. Every mental state is regarded as compounded of three factors in different proportions—namely, a process of sensible affection, of logical grouping, and of motor impulse. But Lewis's work in psychology consists less in any definite discoveries than in the inculcation of a sound and just method. His biological training prepared him to view mind as a complex unity, in which the various functions interact one on the other, and of which the highest processes are identical with and evolved out of the lower. Thus the operations of thought, or "the logic of signs," are merely a more complicated form of the elementary operations of sensation and instinct, or "the logic of feeling." The whole of the last volume of the *Problems* may be said to be an illustration of this position. It is a valuable repository of psychological facts, many of them drawn from the more obscure regions of mental life and from abnormal experience, and is throughout suggestive and stimulating. To suggest, and to stimulate the mind, rather than to supply it with any complete system of knowledge, may be said to be Lewis's service in philosophy. The exceptional rapidity and variety of his intelligence seems to account at once for the freshness in his way of envisaging the subject-matter of philosophy and psychology, and for the want of satisfactory elaboration and of systematic co-ordination. (J S)

LEWIS AND HARRIS form together an island of the Outer Hebrides, nearly separated into two parts by the inlets of Loch Rosort and Seaforth,—the northern part, Lewis or the Lewa, being in Ross-shire, and the southern part, Harris, in Inverness. The island is situated about 30 miles from the mainland, between 57° 40' and 58° 39' N. lat., and 6° and 7° W. long. Its length is 60 miles, the average breadth 15, and the extreme breadth 30. The area is 770 square miles, of which 575 are comprised in Lewis. The greater part of the surface is composed of gneiss rocks, which in Ben More attain a height of 1750 feet, but there is also a large breadth of peat and swamp, with remains of an ancient forest. The coast is much indented by bays. The climate is very moist and unsuitable for tillage. Agriculture is in a backward condi-

tion, but much has been done in draining, reclamation, and planting of trees by the late proprietor of Lewis, Sir James Matheson. Barley and potatoes are the principal crops, and a large number of black cattle are reared. Kelp making is also carried on, but one of the chief supports of the inhabitants is fishing, Stornoway being the largest station for the herring fishery in Scotland, and employing over 1000 boats with nearly 4000 men and boys. The town was made a burgh of barony by James VI. It has a commodious harbour with a patent ship suitable for vessels of 1000 tons. On a height overlooking the bay is the beautiful residence of the proprietor of the island. The most remarkable archaeological remains in Lewis are the druidical stones of the temple of Callernish. There are also a large number of old obelisks, and at Meallista in Uig the remains of an old monastery. Six miles from Stornoway there is a huge cave covered with stalactites. See HERRIES.

LEWIS, SIR GEORGE CORNEWALL, BART. (1806-1863), statesman and man of letters, was born in London on 21st April 1806. His father, Thomas F. Lewis of Harpton Court, Radnorshire, after holding subordinate offices in various administrations became a poor-law commissioner. He was made a baronet in 1846. Lewis was educated at Eton, and at Christ Church, Oxford, where in 1828 he took a first-class in classics and a second-class in mathematics. He then entered the Middle Temple, and was called to the bar in 1831. In the year before he had, with John Romilly and John Stuart Mill, attended the celebrated lectures on jurisprudence delivered by John Austin at London University. In 1832 he undertook his first public work as one of the commissioners to inquire into the condition of the poor Irish residents in the United Kingdom.¹ Again, in 1834, Lord Althorp included him in the commission to inquire into the state of church property and church affairs generally in Ireland. To this fact we owe his work on *Local Disturbances in Ireland, and the Irish Church Question* (London, 1836), in which he condemned the existing connexion between church and state, proposed a state provision for the Catholic clergy, and maintained the necessity of an efficient workhouse organization. During this period of apprenticeship to politics Lewis's mind was much occupied with the phenomena of language. Before leaving college he had published some observations on Whately's doctrine of the predicables, and soon afterwards he assisted Thirlwall and Hare in starting the *Philological Museum*. Its successor, the *Classical Museum*, he also supported by occasional contributions. In 1835 he published an *Essay on the Origin and Formation of the Romance Languages* (re-edited in 1862), which, though anticipated by Schlegel, may be taken as the first effective criticism in England of Raynaud's theory of a uniform romance tongue, represented by the poetry of the troubadours. He also set an excellent example to county gentlemen by compiling a glossary of provincial words used in Herefordshire and the adjoining counties. But the most important work of this earlier period was one to which his logical and philological tastes both contributed. The *Remarks on the Use and Abuse of some Political Terms* (London, 1832) may have been suggested by Bentham's *Book of Parliamentary Fallacies*, but it shows all that power of clear sober original thinking which marks his larger and later political works. And yet this original mind did more than most scholars in the humbler walk of useful translation. He translated Boeckh's *Public Economy of Athens* and Müller's *History of Greek Literature*, and he assisted Tufnell in the trans-

¹ See the Abstract of Final Report of Commissioners of Irish Poor Enquiry, &c., by G. C. Lewis and N. Senior, 1837.

lation of Müller's *Dorians*. Some time afterwards he edited a text of the *Fables* of Dabryus. While his friend Hayward conducted the *Law Magazine*, he wrote in it frequently on such subjects as secondary punishments and the penitentiary system. In 1836, at the request of Lord Glenelg, he accompanied John Austin to Malta, where they spent nearly two years reporting on the condition of the island and framing a new code of laws. One leading object of both commissioners was to associate the Maltese in the responsible government of the dependency. On his return to England Lewis succeeded his father as one of the principal poor-law commissioners. But his literary activity did not cease. In 1841 appeared the *Essay on the Government of Dependencies*, a systematic statement and discussion of the various relations in which colonies may stand towards the mother country. In 1844 Lewis married Lady Maria Theresa Lister, sister of Lord Clarendon, and a lady of literary tastes. Much of their married life was spent in Kent House, Knightsbridge. They had no children. In 1847 Lewis resigned his office. He was then returned for the county of Hereford, and Lord John Russell appointed him secretary to the Board of Control, but a few months afterwards he became under secretary to the Home Office. In this capacity he introduced two important bills, one for the abolition of turnpike trusts and the management of highways by a mixed county board, the other for the purpose of defining and regulating the law of parochial assessment. On the latter subject his evidence before the select committee (Lords) of 1850 is the clearest statement of general results which we have. In that year he succeeded Hayter as financial secretary to the Treasury. About this time, also, appeared his *Essay on the Influence of Authority in Matters of Opinion*. Lewis seems to have thought that authority was too much divided to be of much use in theological matters, while in the world of science he found sufficient authority for declaring that homoeopathy, mesmerism, and phrenology were all impostures. On the dissolution of parliament which followed the resignation of Lord John Russell's ministry in 1852, Lewis was defeated for Herefordshire and then for Peterborough. Excluded from parliament he accepted the editorship of the *Edinburgh Review*, which the death of Empson had left vacant. Lord Halifax offered him, in 1853, the governorship of Bombay, but he remained editor until 1855. During this period he did some public work on the Oxford commission, and on the commission to inquire into the government of London. But its chief fruits were the *Treatise on the Methods of Observation and Reasoning in Politics*, and the *Enquiry into the Credibility of the Early Roman History*,¹ in which he vigorously attacks the theory of epic lays and other theories on which Niebuhr's reconstruction of that history had proceeded. In 1855 Lewis succeeded his father in the baronetcy. He was at once elected member for the Radnor boroughs, and Lord Palmerston made him chancellor of the exchequer. The position was difficult, for he had a war loan to contract and heavy additional taxation to impose. But his industry, method, and clear vision carried him safely through. His financial statement of 13th February 1857, and his speech on 13th February 1858 on the bill for the better government of India were most successful efforts. After the change of ministry in 1859 Sir George became home secretary under Lord Palmerston, and in 1861, much against his wish, he succeeded Sidney Herbert (Lord Herbert of Lea) at the War Office. The closing years of his life were marked by increasing intellectual vigour. In 1859 he published an able *Essay on Foreign Jurisdiction and the Extradition of Criminals*, a subject to which the attempt on Napoleon's

life, the discussions on the Conspiracy Bill, and the trial of Bernard, had drawn general attention. He advocated the extension of extradition treaties, and condemned the principal idea of *Weltrichtsordnung* which Mohl of Heidelberg had proposed. His two latest works were the *Survey of the Astronomy of the Ancients*, in which, without professing any knowledge of Oriental languages, he applies a sceptical analysis to the ambitious Egyptology of Bunsen, and the *Dialogue on the Best Form of Government*, in which, under the name of Crito, the author points out to the supporters of the various systems that there is no one abstract government which is the best possible for all times and places. An essay on the *Characteristics of Federal, National, Provincial, and Municipal Government* does not seem to have been published. Sir George died in April 1863. A marble bust by Weekes stands in Westminster Abbey. He has two other monuments—the reprint from the *Edinburgh Review* of his long series of papers on the *Administrations of Great Britain* (1864), and his *Letters to various Friends* (1870), edited by his brother, who succeeded him in the baronetcy.

Lewis was a man of mild and affectionate disposition, much beloved by a large circle of friends, among whom were Sir E. Head, the Grotes, the Austins, Lord Stanhope, J. S. Mill, Dean Milman, the Duff Gordons. In public life he was distinguished, says Lord Aberdeen, "for candour, moderation, love of truth." He had a passion for the systematic acquirement of knowledge, and a keen and sound critical faculty. Nothing is more remarkable than the practical good sense of his speculative writings. Sometimes he betrayed a slight intellectual impatience; but this was merely the passing irritation of a healthy and modest judgment.

LEWIS, MATTHEW GREGORY (1775-1818), often referred to as "Monk" Lewis, was born in London on July 9, 1775. He was educated for a diplomatic career at Westminster School and at Christ Church, Oxford, spending most of his vacations abroad in the study of modern languages; and in 1794 he proceeded to the Hague as attaché to the British embassy. His stay there lasted only a few months, but was marked by the composition, in ten weeks, of *Ambrosio, or the Monk*, which was published in the summer of the following year. It immediately achieved extensive celebrity; but some passages it contained were of such a nature that about a year after its appearance an injunction to restrain its sale was moved for and a rule nisi obtained. Lewis published a second edition from which he had expunged, as he thought, all the objectionable passages, but the work still remains of such a character as almost to justify the severe language in which the author of *English Bards and Scotch Reviewers* addresses—

"Wonder-working Lewis, Monk or Bard,
Who fann would't make Parnassus a churchyard,
Ere Satan's self with thee might dread to dwell,
And in thy skull discern a deeper hell."

Whatever its demerits, ethical or æsthetic, may have been, *The Monk* did not interfere with the reception of Lewis into the best English society; he was favourably noticed at court, and almost as soon as he came of age he obtained a seat in the House of Commons as member for Hindon, Wilts. After some years, however, during which he never ventured to address the House, he finally withdrew from a parliamentary career. His tastes lay wholly in the direction of literature, and *The Castle Spectre* (1796, a musical drama of no great literary merit, but which enjoyed a long popularity on the stage), *The Minister* (a translation from Schiller's *Kabale u. Liebe*), *Rolla* (1797, a translation from Kotzebue), with numerous other operatic and tragic pieces, appeared in rapid succession. *The Bravo of Venice*, a romance translated from the German, was

¹Translated into German by Liebrecht, Hanover, 1858.

published in 1804, and has since been reprinted; next to *The Monk* it is the work connected with the name of Lewis which has been most extensively read. By the death of his father he succeeded to a large fortune, and in 1816 embarked for the West Indies to visit his estates; in the course of this tour, which lasted four months, the *Journal of a West Indian Proprietor*, published posthumously in 1833, was written. A second visit to Jamaica was undertaken in 1817, in order that he might become further acquainted with, and able to ameliorate, the condition of the slave population, but the fatigues to which he exposed himself in the tropical climate brought on a fever which terminated fatally on the homeward voyage, May 14, 1818. *The Life and Correspondence of M. G. Lewis*, in two volumes, was published anonymously in 1839; compiled by friendly hands, it makes it sufficiently plain that, whatever may have been the errors of judgment and taste displayed in the writings of his precocious youth, he was nevertheless a man of more than ordinary discretion, good feeling, and generosity.

LEWIS, MERIWETHER (1774–1809), American explorer, was born near Charlottesville, Virginia, August 18, 1774. In 1794 he volunteered with the troops called out to suppress the "whisky insurrection," was commissioned as ensign in the regular army in 1796, and as captain in 1800, and was President Jefferson's private secretary from 1801 to 1803. On Jefferson's recommendation he was appointed by Congress to conduct, in connexion with Captain William Clarke, an expedition to the headwaters of the Missouri river, and thence across the mountains to the Pacific Ocean—the first extended exploration of the north-western portion of the United States. The States had as yet acquired no claim to this region, and the exploration was designed by Jefferson in the interests not only of geographical science but of territorial acquisition. Lewis and Clarke, setting out late in 1803 with twenty-eight men, spent the winter at the mouth of the Missouri. Early in the spring the party embarked in several boats, and during the summer made the difficult ascent of the Missouri as far as 47° 21' N. lat., where the second winter was passed among the Mandan Indians. In 1805 the ascent of the Missouri was continued as far as the tributary which they named Jefferson river, which was followed to its source in the south-western part of what is now Montana territory. Procuring a guide and horses from the Shoshone Indians, they pushed westward through the mountains, and on October 7 embarked in canoes on a tributary of the Columbia river, the mouth of which they reached on November 15. They had travelled upwards of 4000 miles from their starting point, had encountered various Indian tribes never before seen by whites, had made scientific collections and observations, and were the first explorers to reach the Pacific by crossing the continent north of Mexico. After spending the winter upon the Columbia, they made the return journey across the mountains and down the Missouri, reaching the Mississippi in September 1806. The reports of the Lewis and Clarke expedition attracted great attention at the time, and it has scarcely been exceeded in romantic interest by later explorations in any quarter of the globe. The leaders and men of the exploring party were rewarded with liberal grants of land, and Lewis was made governor of the territory of Missouri. In the unwonted quiet of his new duties his mind, always subject to melancholy, became unbalanced, and, while on his way to Washington, he committed suicide near Nashville, Tennessee, October 11, 1809.

Jefferson wrote a memoir of Lewis, published in 1814 in connexion with Biddle and Allen's *Narrative of the Lewis and Clarke Expedition*. A new edition by M'Vicker was published at New York in 1848.

LEWISTON, a city of the United States, in Androscoggin county, Maine, is situated 38 miles north of Portland, on the left bank of the Androscoggin, and is connected by several bridges with Auburn, a city of 9566 inhabitants, and the capital of the county. As the river at this point breaks over a ledge of mica schist and gneiss, and the natural fall of 40 feet has been raised to 50 feet by a strong granite dam, Lewiston commands an abundant supply of water-power. Cotton and woollen goods (slirtings, sheetings, cassimeres, beavers, tweeds, cloakings, twines, boots and shoes, machinery, &c., are produced to the annual value of \$11,000,000—there being nine considerable manufacturing corporations in the city besides the Franklin Company, which owns the entire water-power. The city hall (1872) is a very fine building, and a public library (over 6000 volumes in 1880) was founded by the corporation in 1861. Bates College, founded by the Free Baptists in 1863–64, and named in honour of Benjamin F. Bates of Boston, possessed in 1880 11 professors, 161 students, and a library of 6537 volumes.

Lewiston dates from 1770. In 1786 it was incorporated as a town, and in 1821 as a city. The population was 3684 in 1850, 7424 in 1860, 18,600 in 1870, and 19,088 in 1880.

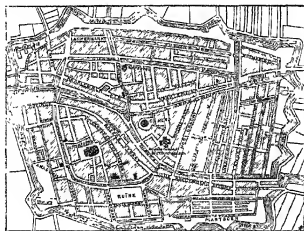
LEXINGTON, capital of Fayette county, Kentucky, is situated near the centre of the State, in the midst of a table-land 1100 feet above the sea, known as the Blue Grass region. It stands on a small tributary of the Kentucky river, 79 miles south of Cincinnati, and 94 miles east by south of Louisville. The population (3584 in 1850, 7424 in 1860, and 13,600 in 1874) in 1880 was 16,656, including about 8000 negroes. Lexington is an important railway junction, has an extensive trade, and manufactures whisky, flour, bagging, ropes, carriages, and machinery. Two railroads, completed in 1859, give access to the mountainous eastern region of the State, from which iron, coal, and timber are obtained in abundance. The surrounding district is characterized at once by beauty and fertility, and the town has been laid out in a spacious and attractive style. It is the seat of the State university (chartered in 1855, originally opened at Harrodsburg in 1859, and removed to Lexington and incorporated with the Transylvania university in 1865), the State agricultural college, and one of the State lunatic asylums (625 patients). Besides the university library, there is a public library of 15,000 volumes.

Lexington was founded by Colonel Robert Patterson in 1775, and received its name in honour of the first contest in the war of American independence, fought in April of that year at Lexington, Middlesex county, Massachusetts.

Lexington in Kentucky must not be confounded with (1) Lexington, the capital of Lafayette county, Missouri, with a population in 1880 of 3996; or (2) Lexington, capital of Rockbridge county, Virginia, a place of 2771 inhabitants, and the seat of the Washington and Lee university (founded in 1749; professors in 1880, 6; students, 800; library, 15,000 volumes), and of the Virginia military institute, founded in 1839, under the patronage of the State, with 12 professors and 800 students.

LEYDEN, or LEMDEN, a city of the Netherlands, in the province of South Holland, about 20 miles south-west of Amsterdam, and 6 miles inland from the German Ocean. The Old Rhine, on which it is situated, enters at the eastern side by two arms which unite near the middle of the town so as to divide the western half into two nearly equal portions. Though the boundaries, which now include about 467 acres, have been six times extended, the general shape is wonderfully regular, nor is regularity wanting in the interior arrangement of the quiet respectable town with its canals and moats, its broad streets, and lifeless squares. The pensive and even melancholy impression which it seems sometimes to produce on the stranger is easily explained. Leyden is *par excellence* an academic city; the bustle of its great markets for cattle and dairy produce is

confined to certain spots, and lasts only for so many hours on so many days, and its industrial activity, considerable though it be, is not sufficient to give that appearance of life and movement which their flourishing local and transit trade makes so generally characteristic of the towns of Holland. The woollen goods (cozzlets and broadcloths), the cotton stuffs, the worsted and yarns, the non and copper wares, and the books and lithographic work which it still produces, are far from maintaining for it the position which it enjoyed when, at the close of the 15th century, its weaving establishments (mainly broadcloth) numbered from three to four hundred, or when, after the expulsion of the Spaniards, Leyden cloth, Leyden balze, and Leyden camlet became familiar terms at home and abroad. Owing to changes of fashion, unwise preservation of old customs and institutions, party spirit, the development of manufactures in other places, these industries had so far declined in the beginning of the 19th century—the total production of all the factories in 1802, for example, did not exceed 1086 pieces of cloth—that the balze manufacture was altogether given up, and the beautiful Say (Worsted) Hall was closed. Although after the revolution of 1813 comparative prosperity was the result of the removal of the French yoke, and more especially of the



Plan of Leyden

introduction of steam, the times of a Maurice or a Frederick Henry have never returned, and still less the wonderful days of the 15th century. The university is still a flourishing institution, with fifty professors, but other universities have grown up in the Netherlands, and even professors of European reputation can no longer attract from foreign lands the numbers that visited Leyden in the days of Lipsius, Vossius, Heinsius, Gronovius, Hemsterhuis, Ruhnken, Valckenae, Sealiger, and Boerhaave. As a class the students are remarkably quiet and orderly. Many are destined to a diplomatic career. The university (*Akademie*) was opened in February 1575, and originally located in the convent of St Barbara. In 1581 it was transferred to the convent of the White Nuns, the site of which it still occupies, though the building was destroyed in 1618. Of the institutions connected with the university it is sufficient to mention the library (upwards of 160,000 volumes and 4650 MSS, and 2400 pamphlet portfolios), rich in Oriental and Greek manuscripts and old Dutch travels, the botanic gardens, with splendid collections of East Indian plants; the observatory (1860), the museum of natural history, one of the principal establishments of its kind in Europe, the museum of antiquities, with a specially valuable Egyptian department; the ethnographical museum, of which the nucleus was Von Siebold's Japanese collections, and the national insti-

tution for East Indian languages, ethnography, and geography. The Thysian library and the library of the Society of Dutch literature (1769) are both large collections, the former especially rich in legal works and native chronicles, the great school of navigation, and the Remonstrant seminary, transferred from Amsterdam in 1873, deserve special mention, and in general it may be said that there is no city in the Netherlands better supplied than Leyden is with educational and intellectual institutions.

Objects of artistic and antiquarian interest are fewer than might be expected from the position which Leyden holds in the history of painting (Rembrandt, Jan Steen, and Gerard Douw were natives of the town), but such as they are—pieces by Van Finck, F. van Mieris, Cornelis Engelbichtszoon, Lucas de Leyden, and other masters—they have for the most part been collected in the newly founded municipal museum located in the old cloth hall. More interesting is the great collection of portraits of famous professors in the aula of the university. All the gate-houses of the city were still standing about the close of the 17th century, two only, the Zylpoort and the Morselpoort have been spared. The old town-hall is a quaint 16th century building, and St Pancratius church has some striking features. Near the site of the Rijnburg gate is the statue of Boerhaave by Stracké. The "Burg," on an artificial mound (perhaps of Roman origin) in the centre of the town, is an old circular wall resting on twenty arches, it forms a favourite promenade, and affords a fine point of view. Towards the south side of the town lies an open space, suggestively called the Ruin, which in 1807 was the scene of a terrible disaster, a powder-ship blowing up and destroying eight hundred houses and killing hundreds of men. In 1623 the population of Leyden was much more than 50,000, and in 1640, it is estimated, reached 100,000. Between 1706 and 1811 it sunk to 30,000. In 1850 it was 35,864, in 1870, 38,943 (9632 Roman Catholics, 396 Jews), and in 1882 about 41,000.

Though *Lugdunum Batavorum* is used by the learned as the Latin name for Leyden, there is no possibility of identifying the town itself with the *Lugdunum* of the Romans. It first appears in 11th and 12th century documents as *Leithon*, *Leithon*, and *Leithan*. The history of Leyden follows the same general lines as the history of the Netherlands. During the period of the counts the city suffered from the quarrels of one count with another (as when Countess Ada was besieged in the castle by Lewis of Loon in 1203), or of the nobles with the citizens, between 1419 and 1456 it was besieged and captured no less than six times by the "Rooks" or the "Cods." From Philip V. it received the confirmation of its privileges (1266) and of its freedom from toll throughout Holland (1290). During the struggle with Spain Leyden covered itself with glory by the resistance with which it held out against the double siege from 31st October 1573 to 21st March 1574, and from 22nd May to 21st October (see *Motley, Rise of the Dutch Republic*, vol. n). With the internal troubles of the 17th century it was closely connected. Coolhaas, one of the first professors of its university, gave rise about 1578 to a question of hierarchy which formed in some sort the prelude to the great contest in which his successors Arminius and Gomarus were protagonists. In 1597 Levensteyn vainly attempted to bring the city over to his side, in 1618 Maurice was so violently disturbed in connexion with the elevation of William III. to the stadtholdership. The revolution, excited by the French, took place in 1798; and in 1818 the Rhénish peasants, in revolt against the conscription, marched into the city. In 1836 there was a great inundation caused by the Esclavier Lake. The bicentenary of the university was celebrated with great ceremony in 1874.

See Miers, *Beschreibung der Stadt Leyden*, 1772-84.

LEYDEN, JOHN (1775-1811), was born on the 8th of September 1775, at Denholm on the Tiviot, not far from Hawick. Like most Scottish villages, Denholm is commonplace and uninteresting, but Leyden's upbringing was in a wilder part of the country, at the foot of Ruberslaw, whither his father had gone as shepherd to a relation of

the family. Though he did not attend school till he was nine years old, long before that he had learnt at home to read, and had devoured all the books he could lay his hands on in the border farm houses and cottages. Naturally his parents thought that a boy so fond of letters was meant for something else than shepherding; and, as the only scholarly office clearly within their horizon was that of a parish minister, they concluded that his gifts pointed in that direction, and with much stinting of their own little comforts sent him to Edinburgh university in 1790. There the uncouth lad, dressed in rough homespun, with a voice that smacked strongly of the Jed and the Teviot, played his part manfully enough in the class-work, but still better in the "societies" where Brougham, Jeffrey, Sydney Smith, Horner, and other clever young fellows were then chopping logic and cracking jokes. Leyden was a diligent but somewhat miscellaneous student, reading everything apparently, except theology, for which he seems to have had no taste. Accordingly, though he completed his divinity course, and took licence from the presbytery of St Andrews, and preached occasionally, it soon became clear that the pulpit was not his vocation, and that the border shepherds were not to find a second Thomas Boston in John Leyden.

In 1794 Leyden had formed the acquaintance of Dr Robert Anderson, editor of *The British Poets*, and of *The Literary Magazine*, a cultivated but not otherwise remarkable individual, who, however, filled a rather important niche in the Edinburgh of that time. Contributions to his magazine were probably what brought them first together, but more important results followed from their intimacy than either the verses on "Rubenslaw," or "The Descent of Odin," translated from the Norse. For it was Anderson who introduced him to Dr Alexander Murray, and Murray, probably, who led him to the study of Eastern languages, to which that great scholar was so passionately devoted. Soon they became warm friends and generous rivals, though Leyden excelled, perhaps, in the rapid acquisition of new tongues, and acquaintance with their literature, while Murray was the more scientific philologist. Through Anderson also he came to know Richard Heber, by whom he was brought under the notice of Walter Scott, when he was collecting materials for his *Minstrelsy of the Scottish Border*. Leyden was admirably fitted for helping in this kind of work. A borderer himself, an enthusiastic lover of old ballads and folk-lore, he spared no pains to enrich the work that promised to bring fame to his beloved hills and glens. Scott tells us how, on one occasion, Leyden walked 40 miles to get the last two verses of a ballad, and returned at midnight, singing it all the way with his loud, harsh voice, to the wonder and consternation of the poet and his household. Neither Scott nor Leyden, however, studied this folk-lore for proper scientific purposes. They cared only for the picturesque and the poetic in it, and were not very successful in their efforts to restore it to life. Of course, the rough old ballads themselves were a welcome addition to our literature, but Leyden's attempt to make Lord Soulis interesting in a modern ballad was something of a failure, and, though he might have made a Scotch Lorelei out of the mermaid of Corrievekan, his poem wants the delicate touch of the German, and he does not know where to stop. Scott, however, got valuable assistance from him in his task, and learned to esteem highly the blunt integrity of the man, his literary enthusiasm, and his large attainments.

Leyden was evidently drifting away from the church into the life of a scholar, but as yet he had not found his line there, was indeed only wasting himself on miscellaneous learning. He had compiled a work of four hundred pages on the *Discoveries and Settlements of Europeans in Northern*

and Western Africa, suggested by Mungo Park's travels. He had edited for Constable *The Complaint of Scotland*, giving a glossary, and a long preliminary dissertation. He had printed various poems, and nearly finished his *Scenes of Infancy*, a poem in four books, based, no doubt, on border scenes and traditions, but meandering "as its own sweet will" over all the world, and a good way beyond it. There are, here and there, some effective enough lines in this poem, but, in the main, it is of the thin, artificial, big-sounding order, and has no unity of design, so that there is no particular reason why it should not go on for ever. He had also made some translations from Eastern poetry, Persian and Arabic, but they have not somehow the aroma of the East. Clearly, here was a man of great and varied powers which, however, were like to run to waste unless he found a definite field to work in. So, at last, friends got him an appointment in India, at first on the medical staff, for which he qualified by a year of intense hard work; but it was hoped something more fitting would turn up by and by. In 1803, therefore, he sailed for Madras, and took his place in the general hospital there. From that he was soon promoted to be naturalist to the commissioners going to survey Mysore. Ere long, however, his knowledge of the languages and dialects of India procured him an appointment as professor of Hindustani, which he soon after resigned for a judgeship, and that again to be a commissioner in the court of requests, which required a familiarity with several Eastern tongues. Friends who had come from the same border country—Lord Minto, Sir John Malcolm, and others—had done what they could to make his path smooth for him, and his linguistic attainments had been recognized by Colebrooke, the greatest Oriental scholar of the day. But in 1811, having joined Lord Minto in the expedition to Java, on landing there he made his way into a library which was said to contain many Eastern MSS., without having the place aired, and was seized with shivering and sickness, first symptoms of the Batavian fever. The climate of India had never agreed with him, and his constitution had already been shaken by several serious illnesses. He was ill fitted, therefore, to endure the assault of this deadly complaint, and after three days of struggle he died on the 28th of August, in the thirty-sixth year of his age. Cut off thus prematurely, he has left comparatively little fruit of all the bright promise of his youth. As a poet he cannot take high rank, but in his knowledge of Eastern languages he would probably have been no mean rival of Henry Colebrooke, had he been spared a little longer to methodize and perfect his attainments. A genuine and generous nature, with a fine enthusiasm for learning, there were few of Britain's sons in India from whom friends at home looked for better work, and few therefore who were more deeply regretted (w c s *)

LEYDEN, LUCAS VAN. See LUGAS.

LHASA, often written LASSA, for many centuries the chief city of Tibet. Though the place is of great celebrity, the accounts of it are scanty, and information has to be sifted from authorities differing considerably in age. Till recently the latitude even of Lhasa has been stated with variations extending over 1½ degrees, whilst the longitude has naturally been still more uncertain. The Jesuit Grueber, who was at Lhasa in 1661-62, made the latitude 29° 6'. In the maps of Tibet sent from China by the Jesuits, and engraved on five separate sheets in Du Halde, it is about 29° 40'. D'Anville, in his *Carte Générale du Tibet*, chiefly based on these last, but modified to suit other data, reverted nearly to Grueber's figure; Giorgi in his *Alphabetum Tibetanicum* states it at about 30° 30'. Klaproth, stretching every datum to cracking point, to suit his fantasies about the course of the great river of Tibet, made it 30° 45' lat (and 91° 50' long.); our last and

highest authority, Pandit Nain Singh, gives (from a mean of twenty observations) $29^{\circ} 39' 17''$, a result which closely confirms the Jesuit record. The longitudes according to the protraction of the same explorer's route is $90^{\circ} 57' 13''$.¹ The height above the sea, by repeated observation of the boiling point, is stated at 11,700 feet (but the report of Nain Singh, on his second visit, gives 11,910). The city stands near the middle of a tolerably level plain, which is surrounded on all sides by hills, and extends about 13 miles from east to west and about 7 miles from north to south. It lies half a mile to the north of a considerable river called the Kichu Tsanpu, or Tsang-chu, flowing here from east-north-east (called by the Mongols, according to Klaproth, *Galyao-Murea*, or "Turbulent River"), and joining the great Tsanpu (or upper course of the Brahmaputra) some 35 miles to the south-west.

The hills round the city are absolutely barren, and without growth of any kind except an occasional bush of so-called "Tartar furze." There are, however, gardens scattered over the plain round the city, and these are planted with trees of some size (it would seem cedar, willow, and cypress). Four defiles in the encompassing hills, by which the approaches to the city pass, are defended by as many forts. We may quote the description of Huc, which, though a little vague, is vivid, and is the only passage affording anything like a picture of this city, so difficult of access:—

"The sun was about to set as we completed our descent of the innumerable zigzags of the mountain path. Issuing into a wide valley, we beheld on our right Lhasa, the famous metropolis of the Buddhist world. The multitudes of aged trees which encircle the city as with a garle of foliage, the lofty white houses, terminating in flat roofs surrounded by terraces, the numerous temples with their gilt canopies, the Buddhists' *Prasads*, crowned by the palace of the Dalai Lama,—all unite to give Lhasa a majestic and imposing appearance."

The meaning of the name *Lha-Sa* is "God's ground." Formerly it used to be known to the Mongols as *Baron-tala*, the "right side" or western region; now, according to Huc they call it *Monke Dhot* or *Dekot*, "Eternal Sanctuary."² In eastern Turkistan it seems to be best known as *Jo*, a name which properly refers to the great central temple of which we shall speak.

The city is nearly circular in form, and according to Nain Singh less than a mile in diameter. It was walled in the latter part of the 17th century, but the walls were destroyed during the Chinese occupation in 1722. The population has been estimated at 40,000 to 80,000; the last estimate perhaps including the great population of monks and students in the convents near the city.³

The chief streets of the city are wide and straight, and in dry weather tolerably clean, but the inferior quarters are unspeakably filthy, and are rife with evil smells and large mangy dogs.⁴ Part (much the greater part, according to Nain Singh) of the houses are of clay and sun-dried brick, but those of the richer people of stone and brick. All, however, are frequently white-washed, the doors and windows being framed in bands of red and yellow. In the suburbs there are houses entirely built of the horns of sheep and oxen set in clay mortar. This construction, according to Huc, is very solid and highly picturesque.

The houses generally are large, and of three stories at least. The owner of the house, with his family, occupies the upper story, whilst the two lower floors swarm with tenants. Externally the lower part of Tibetan houses generally presents lofty dead walls pierced by a few air-holes only, above these run tiers of windows with projecting balconies, and over all flat broad-eaved roofs at varying levels. According to Desideri, in the better houses there are often spacious and well-finished apartments, the principal halls, the verandas, and terraces being often paved with a composition of coloured fragments of stone set in a cement of resin, &c., which with much beating and rubbing becomes like a surface of polished porphyry. In every house there is a kind of chapel or shrine, carved and gilt, on which are set images and sacred books, and before them lamps and incense, with the usual offerings of barley, fruits, &c.

Lhasa is not only the nucleus of a cluster of vast monastic establishments, which attract students and aspirants to the (so-called) religious life from all parts of Tibet and Mongolia, and the seat of a quasi papacy, but is also a great place of pilgrimage, so that the streets and public spaces swarm with visitors from every part of the Himalayan plateau, and from all the steppes of Asia between Manchuria and the Balkash Lake, who come to adore the living Buddha, to seek the purgation of their sins and the promise of a happy transmigration, and to carry away with them holy relics, blessed rosaries, and all the miscellaneous trumpery which is set forth to catch the money of idle people in Asia and Europe, whether they are pilgrims or frequenters of mineral waters.⁵ whilst as usual a great traffic arises quite apart from the pilgrimage. The city thus swarms with crowds attracted by devotion and the love of gain, and presents an astonishing diversity of language, costume, and physiognomy; though, in regard to the last point, varieties of the broad face and narrow eye greatly predominate. Much of the retail trade of the place is in the hands of the women. Huc's account of the curious practice of the Lhasa women in plastering their faces with a dark-coloured unguent is well known, but it does not rest on his authority alone.

During the month of December especially traders arrive from western China by way of Tatsienlu (Tachindö of the Tibetans), bringing every variety of silk-stuffs, carpets, china-ware, and tea, from Siningfu (commonly in Tibet and Turkistan called *Sining*, Ziling, or Ziling, a circumstance that has caused sundry misapprehensions) come silk, gold lace, Russian goods, carpets of a superior kind, precious stones, horse furniture, horses, and a very large breed of fat-tailed sheep, from eastern Tibet much in large quantities, which eventually finds its way to Europe through Nepal; from Bhutan and Sikim, rice, from the latter also tobacco; besides a variety of Indian and European goods from Nepal and Darjiling, and *charas* (resinous exudation of hemp) and saffron from Ladak and Kashmir. The merchants, who arrive in December, leave Lhasa in March, before the setting in of the rains renders the rivers impassable.

The tea importation from China is a large matter, on which an interesting paper has been written by Mr. E. Baber. The tea is of the coarsest quality, derived from straggling and uncared-for trees, allowed to grow to a height of 10 feet or more, and the coarsest produce of these. This is pressed into bricks or cakes, and carried by porters. The quantity that pays duty at Tatsienlu is about 10,000,000 lb., besides some amount smuggled. No doubt a large part of this comes to Lhasa. Tea is an

¹ This is corrected to the latest value of Madras longitude, viz., $80^{\circ} 14' 51''$.

² The first word of this phrase is certainly the Mongol *munke*, "eternal." The second is probably a clerical error for *dekot*, which may represent the *Jo* of the next sentence, which is literally (Tib.) "master, lord," and is applied to very sacred images.

³ Nain Singh says that a census in 1854 gave "9000 women and 6000 men, exclusive of the military and the priests." But these words are subject to too many doubts for precise interpretation.

⁴ The Chinese have a proverb as to the three products of Lhasa being dogs, drabs, and lamps.

⁵ Among articles sold in the Lhasa bazaar are numerous fossil bones, called by the people "lightning bones," and believed to have healing virtues.

absolute necessity to the Tibetan, he is miserable without it.

The chief industries of Lhasa are the weaving of a great variety of stuffs from the fine Tibetan wool, the making of earthenware (said to be of very good quality), and of the wooden pottages (varying immensely in elaboration and price) of which every Tibetan carries one about with him; also the making of certain fragrant sticks of pastille much valued in China and elsewhere.

It is curious that Tibet, though using coined money, seems never, strictly speaking, to have had a coinage of its own. Till nearly the end of last century the coinage had for a long time been derived from Nepal. That valley prior to the Gorkha domination (1768) was under three native dynasties (at Blatgaon, Patan, and Khatmandu), and these struck silver mohurs, as they were called, of the nominal value of half a rupee. The coins were at first not struck specially for Tibetan use, but were so afterwards. These latter bore (obverse) a Nepalese emblem surrounded by eight fleurons containing the eight sacred Buddhist jewels, and (reverse) an eight petaled flower surrounded by eight fleurons containing the names of the eight jewels in Tibetan characters. Ingots of Chinese silver were sent from Lhasa with a small proportion of gold dust, and an equal weight in mohurs was returned, leaving to the Nepal rajahs, between gold-dust and alloy, a good profit. The quality of these coins (weighing about 81 grains Troy) was low, and at last deteriorated so much that the Tibetans deserted the Nepal mints. The Gorkhas, after becoming masters of Nepal, were anxious to renew the profitable traffic in coin, and in this view sent a deputation to Lhasa, with a quantity of coin to be put in circulation. But the Gorkhas were mistrusted, and their coin refused. A coinage was then issued (it would appear once only) in Tibet for domestic use, modelled on an old Khatmandu pattern, and struck by Nepalese artists (see fig. 1). The Gorkhas, however,

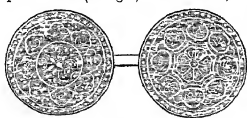


FIG. 1.—Coin struck in Tibet, from specimen in India Library, inscribed "27th year (of cycle=1772 A.D.) from the princely residence of Gulistan."

in 1788 and following years continued to strike coins of progressively debased quality, which were rude imitations of the old Nepalese mintage (see fig. 2), and to endeavour to force this currency on the Tibetans, eventually making the departure of the latter from old usage a pretext for war and invasion. This brought the intervention of the

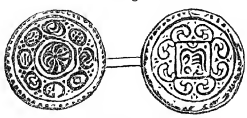


FIG. 2.—Gorkha debased coinage, rubbing from coin in British Museum.

Chinese, who drove the Gorkhas out of Tibet (1792), and then began to strike silver coins for Lhasa use, bearing Chinese and Tibetan characters (see fig. 3). For practical use these Tibet-Chinese coins (of which $2\frac{1}{2}$ = 1

rupee, and which are known as *ashang*, i.e., *wuyshyang*, "cash"), are cut into oblong parts by the guidance of the figures on them. Large lumps of Chinese silver, stamped

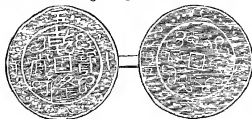


FIG. 3.—Tibeto-Chinese coinage ("Kashang, 58th year," i.e., 1793 A.D.) From specimen in India Library.

with the imperial seal, are also used. But of late years there has been an enormous influx of Anglo-Indian rupees, so that these have become practically the currency of the country, even to the frontier of China, and are now counted, instead of being valued as bullion. They are called *Peking shrank*, or *chanka* (probably Hind *taika*), "English (Peking?) coins." Those that bear a crowned head of the queen are called *Lama* heads, the crown being taken for a wandering lama's head-gear. This great influx of rupees indicates a very considerable amount of trade with India. And, in spite of the extraordinary difficulties of the road eastward from Lhasa, quantities of trifling European articles find their way even to Tatsienlu on the Chinese frontier. Mr. Dabci found quarter-rupees very popular as buttons, British army buttons very common, corkscrews offered for sale (though no one knew their use), and tin-plates very common, stamped with the heads of Napoleon III, Mr. Gladstone, and other celebrities.

The permanent population embraces, besides Tibetans of the country, settled families of Chinese and Kashmiris in considerable numbers, as well as people from Bhutan and Nepal, from Ladak and even from Patna. The Kashmiris and many of the other foreigners are Mohammedans, and much of the trade is in their hands. Besides, a century and a half ago, speaks also of Armenians and even "Muscovites." The Chinese have a crowded burial-ground at Lhasa, tended carefully after their manner. The Kashmiris, who are called *Khach'hé*, are an important body, and have their mosque, and a provost, at once civil and religious, who is recognized by the Government. With their turbans, then fine Caucasian features, and their beards, they strikingly contrast with the mass of other nationalities. The Nepalese (called at Lhasa, according to Huc, *Pe-tan*) supply all the mechanics and metal-workers. There are among them excellent gold and silversmiths; and they make the elaborate gilded canopies crowning the temples, which form so notable a feature of Lhasa. Huc describes a stilted custom among the native population. Every evening, as light begins to fail, they leave off business, and form groups in the streets, all sit down and begin to chant prayer in a low voice. "The combination of religious music arising from these numerous companies produces an aggregate of vast and solemn harmony, which is exceedingly moving."

In the middle of the city is an open space or *place*, in which markets are held, this is densely thronged in the afternoon and evening. On the north side, overlooking this *place*, is a great building which is the residence of the *Gyalpo*, or so-called king of Tibet. It was built at great cost by the dissolute Lama who was set up by the crafty regent Sangge Gyampo, and put to death by the Calmuck prince Latsan or Jangzh Khan in 1708-7 (see *infra*), and, as the Lama used to divert himself there with the dances of the ladies of Lhasa, the palace is known as the

Trasi khang or "dancing house" (so Desideri; the word *tras* cannot be identified).

Immediately west of the place stands the great temple and convent of Labrang (*bla-brang*, "lama-house"), regarded as the *umbilicus* and centre of all Tibet, and from which all the main roads are considered to radiate. This is not merely the great metropolitan convent, sanctuary, and church-centre of Tibet, the St Peter's or Lateran of Lamasim, but contains the palace of the government and seat of civil administration. It is believed to have been founded by the Tibetan Constantine, Srong-dsan-gampo, in the 7th century, as the shrine of one of those two very sacred Buddha images which were associated with his conversion, and with the foundation of the civilized monarchy in Tibet. From this image, called *Jo*, or *Jā*, it is known to the Mongols as the *Jo Erdeni* ("the precious Lord") or *Jo Shalyanant* (to the Chinese as *Ta-shao-er*, "house of the great Jā"), and hence as *Ju* or *Jo* simply, a name used in eastern Turkestan (as already noticed) and probably in Mongolia, as a synonym of Lhasa. The temple appears to be known also as *Lhasa Chhod-khang*, "offering-house of Lhasa," and among Indian and Nepalese visitors as *Molendra Nāh*.¹ The Potala as a sacred centre is modern, whilst the Labrang attaches itself to the whole thread of Tibetan history and religion. On one of the walls of this temple is a picture of the famous "Master of the Law," Hwen Tsang, the travelling doctor of Buddhism (see vol. xii, p. 418), whose journeys have in the revolution of the ages become so familiar to European students, as a mine of information on the geography and history of India during a period so clouded as the 7th century. He is represented with three of his disciples. And before the gate of the Labrang stand several monuments of antiquity, especially that famous obelisk spoken of below, which bears the inscribed record of the treaty of peace concluded in 822 between Thi-de-srong-tsan, king of Tibet, and the emperor Mo-tsung of China. Before this obelisk the apostate from Lamasim, Langdharma, brother and successor of the last-named king, was standing in proud contemplation, when a fanatic recluse, who had been stirred by a vision to avenge his persecuted faith, shot him with an arrow in the forehead.

The main building of the Labrang is three stories high. The entrance, facing eastward, forms a portico supported on six great timber columns, richly carved and gilt, whilst the walls are painted with the history of Sakya. Great folding-doors, covered with reliefs in bronze and iron, lead to the ante-hall, and from this a second gate to the *cella* (so to call it) of the temple. On each side of the gate, two and two, stand colossal of the spirit-kingdoms of the four points of heaven. Within is a great basilica, divided into nave and aisles by many pillars, whilst along each wall, north and south, are chapels or sanctuaries, fourteen to a side.

At the west end steps ascend to a quadrangular choir or chancel, on each side of which also are three chapels, and at the extremity a rectangular apse (if it may be called so), and in it is the altar or graded throne, on which stands the great image of Sakya, seen through a lattice of silver gilt—the higher shelves or offices of the altar being beset with small figures in precious metals of *devas* and *saints*, and the lower ones with lamps burning josticks, platters holding offerings of butter and meal, flowers modelled from butter, &c. In the choir to the right (i.e., looking from the altar) is the elevated and stepped throne of the Grand Lama, held with splendid cushions, surrounded by the nearly equal throne of the Fifth Lama of Shigatse, and then by the seats of other ecclesiastical potentates, reborn and elected, in order; on the left of the Buddha throne, opposite the Grand Lama's, and of equal height, there is said now to be a throne for the emperor of China, then, at a lower level, that of the so-called king of Tibet, whilst the ministers of state follow opposite the inferior lamas.

In a space shut in with silver lattice, on the south side of the

chancel-steps, are seen fourteen or fifteen great disks of silver, set with precious stones, on which are embossed fundamental Buddhist symbols, such as their system of cosmogony, the circles of transmigration, the births of Sakya, &c.

The great nave or central aisle of the basilica is truly hypæthral, but on the second and third uppermost decks it is encompassed with colonnades or verandas, from which the women and the laity look down upon the lamas engaged in chanting the services or in other functions. The sanctuary or chancel itself towers above the rest of the building, and is crowned with a rectangular canopy or pavilion of gilt metal, which rises to a ridge surmounted with fantastic figures. This canopy rests on columns which are also gilt, and from its eaves and angles hang bells that tinkle with every breeze, whilst the pillars beneath the eaves are crowned with a great fringe of bas-reliefs embossed in gilt metal.

This ancient temple contains a vast accumulation from the ages of gold and silver vessels, lamps, reliquaries, and precious bric-à-brac of every kind, which is annually exposed to view in the spring festivities. The daily offices in the Labrang are attended by crowds of worshippers, and a sacred way which leads round it is constantly traversed by devotees who perform the circuit as a work of merit, always in a particular direction.

Besides the convent-cells, halls of study, and magazines of precious lumber, buildings grouped about the Labrang are occupied, as we have said, by the civil administration, e.g., as treasuries, customs office, courts of justice, &c., and there are also private apartments for the Grand Lama and other high functionaries. No woman is permitted to pass the night within the precincts.

Another great and famous temple is the *Ramo-chhé* ("large pan or fold"), at the north end of the city. This is also regarded as a foundation of Srong-dsan-gampo, and is said to contain the body of his Chinese wife, and the second of the primeval palladia, the image that she brought with her to the Snow-land; whence the Mongols and Chinese call it the temple of the little *Jā*. The lamas of this convent, as well as of that next to be mentioned, are noted for their pretensions to and practice of magical arts, one of the degrading characteristics of the lama forms of Buddhism. The orthodox "yellow" sect indeed profess to distinguish between lawful and unlawful magical formulae, and to give degrees only in the former. The lamas of *Ramo-chhé* have also the ill repute of cultivating that species of doctrine which is connected, like their magic, with Tantric mysticism, and which professes to destroy sensual passion by the contemplation of its representations. The walls of the convent are defiled with a series of sculptures of gross obscenity.²

Another convent within the city is that of *Mora*, also near the north end, remarkable for its external order and cleanliness, and, though famous like the last as a school of orthodox magic, noted also for the printing-house in the convent garden. Lastly we notice the *Garnakhia*, the inmates of which are sorcerers of the rude kind, who seem really to represent the rude medicine-men of the superstitions which preceded Buddhism in Tibet. As the vulgar will not dispense with their marvels (knife-awallowing, fire-breathing, cutting off their own heads, and the like), every great orthodox monastery in Tibet keeps one of these conjurers, who does not belong to the fraternity of the house, but lives in a particular part of it, bearing the name of *Choi-chong* (*Khos-kyong*) or "protector of religion," and is allowed to marry. These practitioners of the black art possess no literature, but hand down their mysteries from father to son. Their fantastic equipment, their frantic bearing, and their cries and howls seem to identify them with the grossest Shamanist devil-dancers,—strongly remote in externals from the gentle and cultivated persons in the higher ranks of the Lama Church, of whom we read in Turner or Hux. Other monasteries in or near the city are the *Chumlung* at the north-west corner; the *Tankyating*

¹ So in Nau's Singh's narrative. But the word is properly *Mahendradh*, which is the name of a saint adored by the Nepalese Buddhists, and identified with Padmapani, the fourth Dhyan Bodhi-vast of their system (see Hodgkin in *Journ. Roy. As. Soc.*, xviii, 394).

² It was in this convent that P. Desideri studied the religion of the lamas. "From March to July," he says, "I set myself, I will not say to read, but rather to devour the chief books of the *Kao-n-shih*, and to take in a complete knowledge of all that pertains to that false religion."

at the west of the city, the *Kontsaling*, about a mile west of the city, at the foot of a low isolated hill called Chapochi. Three miles south, beyond the river, is the *Chokchaling*. These four convents are known as "The Four Ling."

Leaving the city by the side of the Namoch'he, we see on our left the famous Potala with its many edifices crowning and seeming to grow out of a rocky hill, which rises like an island from the plain. It forms altogether a majestic mountain of building. At the south base of the rock is a large space inclosed by walls and gates, with great porticoes on the inner side. This swarms with lamas, its nooks with boggans basking in the sun. A series of tolerably easy staircases, broken by intervals of gentle ascent, leads to the summit of the rock. The whole width of this is occupied by the palace. The central part of this group of buildings rises in a vast quadrangular

mass, in four stories, to a great height, terminating in a gilt canopy similar, it would seem, to that on the Labrang. Here on the lofty terrace is the Grand Lama's hall of audience, and from this great height he looks down upon the crowds of his votaries far below, thronging the plain, and screaming to kneel before the sacred hill. The monastic buildings attached to the palace temple are said to contain cells for ten thousand monks. Other palatial buildings, towers, chapels, *chollens* (chantyas), pavilions gleaming with gold and silver, Buddhas and other idols, cluster round and crown the three peaks of Potala. The palace itself is said to be painted externally with red and white stripes. The walls and ceilings of all the chief apartments and temples are covered with rich silks. We give an engraving of it (fig 4), extracted from a Chinese view of Lhasa, published by Klaproth in the work quoted

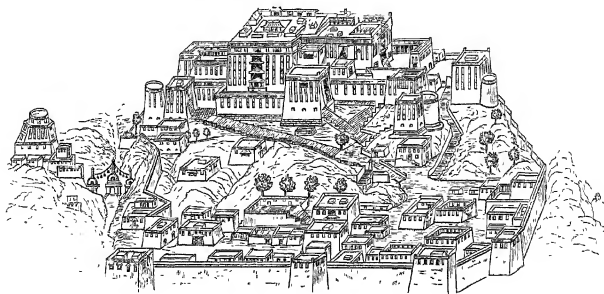


FIG 4.—Potala, the Palace-Temple of the Grand Lama

at the end. The Potala has every appearance of having been drawn from the reality. Two avenues bordered with trees of considerable size lead from the city to the foot of Potala. "You see there constantly," says Huc, "a great number of foreign pilgrims, passing between their fingers the beads of their long Buddhist rosaries, with lamas of the court splendidly attired, and mounted on richly caparisoned horses. There reigns in the neighbourhood of the Potala great and incessant movement, but for the most part everybody is grave and silent, religious thoughts appear to occupy the minds of all." It would seem that between the palace and the city runs a stream which is crossed by a bridge called "The Bridge of Glazed Tiles."

On the north side of the rock a wide and easy road descends winding. By this, which has a parapet along the edge, it is lawful to ride. Not far from the base is a garden-palace in the middle of a lake which is surrounded by trees and shrubberies. This palace, called *Lukhang*, is described by Desideri as of attractive style, and circular in form, with a *loggia* or portico running all round, and adorned with paintings. Here the dissolute Lama who built it, at the end of the 17th century, used to give himself up to dissipation with the women of Lhasa. Several other villas or gardens of the Tibetan people are mentioned; in one of them the Panch'then-Rinpoche (or Tesbu Lama) is received when he visits Lhasa, and the two living Buddhas drink tea together there. It is in the numerous gardens round the town that those large trees grow of which Huc

speaks as giving Lhasa such a green garb of foliage. There is no natural wood.

No country in the world—not even Spain or Italy in the last century—has so abounded in convents and monks as Tibet. The district of Lhasa alone is said to contain thirty great convents, besides many smaller establishments, and a notice of Lhasa would be incomplete without some mention at least of the great monastic establishments which stand within a few miles of the city, and constitute an essential element in its existence. These are not single masses of building like the great convents of Europe. The temple (*Lha-khang*) is the focus of the whole. Round this are gathered numerous houses detached from one another, though not far apart, and generally three stories in height. In each of these are various apartments, each assigned to a monk of some authority and dignity, with several younger members or novices under his immediate direction. Each house has a little garden, and a quantity of vases in which plants are grown. Library, storehouse, hostel, occupy other buildings, and a varying multitude of the peculiar Buddhist objects of adoration which we know as *dagobas* or *chaityas*, as well as of masks with sacred flags and streamers. The whole is usually enclosed in a lofty and solid wall. These establishments have undoubtedly a vast population, though we can hardly accept specific figures, in which indeed authorities do not agree. Huc says the inmates of each of the three great convents which we are about to name amounted to

15,000, Nam Singh states them at 7700, 5500, and 3300 respectively; the former numbers seem excessive, the latter artificial; but no doubt the real numbers are large. In the Labrang they show a copper kettle holding more than one hundred buckets, which was used to make tea for the lamas who took part in the daily temple service.

The three great convents in the vicinity, all claiming to be foundations of Tsongkhapa, the mediatorial reformer and organizer of the modern orthodox Lama Church, are the following—

1. *Bre-bung* (written *Brace-Pung*, "the Rice-Heap," so called from the shape of the hill on which it stands), called by Nam Singh *Lebang*, is 6 or 8 miles from Lhasa, west of the city, at the entrance to the plain from the side of Shigatse and Nepal. In the middle of the convent buildings rises a kind of pavilion, brilliant with colour and gilding, which is reserved for the Dalai Lama, when he visits Bre-bung once a year, and expounds to the inmates. The place is greatly frequented by the Mongol students who come to Lhasa to graduate, and is known in the country as the Mongol convent.

2. *Sera* ("The Golden"), is 2 or 3 miles from the city on the acclivity of the hills which border the valley on the north, and close to the road by which pilgrims enter from Mongolia. The hill is planted with holly and cypress, and from a distance the crowd of buildings and temples, rising in amphitheatres against a background of trees, forms a pleasing picture. In the recesses of the hill, high above the convent, are scattered cells of lamas adopting the solitary life. There are three great temples rising in many stories, the walls of which are entirely covered with gilding, whence the convent's name. In the chief of these temples is preserved the famous *Dorji* of Bon-lhas, the *Yogee* or *Thangka* (the latter word is properly, or Adamant, the symbol of the strong and unbreakable, which the priest grasps and manipulates in various ways during prayer. From this *dorji*, according to one etymology at least, comes the name of the Himalayan mountain *Dorjibud* or *Dorjaling*. The emblem is a bronze instrument, shaped much like a dumb-bell with pointed ends, and it is said by *Koeppen* to have been one of the later lama borrowings from *Srausma*. The original is carried solemnly in procession to Labrang during the New Year's festival. In *Sera* P. Desiderius found shelter during the capture of the city by the *Drangpa* Khan in 1717, speaking of below.

The hill adjacent to it is said to be rich in silver ore, but it is not allowed to be worked. On the summit is a spring, and a holy place of the Lhasa Mohammedans, who resort thither. Near the convent there is said to be gold, which is worked by the monks. "Should they discover a nugget of large size, it is immediately replaced in the earth under the impression that the nugget . . . germinates in time, producing the small lumps which they are privileged to search for" (Nam Singh).

3. *Golden*—This great convent is 10 or 12 miles east of Lhasa, on the other side of the *Kichu* Tsangpo river. It is the oldest monastery of the "Yellow" sect, having been founded by Tsongkhapa, and having had him for its first superior. Here his body is said to be preserved with miraculous circumstances, and here are other relics of him, such as the impression of his hands and feet in hard butter.

Samayé (*Sem-ye*) is another famous convent intimately connected with Lhasa, but it is some 85 miles south-east on the left bank of the great *Sera*. It was founded by Padma Sambhava (*U-shon* of the Tibetans), the apostle who came from Udayana in the fifth century as the great reviver of Buddhism, and was at the head of the old Red sect. It is visited by the Dalai Lama once a year. It is surrounded by a very high circular stone wall, 14 miles in circumference, with gates facing the four points of the compass. On this wall Nam Singh, who was here on his last journey (1874), counted 1030 *chavags* of brook. One very large temple (*Lha-khang*) occupies the centre, and round it are four smaller but still very large temples. Many of the walls are of pure gold, and the wealth is very great. The interior of the temples are covered with beautiful writing in enormous Nagari characters, which the vulgar believe to be the writing of Sakya himself.

Lhasa Festivities.—The greatest of these is at the new year. This lasts fifteen days, and is a kind of lama carnival, in which masks and mummings, wherein the Tibetans take especial delight, play a great part. The celebration commences at midnight, with shouts and clangour of bells, gongs, chank-shells, drums, and all the noisy repertory of Tibetan music; whilst friends exchange early visits and administer coarse sweetmeats and buttered tea. On the 2d day the Dalai Lama gives a grand banquet, at which the Chinese and native authorities are present, whilst in the public spaces, and in front of the great convents, all sorts of shows and jugglers' performances go on. Next day a regular Tibetan exhibition takes place. A long cable, twisted of leather thongs, is stretched from

a high point in the battlements of Potala slanting down to the plain, where it is strongly moored. Two men slide from top to bottom of this huge hypothesis, sometimes lying on the chest (which is protected by a breast-plate of strong leather), spreading their arms as if to swim, and descending with the rapidity of an arrow-flight. Occasionally fatal accidents occur in this performance, which is called "the dance of the gods", but the survivors are rewarded by the court, and the Grand Lama himself is always a witness of it. This practice occurs more or less over the Himalayan plateau, and is known in the neighbourhood of the Ganges as *Barat*. It is employed as a kind of expiatory rite in cases of pestilence and the like. And exactly the same performance is described as having been exhibited in St Paul's Churchyard before King Edward VI., and again before Philip of Spain, as well as, about 1750, at Hertford and other places in England (see Strutt's *Sports*, &c., 2d ed., p. 198).

The most remarkable celebration of the new year's festivities is the great jubilee of the *Monlam* (*Mon-lam*, "prayer"), instituted by Tsongkhapa himself in 1409. Lamas from all parts of Tibet, but chiefly from the great convents in the neighbourhood, flock to Lhasa, and every road leading thither is thronged with troops of monks on foot or horseback, on yaks or donkeys, and carrying with them their breviaries and their cooking-pots. They descend like swarms of bees upon the city, and those who cannot find lodging bivouac in the streets and squares, or pitch their little black tents in the plain. The festival lasts six days, during which there reigns a kind of saturnalia, and the town is abandoned to these crowds of monks. Unspeakable confusion and disorder reign, whilst gangs of lamas parade the streets, shouting, singing, and coming to blows. The object of this great disorderly gathering is, however, supposed to be devotional. Vast processions take place, with mystic offerings and lama-music, to the Labrang and Moru convents; the Grand Lama himself assists at the festival, and from an elevated throne beside the Labrang receives the offerings of the multitude, and bestows his benediction.

On the 15th of the first month multitudes of torches are kept ablaze, which lighten up the city to a great distance, whilst the interior of the Labrang is illuminated throughout the night by innumerable lanterns shedding light on coloured figures in bas-relief, framed in arabesques of animals, birds, and flowers, and representing the history of Buddha, and other subjects, all modelled in butter. The figures are executed on a large scale, and, as described by Huc, who witnessed the festival at Kunbum on the frontier of China, with extraordinary truth and skill. These singular works of art occupy some months in preparation, and on the morrow are thrown away. On other days horse-races take place from Sera to Potala, and foot-races from Potala to the city. On the 27th of the month the holy *Dorji* is carried in solemn procession from Sera to the Labrang, and to the presence of the Lama at Potala.

Of other great annual feasts, one, in the fourth month, is assigned to the conception of Sakya, but appears to connect itself with the old nature-feast of the entering of spring, and to be more or less identical with the *Halt* of India. A second, the consecration of the waters, in September-October, appears, on the confines of India, to be associated with the *Dussehra*.

On the 30th day of the second month there comes off a strange ceremony, akin to that of the scapegoat (which is not unknown in India). It is called the driving out of the demon. A man is hired to perform the part of demon (or victim rather), a part which sometimes ends fatally. He is fantastically dressed, his face mottled with white and black, and is then brought forth from the Labrang to en-

gave in quasi-theological controversy with one who represents the Grand Lama. This ends in their throwing dice against each other (as it were for the weal or woe of Lhasa). If the demon were to win the omen would be appalling, so this is effectually barred by false dice. The victim is then marched outside the city, followed by the troops, and by the whole populace, hooting, shouting, and firing volleys after him. Once he is driven off, the people return, and he is earned off to the Samayé convent. Should he die shortly after, this is auspicious; if not, he is kept in ward at Samayé for a twelvemonth.

Nain Singh, whose habitual accuracy is attested by many facts, mentions a strange practice of comparatively recent origin, according to which the civil power in the city is put up to auction for the first twenty-three days of the New Year. The purchaser, who must be a member of the Breathing monastery, and is termed the *Tajno*, is a kind of lord of misrule, who exercises arbitrary authority during that time for his own benefit, levying taxes and capricious fines upon the citizens.

Climate, &c.—Fundat Nain Singh, who lived at Lhasa continuously from 26th January to 21st April (1866), made indoor observations of the thermometer from 9th to 23d February hourly, with the exception of eight hours of sleep (11 p.m. to 7 a.m.), and the extreme variation in the record is from 26° (February 2d, 11 a.m.) to 46°·75 (February 22d, 2 p.m.). He also mentions that the river (Kichu Tsangpo) which flows by Lhasa was frozen in December,—the great river (Brahmaputra) being open and passed by boats. Water kept in the warmest part of a house froze, and burst the vessels holding it. It is not easy to draw very precise conclusions from these facts, but they perhaps indicate a somewhat less severe winter than that of Ladak, where the true air temperature is reckoned by Captain H. Strachey to range between zero and 30° Fahr. In other respects the Pundit's account of the climate does not differ materially from those we possess of western Tibet. He says, besides, that strong and high winds are very prevalent, especially during March and April, but snow fell only twice in the three months of his stay, and not deeper than 3 inches. The fall on the surrounding hills was somewhat heavier, but apparently it did not lie, for in general hardly any snow was to be seen from the city. Should the snowfall in Lhasa ever exceed a foot, it is regarded as an evil omen. What little Desideri says is to like effect. The cold, he says, was never hurtful to health, and he had often spent the night (in winter apparently) under the open sky, without suffering. Lightning, which occurs only in connexion with the summer rains, is never known to strike houses or to kill.

It begins to be warm in May, and the sun's power rapidly grows most oppressive. There is a distinct rainy season at Shigatse (July to September), and this appears to extend to Lhasa, though the information is not very precise. Nain Singh was told that earthquakes are unknown in the Lhasa province. Cholera is said to be unknown; but dysentery is often violent, and rapidly fatal. Cough and chest diseases are not prevalent, nor are skin diseases common, in spite of the filthy habits of the people. The most dreaded of all diseases is smallpox. Inoculation is habitually used. Ophthalmia is very prevalent and severe.

History.—The seat of the princes whose family raised Tibet to a position among the powers of Asia was originally on the Yarlung river, in the extreme east of the region now occupied by Tibetan tribes. It was transplanted to Lhasa in the 7th century by the king Srong-tsan-gampo, conqueror, civiliser, and proselytizer, the founder of Buddhism in Tibet, the introducer of the Indian alphabet. On the three-peaked crag now occupied by the palace-monastery of the Great Lama this king is said to have established his fortress, whilst he founded in the plain below temples to receive the sacred images, brought respectively from Nepal and from China, by the brides to whom his own conversion is attributed.

Tibet endured as a conquering power some two centuries, and the more famous among the descendants of the founder added to the city. This *rong-do-tsen* (who reigned 740-786) is said to have erected a great temple-palace of which the basement followed the Tibetan style, the middle story the Chinese, and the upper story the Indian—a combination which would equally symbolize the elements that here moulded the culture of Lhasa, such as it is. His son, the last of the great orthodox kings, in the next century, is said to have summoned artists from Nepal and India, and among many splendid foundations to have erected a sanctuary (at Samayé) of vast height, which had nine stories, the base lower of stone, the three middle of brick, the three uppermost of timber. With this king the glory of Tibet and of ancient Lhasa reached its zenith, and in 822 an obelisk recording his treaty on equal terms with the Great Tang emperor of China was erected in the city. There followed dark days for Lhasa and the Buddhist Church in the accession of this king's brother Langdharma, who has been called the Julian of the Lamas. This king rejected the doctrine, persecuted and scattered its ministers, and threw down its temples, convents, and images. It was more than a century before Buddhism recovered its hold, and its convents were rehabilitated over Tibet. The country was then split into an infinity of petty states, many of them ruled from the convents by like ecclesiastics, but, though the old monarchy never recovered, Lhasa seems to have maintained some supremacy, and probably never lost its claim to be the chief city of that congeries of principalities, with a common faith and a common language, which was called Tibet.

The Arab geographers of the 10th century speak of Tibet, but it is without real knowledge, and none speak of any city that we can identify with Lhasa. The first passage in any Western author in which such identification can be probably traced occurs in the narrative of Frai Odorico of Portofino (c. 1680). This remarkable traveller's route from Europe to India, and thence by sea to China, can be traced satisfactorily, but his journey homeward through Asia the indications are very fragmentary. He speaks, however, on his return journey of the realm of Tibet, which lay on the confines of India proper—"The folk of that country dwell in tents made of black felt. But the chief and royal city is all built with walls of black and white, and all its streets are very well paved. In this city no one shall dare to shed the blood of any, whether man or beast, for the reverence they bear a certain idol in this town is worshipped. In that city dwelleth the *Alansi*, &c., in their tongue the pope, who is the head of all the nobles, and who has the disposal of all their benches such as they are after their own will." (p. 100.)

We know that Kubla Khan had constituted a young prince of the Lama Church, *Mati Dhwaj*, as head of that body, and tributary ruler of Tibet, but besides this all is obscure for a century. This passage of Odorico shows that such authority continued under Kubla's descendants, and that some foreboding of the pestilence smote occupied by the Dalai Lama already existed. But it was not till a century after Odorico that the strange history of the dynasty of the Dalai Lamas of Lhasa actually began. And in the first two centuries of its existence the residence of those pontiffs was rather at Brebrog or Sen than at Lhasa itself, though the latter was the centre of devout resort. A great event for Lhasa was the conversion, or reconversion, of the Mongols to Lamaism (c. 1277), which made the city the focus of sanctity and pilgrimage to so vast a tract of Asia. It was in the middle of the 17th century that Lhasa became the residence of the Dalai Lama. A native prince, known as the Tsampo, with his seat at Shigatse, had made himself master of southern Tibet, and threatened to absorb the whole. The fifth Dalai Lama, *Nyang Lobsang*, called in the aid of a Geluk monk, *Gusha Khan*, from the neighbourhood of the Koko-nur, who defeated and slew the Tsampo and made over full dominion in Tibet to the Lama (1643). The latter now first established his court, and built his palace, on the rock-aisle of the fortress of the ancient monarchy, which apparently had fallen into ruin, and to this he gave the name of *Potala*.

In the time of this Dalai Lama, Lhasa was visited for the first time by European travellers. In 1624 Antonio d'Andrade, a Portuguese Jesuit, had penetrated to Tibet through the Ganges Himalaya, and returned the following year with a companion. But the place which he reached was *Chapungwa* in the kingdom of *Cogyne*, as he calls it, &c., Chapang in the province of Gugu on the Tibetan Setiof, and he never got nearer Lhasa. In June 1681 the Jesuit

¹ This name is absurdly explained by Abbé Huc as *Buddha-la*—"hill of Buddha." This is not even a possible etymology, for, whilst the actual term *Buddha* seems never to be used untranslated in Tibet, one may discern from Huc's own book that it means, not "a hill," but "a pass" over mountains. The name seems to be really taken from the classical traditions of the Buddhists, *Potala*, "the harbour" (the *Patala* of the Greeks, the modern Hyderabad on the Indus), was in legend the royal seat, for more than a hundred generations, of the Sakya progenitors of Gautama Buddha (see *Candac de Korbs in Journ. As. Soc. Bengal*, n. 599).

fathers, Albert D'Orville and John Grueber, stated from Peking, and by the way of Shingfu and the Koko-nur, reached Lhasa, where they stayed a month, and then went on through Nepal to India. The extracts from Grueber's narrative, given by Athanasius Kircher in his *China Illustrata* (Amst., 1667), are accompanied by a drawing of Potala which, though meagre, appears to be genuine, and is the only European representation in existence of that Tibetan fortress.

The founder of Potala died in 1682, and his death was followed by events which brought on a time of trouble. He had appointed as "regent" or civil administrator (*Tseri*, or *Debs*), one supposed to be his own natural son. This remarkable personage, Sangye Gyantsi, of great ambition and accomplishment, still remained in Tibet as the author of some of the most valued works of the native literature, concealed the death of his master, asserting that the latter had retired, in mystic meditation or trance, to the upper chambers of the palace. The government continued to be carried on in the name of the regent, who leagueed with Galdan Khan of Dzungaria against the Chinese (Manchu) power. It was not till the great emperor Kang-hi was marching on Tibet that the death of the Lama, sixteen years before, was admitted. A solemn funeral was then performed, at which 108,000 lamas assisted, and a new incarnation was set up in the person of a youth of fifteen. This young man was the second of the Lamasé Church in every line of civil living and debauchery. But it was under him and the regent Sangye Gyantsi that the Potala palace attained its present scale of grandeur, and that most of the other great buildings of Lhasa were extended and embellished. In 1705-6 a Calmuck prince, Lefsan Khan, great grandson of Bussai Khan, taking the renowned name of Jeppu Khan, made Lhasa master of Tibet, and put to death both the civil regent and the disolute Lama whom he had set up. The Dzungians crossed the northern desert in 1717, and stormed Lhasa, but were in vain driven out by the army of Kang-hi in 1720, and from that time the Chinese power, though, as elsewhere, it has been at times sorely shaken, has never quite lost its hold of Tibet.

It was in the midst of these troubled times (1708) that a Capuchin mission entered Lhasa. It was unfortunately in the death of its successive heads, and from about 1713 it was abandoned for several years, but after an interval the Capuchins reappeared, twelve in number, reaching Lhasa in 1720. On the 10th of April 1721, they heard of them all the head of the mission, P. Orazio della Porta, appeared at Rome in 1725 to report that nine were dead, and to ask reinforcement. He returned with nine more, carrying presents to the Grand Lama, and the so-called "king of Tibet." In 1742 he reported his safe arrival, and that the presents he had recently called to Nepal, made him master of the branch of the mission, he died there in 1747. We possess some of the results collected by this mission in an excellent short treatise on Tibet by P. Orazio himself, as well as in the extraordinary jodge-podge of crude philology, rubbish, and valuable facts (like fossils imbedded in a bank of mud), the *Alphabetum Tibetanicum* of the Augustinian monk At. Giorgi (Rome, 1723). The mission seems to have been expelled from Tibet in 1754, and found refuge for a time in Nepal. Some fifty volumes, the relics of the mission library, were in 1847 recovered from Lhasa by Mr. Bryan Hodgson, through the courtesy of the Grand Lama himself, and were transmitted as an offering to Pope Pius IX., then in the first bloom of reputation.

In 1716, moreover, two Jesuits, P. Ignazio Desideri di Pastore, and P. Freyre, a Portuguese, reached Lhasa by way of Kashmir, Ladakh, and the enormous journey from Ladakh by the holy lakes and the valley of the Tsangpo. Desideri remained at Lhasa till April 1721, witnessing the capture of Lhasa successfully by Dzungar and Chinese. Of the moderation of the latter, and their abstinence from all outrage or plunder, he speaks highly. His departure was due to controversies between the Jesuits and Capuchins at Rome, which caused an order to be issued for his retirement from Tibet. An interesting letter from him, dated 1719, 1716, is printed in the *Lettres Édiifiées*, Roc. xv, but a large MS. volume of his observations during his residence in Tibet is still unpublished. The next European visitor was Samuel Van de Putte of Friesland, an LL.D. of Leyden, whose thirst for travel carried him through India to Lhasa, where he is said to have remained a long time, to have acquired the language, and to have become intimate with some of the lamas. After travelling from Lhasa to Peking with a lama mission he returned, again by Lhasa, to India, and was an eye-witness of the sack of Delhi by Nadir Shah in 1737. Unhappily he ordered his papers to be burnt after his death, and the knowledge that such a traveller must have accumulated died with him. We pass on to 1811-12 when the first (and last) English visit to Lhasa occurred. The traveller was Thomas Manning, a Cambridge man of Caius College, who had been long devoted to Chinese studies, the "friend M." of Charles Lamb, from whom Eliza Follen professes to have got that translation of a Chinese MS. which furnished the immortal dissertation on roast pig. After residing some years at Canton, Manning went to Nankai, bent on reaching the interior of China through Tibet, since from the seaboard it was sealed. He actually did reach Lhasa, stayed there about five months, and had several interviews with the Dalai Lama, but was compelled to return to India. He never

published anything regarding his journey, and the very fact of its occurrence was known to few, when his narrative was printed, through the penmanship of Mr. C. Mackham, in 1876. The man had given the reins to his own eccentricities till he seemed to have lost all power of seriousness, and the account, though containing some passages of great interest, is most disappointing.

The next travellers to reach Lhasa were Eife and Gabet, French Lazarist priests, who travelled from China the route followed by Grueber and by Van de Putte, viz. Siningfu, and reached Lhasa 29th January 1846. On the 16th of March they were sent off under escort by the rugged road to Su-fu-dun. Huc's book, *Souvenirs du Tibet*, &c., is probably still well known, and deserves to be so, for it is one of the most delightful among books of travel. Huc was indeed, not only without a sense, perhaps without accurate knowledge of any kind, but also without that geographical sense which sometimes enables a traveller to bring back valuable contributions to geographical knowledge though unable to make instrumental observations. He was, however, amazingly clever as a narrator and sketched of character, and, in this his first work, his ambition to slake had not gained the upper hand as it did fatally in later works. It was Ke-shen, a well-known Chinese statesman, disgraced for making peace with the English at Canton in 1841, and who was then on a nominal detention to Lhasa, who ostensibly came to them. The Tibetan regent, with his enlightened and kindly spirit, is painted by Huc in most attractive colours, and Mr. Markham expresses strongly the opinion that the native authorities were most willing to receive strangers, whilst the jealousy that excluded them was Chinese only. Recent experience of attempts to enter Tibet contradicts this view. The lamas, whose rule seems to have become more and more grasping and oppressive, appear to be sensible that their system would cease to find peace, and are violently opposed to the passage of Europeans across the Tibetan frontier.

Our latest narrative of a visit to Lhasa is that of the late Pandit Nair Singh, trained as an explorer in the Indian survey department. He reached the city in the course of two most remarkable journeys. In the first, after an ineffectual attempt by Nepal, he travelled by the Manasarovar Lake, and the road thence eastward, parallel to the course of the Tsangpo, reaching Lhasa 10th January 1866, and leaving it 21st April 1867. On the 10th of April 1867, he started from Ladakh, crossing the vast and elevated plateau by the Tengri-nur and other great lakes, and again reaching Lhasa 18th November. Between these two journeys Lhasa had also been visited by another native explorer in 1873. Nair Singh, by his extraordinary surveys, and by repeated observations of latitude on his first visit, has, for us, the position of Lhasa. But he also has given an account of his journey, and of his residence there, which, though brief, is full of intelligence and interest, and appears to be thoroughly trustworthy. This enterprising and deserving man was, on the completion of his journey in 1875, rewarded by the Indian Government with a pension and grant of land, and afterwards received the gold medal of the Roy. Geog. Soc. and the Companionship of the Star of India. He died early in 1882.

See Koeppen, *Die Lamasische Literatur und Kirche* (Berlin, 1869), being the 2d vol. of *Die Religion des Buddha*, Giorgi, *Alphabetum Tibetanicum*, Rome, 1723; Huc, *Souvenirs d'un Voyage*, &c., Paris, 1846, vol. ii., *Des. du Tibet* (Wei-tsang-thou-chi), edited by Klaproth, Paris, 1831; Pandit Nair Singh (Colonel Montgomerie's Report) in *Journ. Roy. Geog. Soc.*, vol. xxviii, 122 ff. 1878; Bogie and Manning, by C. Markham, C.B. (2d ed. 1879); MS. narrative of P. Ignazio Desideri (copy in possession of Hakluyt Soc.). Also articles, by Dr. A. Campbell in *Journ. Asiatic Soc. Bengal*, vol. xxiv, p. 216; by the late Wilfrid Heesley, B.C.S., in *Cala Review*, vol. iix, p. 1; by Col. H. Yule, in *Blackwood's Mag.*, March 1862, and in the *Times*, May 16, 1876; paper on "Chinese Tea Trade with Tibet," by E. C. Baker, printed in *Asiatic Researches of India*, November 8, 1879; "The Silver Coinage of Tibet," by J. H. van der Couperie, in *Nieuw. Chron.*, 8d ser., vol. i. (H. Y.)

L'HÔPITAL, or L'HOSPITAL, MICHEL DE (c.1505-1573), chancellor of France from 1560 to 1568, was born near Aignepierre in Auvergne (now Puy-de-Dôme) about the year 1505. His father, who was physician and controller of accounts to the constable Charles de Bourbon, sent him to study at Toulouse, whence at the age of eighteen he was driven by the evil fortunes of the family patron, after suffering arrest and imprisonment, to Padua, in which university he studied law and letters for about six years. On the completion of his studies he joined his father at Bologna, and afterwards, the constable having died, went to Rome in the suite of Charles V. For some time he held the position of auditor of the rota at Rome, but in 1534, encouraged by the fair promises of Cardinal de

² See Walker's Report for 1873-74.

Grammont, he returned to France. The death of his patron soon afterwards seriously impaired his prospects; but after he had entered himself of the Parisian bar, his marriage, in 1537, to a daughter of the lieutenant-criminal procured for him the post of counsellor to the parliament of Paris. This office he held until 1547, when he was sent by Henry II. on a mission to Bologna, where the council of Trent was at that time sitting; after sixteen months of wearisome inactivity there, he was by his own desire recalled at the close of 1548. L'Hôpital now for some time held the position of "chancellor" in the household of the princess Margaret, duchess of Berry, and in 1554 he was made superintendent of the royal finances. In 1559 he accompanied his mistress, now duchess of Savoy, to Nice, where, on the following year, tidings reached him that he had been chosen to succeed Olivier in the chancellorship of France. One of his first acts after entering on the duties of his office (in July 1560) was to cause the parliament of Paris to register the edict of Romorantin, of which he is sometimes, but erroneously it would seem, said to have been the author. Designed as it was to protect so-called heretics from the secret and summary methods of the Inquisition, it certainly had his sympathy and approval. In accordance with the consistent policy of inclusion and toleration by which the whole of his official life was characterized, he induced the council to call the Assembly of Notables, which met at Fontainebleau in August 1560 and agreed that the States General should be summoned, all proceedings against heretics being meanwhile suppressed, pending the reformation of the church by a general or national council. The States General met in December; the edict of Orleans (July 1561) followed, and finally, after the colloquy of Poissy, that of January 1563, the most liberal (except that of Nantes) ever obtained by the Protestants of France. Its terms, however, were not carried out, and during the war which was the inevitable result of the massacre of Vassy in May, L'Hôpital, whose dismissal had been for some time urged by the papal legate Hippolytus of Este, found it necessary to retire to his estate at Vignay near Etampes, whence he did not return until after the pacification of Amboise (March 19, 1563). It was by his advice that Charles IX. was declared of age (August 17, 1563) at Rouen, a measure which really increased the power of Catherine de' Medici; and it was under his influence also that the parliament of Paris in 1564 refused to sanction the publication of the acts of the council of Trent, on account of their inconsistency with the Gallican liberties. In 1564-66 he accompanied the young king on an extended tour through France; and in 1566 he was instrumental in the promulgation of an important edict for reform of abuses in the administration of justice. The renewal of the religious war in September 1567, however, was at once a symptom and a cause of diminished influence to L'Hôpital, and in February 1568 he obtained his letters of discharge, which were registered by the parliament on May 11, his titles, honours, and emoluments being reserved to him during the remainder of his life. Henceforward he lived a life of unbroken literary seclusion at Vignay, his only subsequent public appearance being by means of a "mémoire" which he addressed to the king in 1570 under the title *Le but de la guerre et de la paix, ou Discours du chancelier L'Hôpital pour exhorter Charles IX. à donner la paix à ses subjects*. Though not exempt from considerable danger, he passed in safety through the troubles of the St Bartholomew, but did not long survive them. His death took place either at Vignay or at Bélesbat (Courdimanche, Etampes) on March 13, 1573.

After his death, Pithus, assisted by De Thou and Scévole de Sainte-Marthe, collected a volume of the *Œuvres* of L'Hôpital, and in 1586 his grandson published *Epistolæ seu Sermones*

libræ æsæ. The complete *Œuvres* of L'Hôpital were published for the first time by Dufoy (6 vols 8vo, Paris, 1824-25). They include his "Harangues" and "Remonstrances," the *Épîtres*, the *Mémoires* to Charles IX., a *Traité de la Réformation de la Justice*, and the will of L'Hôpital. Haag (*France Prot.*, vii. p. 83) gives the titles of several MSS. still unpublished. Villamain wrote a *Vie de L'Hôpital*, which has recently been reprinted (1874), and there are monographs also by Tallander (1861) and by Dupré-Lasol (1875).

LIAU-YANG, or LIAOU-YANG, a city of China, formerly the chief town of the province of Liau-tung or Shing-king (southern Manchuria), and still a place of considerable mark, 35 miles south of Moukden. It is situated in a rich cotton district, and carries on no small trade. The walls include an area about $2\frac{1}{2}$ miles long by 2 miles broad, and there are pretty extensive suburbs; but a good deal even of the enclosed area is under cultivation. The population is estimated at 80,000.

LIBANIUS, a Sophist, was the most distinguished Greek writer of the 4th century A.D. He was born at Antioch between 314 and 316. He studied at Athens, and spent most of his earlier manhood in Constantinople and Nicomedia. His private classes at Constantinople were much more popular than those of the public professors; and their jealousy found means of having him expelled from Constantinople in 346 on the charge of studying magic. He was recalled from Nicomedia after five years. Ill health obliged him to retire to Antioch, where he spent the later part of his life. Though a pagan by religion, he enjoyed the favour of the Christian emperors. When Julian restored paganism as the state religion, Libanius showed no intolerance. Among his pupils he numbered St John Chrysostom and St Basil. His works, consisting chiefly of orations, declamations on set topics, and letters, are very voluminous, and have not yet been published in one single edition. He devoted much time to the study of the classical Greek writers, on whom his style is modelled with considerable success.

The best edition of the orations and declamations is Reuske's, of the letters Wolf's. See Westermann, *Gesch. d. Griech. Bedenktheit*; Bernhardt's and other histories of Greek literature; Förster, *Zur Schriftstellerei des Libanius*, and articles in *Hermes*, vols. ix. and x.

LIBAU (*Leepaja* of the Letts), a port of Russia, on the Baltic Sea, in the government of Courland and district of Grobin, 143 miles by rail south-west of Riga. It is situated at the northern extremity of a narrow sandy peninsula which separates Lake Libau (12 miles long and 2 miles wide) from the Baltic Sea. The town is well built of stone, with good gardens, and has a gymnasium and more than twenty different schools, cigar manufactories, machine works, and a small wharf. The sea throwing up a good deal of amber, many inhabitants are engaged in the fabrication of small articles of that substance. The harbour of Libau was 2 miles south of the town until a canal was dug through the peninsula in 1897, but this canal is liable to be silted up, and the depth at the bar is only 9 feet, or even 6 feet during south-west winds, so that larger ships must lie in the open roadstead. Libau being the most southern Baltic port in Russia has the advantage of freezing only for a few weeks during the winter. Since being brought, in 1872, into railway connexion with Moscow, Orel, and Kharkoff, it has become an important Russian port, and competes with the northern ports of Prussia, the exports already exceeding by 100,000 tons those from Königsberg. In 1879 the port of Libau was visited by 1976 ships, and the export of corn, flax, hempseed, and linseed has reached 28,212,600 roubles (about £2,822,000), against 1,980,000 roubles and 367 ships in 1872. The merchants carry on an active trade in grain and flax, making their purchases directly in southern Russia; their warehouses are numerous, spacious, and well built. The

yearly fair has some importance for the neighbouring districts. The town is also a watering-place, yearly visited by several hundreds of persons. Population in 1881, 27,500, with military and railway servants, 30,000.

The port of Lahn, *Lepa portus*, is mentioned as early as 1263, it then belonged to the Lovenian order. In 1418 it was burnt by Lithuanians, and in 1560 it was mortgaged by the grandmaster of the order to the Prussian duke Albert. It was annexed to Russia in 1795.

LIBEL AND SLANDER are the terms employed in English law to denote injurious attacks upon a man's reputation or character by words written or spoken, or by equivalent signs. In most early systems of law we find verbal injuries treated as a criminal or quasi-criminal offence, the essence of the injury lying not in pecuniary loss, which may be compensated by damages, but in the personal insult which must be atoned for,—a vindictive penalty coming in the place of personal revenge. By the law of the XII. Tables, the composition of scurrilous songs and gross noisy public affronts were punished by death. Minor offences of the same class seem to have found their place under the general conception of *iniuria*, which included ultimately every form of direct personal aggression which involved contumely or insult. In the later Roman jurisprudence, which has, on this point, exercised considerable influence over modern systems of law, we find verbal injuries dealt with in the edict under two heads. The first comprehended defamatory and injurious statements which were made in a public manner (*convictum contra bonos mores*). In this case the essence of the offence lay in the unwarrantable public proclamation, in the contumely which was offered to a man before his fellow-citizens. In such a case the truth of the statements was justification for the unnecessarily public and insulting manner in which they had been made. The second head included defamatory statements which were made in private, and in this case the offence lay in the imputation itself, not in the manner of its publication. The truth was therefore a sufficient defence, for no man had a right to demand legal protection for a false reputation. Even belief in the truth was enough, because it took away the intention which was essential to the notion of *iniuria*. The law thus aimed at giving sufficient scope for the discussion of a man's character, while at the same time it protected him from needless insult and pain. The remedy for verbal injuries was long confined to a civil action for a money penalty, which was estimated according to the gravity of the case, and which, although vindictive in its character, doubtless included practically the element of compensation. But a new remedy was introduced which the extension of the criminal law under which many kinds of defamation were punished with great severity. We find at the same time increased importance attached to the publication of defamatory books and writings, the *libri* or *libelli famosi*, from which we derive our modern use of the word libel; and under the later emperors the latter term came to be specially applied to anonymous accusations or paeuils, the dissemination of which was regarded as peculiarly dangerous, and visited with very severe punishment, whether the matter contained in them were true or false.

The earlier history of the English law of defamation is somewhat obscure. Civil actions for damages seem to have been tolerably frequent so far back as the reign of Edward I. There was no distinction drawn between words written and spoken. When no pecuniary penalty was involved such cases fell within the old jurisdiction of the ecclesiastical courts, which was only finally abolished during the present reign. It seems, to say the least, uncertain whether any generally applicable criminal process was in use. The crime of *scandalum magnatum*, spreading false reports about the magnates of the realm, was established by statutes,

but the first fully reported case in which libel is affirmed generally to be punishable at common law is one tried in the Star Chamber in the reign of James I. In that case no English authorities are cited except a previous case of the same nature before the same tribunal; the law and terminology appear to be taken directly from Roman sources, with the insertion that libels tended to a breach of the peace; and it seems probable that that not very scrupulous tribunal had simply found it convenient to adopt the very stringent Roman provisions regarding the *libelli famosi* without paying any regard to the Roman limitations. From that time we find both the criminal and civil remedies in full operation, and will now consider how the law stands with regard to each at the present time.

Civil Law—The first important distinction we encounter is that between slander and libel, between the oral and written promulgation of defamatory statements. In the former case the remedy is limited. The law will not take notice of every kind of abusive or defamatory language. It must be shown either that the plaintiff has suffered actual damage as a direct consequence of the slander, or that the imputation is of such a nature that we are entitled to infer damage as a necessary consequence. The special damage on which an action is founded for slanderous words must be of the nature of pecuniary loss. Loss of reputation or of position in society, or even illness, however clearly it may be traced to the slander, is insufficient. When we cannot prove special damage, the action for slander is only allowed upon certain strictly defined grounds. These are the imputation of a crime or misdemeanour which is punishable corporally, e.g., by imprisonment, the imputation of a contagious or infectious disease, statements which tend to the dishonour of an appellant heir (other cases of slander of title when the party is in possession requiring the allegation of special damage); and lastly, slanders directed against a man's professional or business character, which tend directly to prejudice him in his trade, profession, or means of livelihood. In the latter case the words must either be directly aimed at a man in his business or official character, or they must be such as necessarily to imply unfitness for his particular office or occupation. Thus words which merely reflect generally upon the moral character of a tradesman or professional man are not actionable, but they are actionable if directed against his dealings in the course of his trade or profession. But, in the case of a merchant or trader, an allegation which affects his credit generally is enough, and in the same way it has been held that statements are actionable which affect the ability or moral character of persons who hold office, or exercise occupation which requires a high degree of ability, or infer peculiar confidence. In every case the plaintiff must have been at the time of the slander in the actual exercise of the occupation or enjoyment of the office with reference to which the slander is supposed to have affected him.

The action for libel is not restricted in the same way as that for slander. Originally, as we have seen, there appears to have been no essential distinction between them, but the establishment of libel as a criminal offence had probably considerable influence, and it soon became settled that written defamatory statements, or pictures and other signs which bore a defamatory meaning, implied greater malice and deliberation, and were generally fraught with greater injury than those which were merely made by word of mouth. The result has been that the action for libel is not limited to special grounds, or by the necessity of proving special damage. It may be founded on any statement which disparages a man's private or professional character, or which tends to hold him up to hatred, contempt, or ridicule. In one of the leading cases, for example, the

plaintiff obtained damages because it was said of him that he was a hypocrite, and had used the cloak of religion for unworthy purposes. In another case a charge of ingratitude was held sufficient. In civil cases the libel must be published by being brought by the defendant under the notice of a third party, and it has even been held that it is sufficient if this has been done by gross carelessness, without deliberate intention to publish. Every person is liable to an action who is concerned in the publication of a libel, whether he be the author, printer, or publisher, and the extent and manner of the publication, although not affecting the ground of the action, is a material element in estimating the damages.

It is not necessary that the defamatory character of the words or writing complained of should be apparent on their face. They may be couched in the form of an insinuation, or may derive their sting from a reference to circumstances understood by the persons to whom they are addressed. In such a case the plaintiff must make the injurious sense clear by an averment called an *innuendo*, and it is for the jury to say whether the words bore the meaning thus ascribed to them.

In all civil actions for slander and libel the falsity of the injurious statements is an essential element, so that the defendant is always entitled to justify his statements by their truth; but when the statements are in themselves defamatory, their falsity is presumed, and the burden of proving their truth is laid upon the defendant. There are however, a large class of false defamatory statements, commonly called privileged, which are not actionable on account of the particular circumstances in which they are made. The general theory of law with regard to these cases is this. It is assumed that in every case of defamation intention is a necessary element, but in the ordinary case, when a statement is false and defamatory, the law presumes that it has been made or published with an evil intent, and will not allow this presumption to be rebutted by evidence or submitted as matter of fact to a jury. But there are certain circumstances in which the natural presumption is quite the other way. There are certain natural and proper occasions on which statements may be made which are in themselves defamatory, and which may be false, but which naturally suggest that the statements may have been made from a perfectly proper motive and with entire belief in their truth. In the cases of this kind which are recognized by law, the presumption is reversed. It lies with the plaintiff to show that the defendant was actuated by what is called *express malice*, by an intention to do harm, and in this case the question is not one of legal inference for the court, but a matter of fact to be decided by the jury. Although, however, the theory of the law seems to rest entirely upon natural presumption of intention, it is pretty clear that in determining the limits of privilege the courts have been almost wholly guided by considerations of public or general expediency.

In some cases the privilege is absolute, so that we cannot have an action for defamation even although we prove express malice. Thus no action of this kind can be maintained for statements made in the course of judicial proceedings if they are in any sense relevant to the matter in hand. In the same way no statements or publications are actionable which are made in the ordinary course of parliamentary proceedings. Papers published under the authority of parliament are protected by a special Act, 3 & 4 Vict. c. 9, which was passed after a decree of the law courts adverse to the privilege claimed. The reports of judicial and parliamentary proceedings stand in a somewhat different position, which has only been attained after a long and interesting conflict. The general rule now is that all reports of parliamentary or judicial proceedings

are privileged in so far as they are honest and impartial. Even *ex parte* proceedings, in so far as they take place in public, now fall within the same rule. But if the report is garbled, or if part of it only is published, the party who is injured in consequence is entitled to maintain an action, and to have the question of malice submitted to a jury. Comments on subjects of public interest, on the proceedings of courts or public bodies, on publications, exhibitions, and on persons who have in any way chosen to invite the public attention, fall within a similar rule. The public interest demands that on all these subjects a fair latitude for discussion should be permitted; the citizen is entitled to the utmost liberty so long as he expresses nothing more than his honest opinion of the subject before him, but if it can be proved that he has used false and defamatory language out of malice, and especially if he has travelled beyond the facts which are properly before the public, he is no longer protected by his privilege. In private life a large number of statements are privileged so long as they remain matters of strictly private communication. It is difficult to define the limits of private privilege without extensive reference to concrete cases, but generally it may be said that it includes all communications which are made in performance of a duty not merely legal but moral or social, answers to *bona fide* inquiries, communications made by persons in confidential relations regarding matters in which one or both are interested, and even statements made within proper limits by persons in the *bona fide* prosecution of their own interest. Common examples of this kind of privilege are to be found in answer to inquiries as to the character of servants or the solvency of a trader, warnings to a friend, communications between persons who are jointly interested in some matters of business. But in every case we must be careful not to exceed the limits of publication required by the occasion, or otherwise the privilege is lost. Thus defamatory statements may be privileged when made to a meeting of shareholders, but not when published to others who have no immediate concern in the business.

In a few instances in which an action cannot be maintained even by the averment of malice, the plaintiff may maintain an action by averring not only malice but also want of reasonable and probable cause. The most common instances of this kind are malicious charges made in the ordinary course of justice and malicious prosecutions. In such cases it would be contrary to public policy to punish or prevent every charge which was made from a purely malicious motive, but there is no reason for protecting accusations which are not only malicious, but destitute of all reasonable probability.

Criminal Law.—Publications which are blasphemous, immoral, or seditious are frequently termed libels, and are punishable both at common law and by various statutes. The matter, however, which constitutes the offence in these publications lies beyond our present scope. Libels upon individuals may be prosecuted by criminal information or indictment, but there can be no criminal prosecution for slander. So far as concerns the definition of libel, and its limitation by the necessity of proving in certain cases express malice, there is no substantial difference between the rules which apply to criminal prosecutions and to civil actions, with the one important exception (now considerably modified) that the falsity of a libel is not in criminal law an essential element of the offence. If the matter alleged were in itself defamatory, the court would not permit inquiry into its truth. The sweeping application of this rule seems chiefly due to the indiscriminate use, in earlier cases, of a rule in Roman law which was only applicable to certain modes of publication, but has been supported by various reasons of general policy, and especially by the

view that one main reason for punishing a libel was its tendency to provoke a breach of the peace. The same view has occasioned a difference in the publication required in civil and criminal actions. It is enough in criminal law that the libel has been published to the party against whom it is directed, if it is averred that it is intended or calculated to produce a breach of the peace. Important alterations, however, have been introduced into this branch of the law by 6 & 7 Vict. c. 95. By that Act any person who maliciously publishes a defamatory libel may be punished by fine or imprisonment or both, the imprisonment not to exceed one year. Any person maliciously publishing a defamatory libel, knowing the same to be false, is liable to fine and imprisonment for two years. In every case the truth of the matters charged may be inquired into if it be pleaded, but the truth does not amount to a defence unless it is also proved that the publication was for the public benefit; and if, after such plea, the defendant is convicted, it is competent to the court to consider whether the guilt of the defendant is mitigated or aggravated by the plea, and the evidence given in relation to it. By the same Act a defendant is protected from publication of libels without his knowledge, authority, or consent, if the publication did not arise from the want of due care and caution on his part. The court are further authorized to award costs to the defendant in any information or indictment at the instance of a private prosecutor.

An important dispute about the powers of the jury in cases of libel arose during last century in connexion with some well known trials for seditious libels. The point is familiar to readers of Macaulay in connexion with the trial of the seven bishops, but the cases in which it was brought most prominently forward, and which led to its final settlement, were those against Woodfall (the printer of *Junius*), Wilkes, and others, and especially the case against Shipley, the dean of St Asaph (21 St. Tr. 925), in which the question was fought by Mr Erskine with extraordinary energy and ability. The controversy turned upon the question whether the jury were to be strictly confined to matters of fact which required to be proved by evidence, or whether in every case they were entitled to form their own opinion upon the libellous character of the publication and the intention of the author. There could be no doubt of course that the jury, if they pleased, had it in their power to return a general verdict of guilty or not guilty, but both in theory and practice they were subject in law to the directions of the court, and had to be informed by it as to what they were to take into consideration in determining upon their verdict (see *JURY*). There is no difficulty about the general application of this principle in criminal trials. In a case of murder, for example, the judge directs the jury that if they are satisfied the accused did so and so they ought to find him guilty. He directs them, not merely as to the definition of the crime, but as to the particular facts which fall within that definition. If the crime is one which is inferred by law from certain facts, they are only concerned with these facts, and must accept the construction which is put upon them by law. Applying these principles to the case of libel, juries were directed that it was for the court to determine whether the publication fell within the definition of libel, and whether the case was one in which malice was to be inferred by construction of law. If the case were one in which malice was inferred by law, the only facts left to the jury were the fact of publication and the meaning ascribed by innuendoes; they could not go into the question of intention, unless the case were one of privilege, in which express malice had to be proved. In general principle, therefore, the decisions of the court were in accordance with the ordinary principles of criminal law. But there were

undoubtedly some peculiarities in the case of libel. The sense of words, the inferences to be drawn from them, and the effect which they produce are not so easily defined as gross matters of fact. They seem to belong to those cases in which the impression made upon a jury is more to be trusted than the decision of a judge. And further, owing to the mode of procedure, the defendant was often punished before the question of law was determined. But nevertheless the question would scarcely have been raised had the libels related merely to private matters. The real ground of dispute was the liberty to be accorded to political discussion. Had the judges taken as wide a view of privilege in discussing matters of public interest as they do now, the question could scarcely have arisen; for Erskine's whole contention really amounted to this, that the jury were entitled to take into consideration the good or bad intent of the authors, which is precisely the question which would now be put before them in any matter which concerned the public. But at that time the notion of a special privilege attaching to political discussion had scarcely arisen, or was at least confined within very narrow limits, and the cause of free political discussion seemed to be more safely entrusted to juries than to courts. The question was finally settled by Mr Fox's Libel Act (32 Geo. III. c. 50), by which the jury were entitled to give a general verdict on the whole matter put in issue.

Scotch Law.—In Scotch law there were originally three remedies for defamation. It might be prosecuted by or with the concurrence of the lord advocate before the Court of Justiciary; or, secondly, a criminal remedy might be obtained in the commissary (ecclesiastical) courts, which originally dealt with the defender by public retraction or penance, but subsequently made use of fines payable to their own prosecutor or to the party injured, these latter being regarded as solatium to his feelings; or, lastly, an action of damages was competent before the Court of Session, which was strictly civil in its character, and aimed at the reparation of pecuniary loss. The first remedy has fallen into disuse, the second and third (the commissary courts being now abolished) became mixed up together, and are represented by the present action for damages or solatium. Originally the action before the Court of Session was strictly for damages founded, not upon the *animus injuriandi*, but upon culpa, and could be defended by proving the truth of the statement. But in time the Court of Session began to assume the original jurisdiction of the commissary courts, and entertained actions for solatium in which the *animus injuriandi* was a necessary element, and to which, as in Roman law, the truth was not necessarily a defence. Ultimately the two actions got very much confused. We find continual disputes as to the necessity for the *animus injuriandi* and the applicability of the plea of *veritas convicta*, which arose from the fact that the courts were not always conscious that they were dealing with two actions, to one of which these notions were applicable, and to the other not. On the introduction of the jury court, presided over by an English lawyer, it was quite natural that he, finding no very clear distinction maintained between damage and solatium, applied the English plea of truth as a justification to every case, and retained the *animus injuriandi* both in ordinary cases and cases of privilege in the same shape as the English conception of malice. The leading and almost only difference between the English and Scotch law now are that the latter makes no essential distinction between oral and written defamation, that it practically gives an action for every case of defamation oral or written upon which in England a civil action might be maintained for libel, and that it possesses no criminal remedy. In consequence of the latter defect and the indiscriminate application of the plea of *veritas* to every case both of damages and solatium, there appears to be at present no remedy in Scotland even for the wildest and most needless publication of offensive statements if only they are true.

American Law.—In this as in so many other departments the American law scarcely if at all differs from that of England. In so far indeed as the common law is concerned, they may be said to be substantially identical. The principal statutes which have altered the English criminal law, such as Mr Fox's Act, and 6 & 7 Vict. c. 95, are also represented by equivalent legislation in most American States. (A. G.)

LIBER AND LIBERA, among the Romans, were a pair of deities, male and female, in whose worship two very different phases exist side by side. In the country feast of the vintage, and the city festival of March 17th called

Liberia, we find purely Italian ceremonial unaffected by Greek religion. The country festival was a great merry-making, where the first-fruits of the new must were offered to the gods. It was full of unbridled rejoicing, and characterized by the grossest symbolism, in honour of the fertility of nature. It is usual to refer the name Liber to the free unrestrained character of his worship. In the city festival, growing civilization had impressed a new character on the primitive religion, and connected it with the framework of society. At this time the youths laid aside the boy's *toga pretexta* and assumed the man's *toga libera* or *virilis*. Calces of *far*, honey, and oil (*liba*) were offered to the two gods at this festival. Liber is often invoked as *Liber Pater*, and we find even the expression *Jupiter Liber*, taking us back to the primitive stage of religion when no divine hierarchy of gods had been elaborated, and when Liber and Libera were in the spheres of their cultus the sole god and goddess. Originally Liber is probably only an epithet of Jupiter.

At an early period the Hellenic religion of Demeter, common to all the Greek colonies of Italy and Sicily, spread to Rome, then Liber and Libera were identified with Dionysus and Persephone, and associated with another Italian goddess Ceres, who was identified with Demeter. At the order of the Sibylline books, a temple was built to these three deities near the Circus Flaminius; the whole cultus was borrowed from the Greeks, down even to the terminology, and priestesses were brought from the Greek cities. The temple, *Aedes Ceres*, was founded by Aulus Postumius, 495 B.C., and dedicated by Spurius Cassius, 493 B.C. The chief festival of this cultus lasted eight days, from the 12th to the 19th of April; it was accompanied by games, called *Ludi Ceresiales* or *Liberales*. The plebeian ediles, appointed about the time when the temple was founded, were closely attached to it, and from that time plebeian liberty continued in intimate relation to the *Aedes Ceres* and the gods there worshipped.

LIBERIA, a Negro republic on the Grain Coast of West Africa. Founded in 1822 by American philanthropists for the settlement of freedmen who wished to return to their native land, or to enjoy political and social privileges then denied them in the United States, it remained for twenty-five years under the tutelage of the mother country, but on the 26th July 1847 it was declared independent. In 1848 it was recognized as a sovereign state by Great Britain, which aided it in various ways, and by other Continental powers, and finally in 1861 by the United States. Its nominal boundaries are from the river Jong, a tributary of the Sherbar, in 7° 35' N. lat., 12° 20' W. long., and the river San Pedro, in 4° 45' N. lat., 6° 40' W. long., a distance of 380 miles, the limits of the state in the interior being usually stated at from 80 to 100 miles eastward, though this is unsettled, and the entire area of the country at 24,000 square miles, or 1000 miles less than Holland and Belgium combined. Like that of northern Guinea generally, the Liberian shore is low, but the country rises towards the interior, and is well-wooded and watered by numerous streams. The climate is, however, hot and unhealthy for Europeans, though of late years it has been improved by drainage, and is considered superior to that of any part of the neighbouring coast. The soil is fertile and well suited for the growth of tropical crops, such as cotton, rice, sugar, indigo, yams, ground-nuts, bananas, ginger, cassava, pine-apples, coconuts, limes, oranges, tamarinds, and the Liberian variety of coffee¹ held in such high esteem. These products, in addition to palm oil, form the main subsistence of the inhabitants, who in

return import arms, ammunition, tobacco, salt provisions, implements of husbandry, cutlery, British cottons, and other manufactured goods. Coffee, palm oil, palm-kernels, rubber, ivory, dye woods, hides, ivory, arrowroot, sugar, cocoa, ginger, and rice form the principal articles of its commerce, which is carried on chiefly with Great Britain, Holland, Hamburg, and America. Copper, gold, iron, and deposits of gum-copal exist, but they are not worked, and all the large wild animals have long since been killed or driven out of the woods. Stock can be kept in the higher lands. The government is modelled on that of the United States, and consists of a president, and a congress composed of a senate of eight members elected for four years, and of a house of representatives of thirteen members elected for three years, in addition to a supreme court, and a cabinet of the American type. One additional representative is given for each additional 10,000 inhabitants by which the population may increase. Military service in the militia is obligatory on every male citizen between the ages of sixteen and fifty, but there is no standing army. There is no established church, and all faiths are equally tolerated. The state is divided into four counties (Mezurado, Grand Bassa, Sinoe, and Maryland), and these again into townships, each 64 square miles in area. There are a number of little villages, but the only place of any consequence is Monrovia, the capital, containing 13,000 inhabitants, and in appearance very like a town in the southern United States, but in no way remarkable except for the large number of churches within its bounds. Besides Monrovia the chief ports are Robertsport, Marshall, Edina or Buchanan, Greenville, Sesters River, Sasstown, and Harper, and in 1881 foreigners were further permitted to trade at any point to the north of Robertsport. The present population of the republic (1882) comprises 18,000 civilized negroes, chiefly of American origin, and 1,050,000 half-wild natives, some of whom are adopting a settled life, and conforming to the habits of their tamed countrymen. Among the more interesting tribes are the Vei, the Bassas, the Krus, and the Mandingoes. The American Methodist Episcopal mission dates from 1833, the American Episcopal from 1834, and that of the American Baptists from 1835. The revenue of the state was returned at September 30, 1875, as 111,457 dollars, chiefly derived from customs, the national debt being 500,000 dollars, contracted in England in 1871. Of this neither principal nor interest has been paid. Socially and politically the state cannot be pronounced a marked success. The negroes in America display little desire to throw in their fortunes with it, now that they are free to go whither they list, nor do the barbarous tribes on the border of the republic seem to admire the black parody on a white man's government, which for sixty years has been presented to them. There is now and again a small immigration from the United States, but the Liberian civilization, cut off from the benefit of intercourse with a higher and broader culture, is apt to deteriorate, while neither the climate nor the laws and social surroundings are ever likely to attract many white men to its shores. It is, however, only fair to add that, though internal disorder is too often the rule, the state shows an appreciation of education and religion, and a keen desire to stand well in the good opinion of the powers with which it has relations by accredited representatives. It has formed treaties with most of the European countries, and with Hayti and the United States; and, though it has not paid its debts, successive Governments are in the habit of registering vows to meet this first obligation of a nation towards its neighbours. British coin and an irredeemable

¹ Liberian coffee (see *Coffea*, vol. vi. p. 110) has been introduced into Brazil, Ceylon, the Dutch Indies, &c. The quantity actually exported from Liberia is comparatively small.

² Maryland was originally a separate colony, founded in 1681; it became an independent republic in 1788, and about 1800 was incorporated with its older neighbour.

paper currency are the money chiefly in circulation, but all accounts are kept in United States dollars and cents. The weights employed are also British, except that gold from the interior is bought and sold by the *usano* = 16 *akis* = 16,000 cowries = 314.76 grains Troy. The *gondar-ardeb* (7.74 imperial pints), the *massah-ardeb* (2.32 imp. gals), and the *kuba* (1.788 imp. pints) are also in common use.

See Guiley's *Life of Jehu's Ashmun*, 1836, Stockwell, *The Republic of Liberia*, 1848, Wilson, *West Africa*, 1866, Hutchinson, *Impressos of West Africa*, 1868, Ritter, in *Zeitschrift für allgemeine Ethnologie*, vol. i, 1853, Brown, *Countries of the World*, vol. vi, pp. 123-127, 1881, Bowen, *Central Africa*, 1887, Thomas, *West Coast of Africa*, 1880, "Die Negersrepublik Liberia," in *Unsere Zeit*, vol. iii, 1868, U.S. Consular Reports, 1881.

LIBERIUS, pope from 352 to 366, the successor of Julius I, was consecrated according to the *Catalogus Liberianus* on May 22. His first recorded act was, after a synod had been held at Rome, to write to Constantius, then in quarters at Arles (353-54), asking that a council might be called at Aquileia with reference to the affairs of Athanasius, but his messenger Vincentius of Capua, so far from being successful in his mission, was himself compelled by the emperor at a conciliabulum held in Arles to subscribe against his will a condemnation of the orthodox patriarch of Alexandria. In 355 Liberius was one of the few who, along with Eusebius of Vercelli, Dionysius of Milan, and Lucifer of Cagliari, refused to sign the condemnation of Athanasius, which had anew been imposed at Milan by imperial command upon all the Western bishops, the consequence was his relegation to Beroea in Thracia, Felix II. (antipope) at the same time being consecrated his successor by three "catacompi haud episcopi," as Athanasius called them. At the end of an exile of more than two years he yielded so far as to subscribe the third Sirmian formula giving up the "homoeousion,"—an act which procured his immediate and triumphant return to Rome, but has ever since caused considerable embarrassment to maintainers of the indefectibility of Roman orthodoxy. The remainder of his pontificate was uneventful. He died on September 24, 366, and was succeeded by Damasus I. With the rest of the first sixty popes he shares the title of "Saint." His biographers used to be perplexed by a letter purporting to be from Liberius, in the works of Hilary, in which he seems to write, in 352, that he had excommunicated Athanasius at the instance of the Oriental

bishops; but the document is now held to be spurious. See Hefele, *Conciliengesch.*, i. p. 648 *sq.*

LIBOURNE, the chief town of an *arrondissement*, and in point of population the second town of the department of Gironde, France, is situated at the confluence of the Isle with the Dordogne, 537 miles by rail south-west from Paris, and 22 miles east from Bordeaux. The sea is 56 miles off, but the tide affects the river so as to admit of vessels of 300 tone burden reaching the town. The Dordogne is here crossed by a stone bridge 492 feet long, and a suspension bridge across the Isle connects Libourne with the adjoining Fronsac, the citadel of which, 235 feet above the sea, was at one time occupied by a palace of Charlemagne, and subsequently became an important fortress. Libourne is regularly built, but has no monuments of much architectural or historical interest, the (restored) Gothic church has a stone spire 233 feet high. On the quay there is a maculated clock-tower which is a remnant of the ramparts of the 14th century, and the town-house, containing a small museum, is a quaint relic of the 18th century. There is a statue of the Duc Dezaux, who was born in the neighbourhood. The principal articles of commerce are the wines and brandies of the district, the growths of chief repute being those of St Emilion, a short distance above Libourne, on the right bank of the Dordogne, and of Canon, a little below Fronsac. There is also some trade in yarn, grain, and wood for cooperage. Woollen stuffs and some articles of army outfit are manufactured, and nailing, tanning, shoemaking, and shipbuilding are also carried on. The harbor is used exclusively by small vessels for the export of wines; the shipping owned in the place does not exceed 2500 tons. The population of Libourne in 1870 was 15,231.

Like other sites at the confluence of important rivers, that of Libourne was appropriated at an early period. Under the Romans *Condat* stood rather more than a mile to the south of the present Libourne, where the old Gothic chapel of *Condat novus* was destroyed during the troubles of the 5th century. Reconstructed by Charlemagne, it was rebuilt, under its present name, and on the site and plan it still retains, by Edward, prince of Wales, in 1276. It suffered considerably in the struggles of the French and English for the possession of Guienne in the 14th century, and again during the religious wars, and finally in the war of the Fronde in the minority of Louis XIV. Nevertheless it ultimately outgrew both its powerful neighbours Fronsac and Saint Emilion, the latter of which is archeologically one of the most curious spots in France.

LIBRARIES

HISTORY AND DESCRIPTION.

ANCIENT PERIOD.

LIBRARIES, in our modern sense of collections of printed or written literature, imply an advanced and elaborate civilization. If the term be extended to any considerable collection of written documents, they must be nearly as old as civilization itself. The earliest use to which the invention of inscribed or written signs was put was probably to record important religious and political transactions. These records would naturally be preserved in sacred places, and accordingly the earliest libraries of the world were probably temples, and the earliest librarians priests. And indeed before the extension of the arts of writing and reading the priests were the only persons who could perform such work as, e.g., the compilation of the *Annales Maximæ*, which was the duty of the pontifices in ancient Rome. The beginnings of literature proper in the shape of ballads and songs may have continued to be conveyed orally only from one generation to another, long after the record of important religious or civil events was regularly committed to writing. The earliest collections of which we know anything therefore were collections of

archives. Of this character appear to have been such famous collections as that of the Medians at Ecbatana or the Persians at Susa. It is not until the development of arts and sciences, and the growth of a considerable written literature, and even of a distinct literary class, that we find collections of books which can be called libraries in our modern sense. It is of libraries in the modern sense, and not, except incidentally, of archives that we are to speak.

The researches which have followed the discoveries of Botta and Layard have thrown unexpected light not only upon the history but upon the arts, the sciences, and the literatures of the ancient civilizations of Babylonia and Assyria. In all these wondrous revelations no facts are more interesting than those which show the existence of extensive libraries so many ages ago, and none are more eloquent of the elaborateness of these forgotten civilizations.

In the course of his excavations at Nineveh in 1850, Assyria Layard came upon some chambers in the south-west palace, the floor of which, as well as of the adjoining rooms, was covered to the depth of a foot with tablets of clay, covered with cuneiform characters, in many cases so small as to require a magnifying glass. These varied in size

from an inch to a foot square. A great number of them were broken, as Layard supposed by the falling in of the roof, but as the late Mr. George Smith thought by having fallen from the upper story, upon which he believed the collection to have been placed. These tablets formed the library of the great monarch Assur-bani-pal—the Sardanapalus of the Greeks—the greatest patron of literature amongst the Assyrians. It is estimated that this library consisted of some ten thousand distinct works and documents, some of the works extending over several tablets. The tablets appear to have been methodically arranged and catalogued, and the library seems to have been thrown open for the general use of the king's subjects.¹ A great portion of this library has already been brought to England and deposited in the British Museum, but it is calculated that there still remain some 20,000 fragments to be gathered up. For further details as to Assyrian libraries, and the still earlier Babylonian libraries from which the Assyrians drew their science and literature, see *BABYLONIA*, vol. iii. p. 191.

Egypt.

Of the libraries of ancient Egypt our knowledge is much less full and precise. It seems to be ascertained that the oldest hieroglyphic writings now extant run some centuries farther back than 2000 B.C. We possess a papyrus manuscript which is assigned to the age of Amenophis I. of the 18th dynasty, perhaps about 1800 B.C., and the fabric is so perfect as to point to a much earlier invention.² With the invention of papyrus came the age of books. The temples were the centres of literary activity, and to each of them were attached professional scribes who occupied a very respectable position. Their function was regarded as a religious one, for the distinction between religion and science had not yet been made. The sacred books of Thoth—forty-two in number—constituted as it were a complete encyclopædia of religion and science. But they did not forbid speculation, or a wider development of the principles contained in them. So there arose a great mass of literature in the shape of exposition and commentary. To such an extent did this increase that at the time of the Greek conquest of Egypt the Thoth literature is said to have amounted to 36,826 books.³ Books were collected not only in the temples but also at the tombs of kings. The most famous of these libraries dates from the 14th century B.C., and was the so-called library of King Osmendias, described by Diodorus Siculus, who relates that it bore an inscription which he renders by the Greek words ΨΥΧΗΣ ΙΑΤΡΕΙΟΝ, "the dispensary of the soul." Osmendias has been identified with the great king Ramses I., and the seat of the library is supposed by Wilkinson to have been the Ramesseum, the magnificent palace temple near Thebes.⁴ Lepsius thinks he has found the tombs of two of the librarians of Osmendias.⁵ According to Eusebius there was also a great collection in a temple at Memphis. A heavy blow was dealt to the old Egyptian literature by the Persian invasion, and many of their books were carried away by the conquerors. They were only delivered from the yoke of Persia to succumb to that of Greece, and henceforward their civilization was dominated by foreign influences. Of the libraries of Greece under the Ptolemies we shall therefore speak a little further on.

Greece.

Of the libraries of ancient Greece we have very little knowledge, and such knowledge as we possess comes to us for the most part from late compilers. Amongst those who are known to have collected books are Ptolemy, Polyarchus of Samos, Euclid the Athenian, Nicocrates of

Cyprus, Euripides and Aristotle (Athenæus, i. 4). At Cnidus there is said to have been a special collection of works upon medicine. Ptolemy is said to have been the first of the Greeks who collected books on a large scale.

Aulus Gellius, indeed, tells us in language perhaps "not well suited to the 6th century A.D.,"⁶ that he was the first to establish a public library. The authority of Aulus Gellius is hardly sufficient to secure credit for the story that this library was carried away into Persia by Xerxes and subsequently restored to the Athenians by Seleucus Nicator. Plato is known to have been a collector, and Xenophon tells us of the library of Euthydemus. The library of Aristotle was bequeathed by him to his disciple Theophrastus, and by Theophrastus to Neleus, who carried it to Scepsis, where it is said to have been concealed underground to avoid the literary cupidity of the kings of Pergamum. Its subsequent fate has given rise to much controversy, but, according to Strabo (xii. pp. 608, 609), it was sold to Apollonius of Teos, who carried it to Athens, where after Apollonius' death it fell a prey to the conspirator Sulla, and was transported by him to Rome. The story told by Athenæus (i. 4) is that the library of Neleus was purchased by Ptolemy Philadelphus. The names of a few other libraries in Greece are barely known to us from inscriptions, of their character and contents we know nothing. If indeed we are to trust Strabo entirely, we must believe that Aristotle was the first person who collected a library, and that he communicated the taste for collecting to the sovereigns of Egypt.

It is at all events certain that the libraries of Alexandria were the most important as they were the most celebrated of the ancient world. Under the enlightened rule of the Ptolemies a society of scholars and men of science was attracted to their capital. It seems pretty certain that Ptolemy Soter had already begun to collect books, but it was in the reign of Ptolemy Philadelphus that the libraries were properly organized and established in separate buildings. Ptolemy Philadelphus sent into every part of Greece and Asia to secure the most valuable works, and no exertions or expense were spared in enriching the collections. Ptolemy Euergetes, his successor, is said to have caused all books brought into Egypt by foreigners to be seized for the benefit of the library, while the owners had to be content with receiving copies of them in exchange. Nor did the Alexandrian scholars exhibit the usual Hellenic exclusiveness, and many of the treasures of Egyptian and even of Hebrew literature were by their means translated into Greek. There were two libraries at Alexandria; the larger, in the Bruchium quarter, was in connexion with the Museum, a sort of academy, while the smaller was placed in the Serapeum. The number of volumes in these libraries was very large, although it is difficult to attain any certainty as to the real numbers amongst the widely varying accounts. According to a scholium of Theophrastus, who appears to draw his information from the authority of Callimachus and Eratosthenes, who had been librarians at Alexandria, there were 42,800 volumes or rolls in the Serapeum and 490,000 in the Bruchium.⁷ This enumeration seems to refer to the librarianship of Callimachus himself under Ptolemy Euergetes. In any case the figures agree tolerably well with those given by Aulus Gellius⁸ (700,000) and Seneca⁹ (400,000). It should be observed that, as the ancient roll or volume usually contained a much smaller quantity of matter than a modern book—so that, e.g., the history of Herodotus might form nine "books" or volumes, and the *Iliad* of Homer twenty-four—these numbers must be dis-

¹ See Meunier, *Bibliothèque du Palais de Nivernais*, Paris, 1880.

² Wuttke, *Entstehung der Schrift*, p. 651, Leipzig, 1872.

³ Lepsius, *Chronologie der Ägypter*, p. 42, Berlin, 1849.

⁴ Wilkinson, *Ancient Egypt*, i. 111 et seq.

⁵ Lepsius, *Chronologie der Ägypter*, p. 89.

⁶ Gellius, *History of Greece*, iv. 37, following Boetius.

⁷ Strabo, *Die Alexandrianischen Bibliotheken*, p. 22; *Cyprus, Phil.*, i. 328.

⁸ *Id.*, vi. 17.

⁹ *De Tranq. An.*, 9.

counted for the purposes of comparison with modern collections.¹ The series of the first five librarians at Alexandria appears to be pretty well established as follows—Zenodotus, Callimachus, Eratosthenes, Apollonius, and Aristophanes; and their activity covers a period of about a century.² The first experiments in bibliography appear to have been made in producing catalogues of the Alexandrian libraries. Amongst other lists, two catalogues were prepared by order of Ptolemy Philadelphus, one of the tragedies, the other of the comedies contained in the collections. The *Mouseion* of Callimachus formed a catalogue of all the principal books arranged in 120 classes. When Caesar set fire to the fleet in the harbour of Alexandria, the flames accidentally extended to the larger library of the Bruchium, and it was destroyed.³ Antony endeavoured to repair the loss by presenting to Cleopatra the library from Pergamus. This was very probably placed in the Bruchium, as thus continued to be the literary quarter of Alexandria until the time of Aurelian. Thenceforward the Serapeum became the principal library. The usual statement that from the date of the restoration of the Bruchium under Cleopatra the libraries continued in a flourishing condition until they were destroyed after the conquest of Alexandria by the Saracens in 640 A.D. can hardly be supported. It is very possible that one of the libraries perished when the Bruchium quarter was destroyed by Aurelian, 273 A.D. In 389 or 391 an edict of Theodosius ordered the destruction of the Serapeum, and its books were pillaged by the Christians. When we take into account the disordered condition of the times, and the neglect into which literature and science had fallen, there can be little difficulty in believing that there were but few books left to be destroyed by the soldiers of 'Amr. The familiar anecdote of the caliph's message to his general (vol. i. p. 494) rests mainly upon the evidence of Abulfargius, so that we may be tempted to agree with Gibbon that the report of a stranger who wrote at the end of six hundred years is overbalanced by the silence of earlier and native annalists. It is, however, so far from easy to settle the question that a cloud of names could easily be cited upon either side, while some of the most careful inquirers confess the difficulty of a decision.⁴

779-
as The magnificence and renown of the libraries of the Ptolemies excited the rivalry of the kings of Pergamus, who vied with the Egyptian rulers in their encouragement of literature. Despite the obstacles presented by the embargo placed by the Ptolemies upon the export of papyrus, the library of the Attali attained considerable importance, and, as we have seen, when it was transported to Egypt numbered 300,000 volumes. We learn from a notice in Suidas that in 221 A.C. Antiochus the Great summoned the poet and grammarian Euphorion of Chalcis to be his librarian.

1000. The early Romans were far too warlike and practical a people to devote much attention to literature, and it is not until the last century of the republic that we hear of libraries in Rome. The collections of Carthage, which fell into their hands when Scipio sacked that city (149 A.C.), had no attractions for them; and with the exception of the writings of Mago upon agriculture, which the senate reserved for translation into Latin, they bestowed all the

books upon the kinglets of Africa.⁵ It is in accordance with the military character of the Romans that the first considerable collections of which we hear in Rome were brought there as the spoils of war. The first of these was that brought by Æmilius Paulus from Macedonia after the conquest of Perseus (167 A.C.). The library of the conquered monarch was all that he reserved from the prizes of victory for himself and his sons, who were fond of letters. Next came the library of Apellion the Teian, brought from Athens by Sulla (86 B.C.). This passed at his death into the hands of his son, but of its later history nothing is known. The rich stores of literature brought home by Lucullus from his eastern conquests (about 67 B.C.) were freely thrown open to his friends and to men of letters. Accordingly his library and the neighbouring walks were much resorted to, especially by Greeks. It was now becoming fashionable for rich men to furnish their libraries well, and the fashion prevailed until it became the subject of Seneca's scorn and Lucian's wit. The zeal of Cicero and Atticus in adding to their collections is well known to every reader of the classics. Tyrannius is said to have had 30,000 volumes of his own; and that M. Terentius Varro had large collections we may infer from Cicero's writing to him: "Si hortum in bibliotheca habes, nihil deerit." Not to prolong the list of private collectors, Sereus Sammonicus is said to have left to his pupil the younger Gordian no less than 62,000 volumes. Amongst the numerous projects entertained by Caesar was that of presenting Rome with public libraries, though it is doubtful whether any steps were actually taken towards its execution. The task of collecting and arranging the books was entrusted to Varro. This commission, as well as his own fondness for books, may have led Varro to write the book upon libraries of which a few words only have come down to us, preserved by a grammarian. Varro also appears to have been the first to ornament a library with the statues and busts of learned men, though the idea is sometimes attributed to Asinius Pollio. The greater honour of being the first actually to dedicate a library to the public is said by Pliny and Ovid to have fallen to Pollio, who erected a library in the Atrium Libertatis on Mount Aventine, defraying the cost from the spoils of his Illyrian campaign. The library of Pollio was followed by the public libraries established by Augustus. That emperor, who did so much for the embellishment of the city, erected two libraries, the Octavian and the Palatine. The former was founded (33 A.C.) in honour of his ancestor, and was placed in the Porticus Octaviae, the lower part of which served as a promenade, while the upper part contained the library. The charge of the books was committed to C. Melissus. The other library formed by Augustus was attached to the temple of Apollo on the Palatine hill, and appears from inscriptions to have consisted of two departments, a Greek and a Latin one, which seem to have been separately administered. The charge of the Palatine collections was given to Pompeius Macer, who was succeeded by Julius Hyginus, the grammarian and friend of Ovid. The Octavian library perished in the fire which raged at Rome for three days in the reign of Titus. The Palatine was, at all events in great part, destroyed by fire in the reign of Commodus. The story that its collections were destroyed by order of Pope Gregory the Great in the 6th century is now generally rejected. The successors of Augustus, though they did not equal him in their patronage of learning, maintained the tradition of forming libraries. Tiberius, his immediate successor, established one in his splendid house on the Palatine, to which Gellius refers as the "Tiberian library," and

¹ This view as to the smallness of the ancient book before Callimachus has been pushed perhaps a little too far. See Theodor Birt's ingenious suggestions in *Das antike Buchwesen*, Berlin, 1893, p. 439 ff. Dr. Birt, indeed, agrees that these large numbers must be discounted, but only on the ground of the very considerable number of duplicates in the Alexandrian libraries.

² Reisch, *loc. cit.*, 19.

³ Parthey (*Alexandrinisches Museum*) assigns topographical reasons for doubting this story.

⁴ Some of the authorities have been collected by Parthey, *op. cit.*

⁵ Pliny, *H. N.*, xviii. 5.

Suetonius relates that he caused the writings and images of his favourite Greek poets to be placed in the public libraries. Vespasian established a library in the Temple of Peace erected after the burning of the city under Nero. Domitian restored the libraries which had been destroyed in the same conflagration, procuring books from every quarter, and even sending to Alexandria to have copies made. He is also said to have founded the Capitoline library, though others give the credit to Hadrian. The most famous and important of the imperial libraries, however, was that created by Ulpian Trajanus, known as the Ulpian library, which was first established in the Forum of Trajan, but was afterwards removed to the baths of Diocletian. In this library were deposited by Trajan the "libri iurisi" and "libri elephantini," upon which the senatus consulta and other transactions relating to the emperors were written. The library of Domitian, which had been destroyed by fire in the reign of Commodus, was restored by Gordian, who added to it the books bequeathed to him by Surrentus Summoecus. Altogether in the 4th century there are said to have been twenty-eight public libraries in Rome.

Nor were public libraries confined to Rome. Besides a library at Tiber, which is twice mentioned by Gellius, and was probably founded by Hadrian, the younger Pliny mentions that he had himself dedicated a library to his fellow-townsmen at Comum; and an inscription discovered at Milan proves that he also contributed a large sum to the support of a library there. Hadrian established a library at Athens; and Strabo mentions the library of Smyrna. Gellius also mentions a library at Patra. From one of his references (xix. 5) to the Tiburtine library we may infer that it was not unusual for books to be lent out from these libraries. Considerable care was bestowed by the Romans upon the placing of their libraries. The room or building generally had an eastern aspect. The books or rolls were arranged upon the shelves of presses running round the walls, with additional presses placed in the middle of the room. Thus the library discovered at Herculaneum contained 1756 MSS. placed on shelves running round the room to a height of some 6 feet, with a detached central press. These presses in large libraries were numbered. They were often made of precious woods and richly ornamented, while the room was adorned with portraits and statues.

As the number of libraries in Rome increased, the librarian, who was generally a slave or freedman, became a recognized public functionary. The names of several librarians are preserved to us in inscriptions, including that of C. Hyemenus, who appears to have fulfilled the double function of physician and librarian to Augustus. The general superintendence of the public libraries was committed to a special official. Thus from Nero to Trajan Dionysius, an Alexandrian rhetorician, discharged this function. Under Hadrian it was entrusted to his former tutor C. Julius Vestinus, who afterwards became administrator of the Museum at Alexandria.

When the seat of empire was removed by Constantine to his new capital upon the Bosphorus, the emperor established a collection there, in which Christian literature was probably admitted for the first time into an imperial library. Diligent search was made after the Christian books which had been doomed to destruction by Diocletian. Even at the death of Constantine, however, the number of books which had been brought together amounted only to 6900. The smallness of the number, it has been suggested, seems to show that Constantine's library was mainly intended as a repository of Christian literature. However this may be, the collection was greatly enlarged by some of Constantine's successors, especially by Julian and Theodosius, at whose

death it is said to have increased to 100,000 volumes. Julian, himself a close student and voluminous writer, though he did his best to discourage learning among the Christians, and to destroy their libraries, not only augmented the library at Constantinople, but founded others, including one at Nisibis, which was soon afterwards destroyed by fire. From the Theodosian code we learn that in the time of that emperor a staff of seven copyists was attached to the library at Constantinople under the direction of the librarian. The library was burnt under the emperor Zeno in 477, but was again restored.

Meanwhile, as Christianity made its way and a distinctively Christian literature grew up, the institution of libraries became part of the organization of the church. When the church of Jerusalem was founded in the 3d century a library was added to it, and it became the rule to attach to every church a collection of the books necessary for the inculcation of Christian doctrine. The largest of these libraries, that founded by Pamphilus at Caesarea, and said to have been increased by Eusebius, the historian of the church, to 30,000 volumes, is frequently mentioned by St Jerome. St Augustine bequeathed his collection to the library of the church at Hippo, which was fortunate enough to escape destruction at the hands of the Vandals.

The removal of the capital to Byzantium was in its result a serious blow to literature. Henceforward the science and learning of the East and West were divorced. The libraries of Rome ceased to collect the writings of the Greeks, while the Greek libraries had never cared much to collect Latin literature. The influence of the church became increasingly hostile to the study of pagan letters. The repeated irruptions of the barbarians soon swept the old learning and libraries alike from the soil of Italy. With the close of the Western empire in 476 the ancient history of libraries may be said to cease.

MEDIEVAL PERIOD.

During the first few centuries after the fall of the Western empire, literary activity at Constantinople had fallen to its lowest ebb. In the West, amidst the general neglect of learning and literature, the collecting of books, though not wholly forgotten, was cared for by few. Sidonius Apollinaris tells us of the libraries of several private collectors in Gaul. Publius Consentius possessed a library at his villa near Narbonne which was due to the labour of three generations. The most notable of these appears to have been the prefect Tonantius Ferreolus, who had formed in his villa of Prusiana, near Nîmes, a collection which his friend playfully compares to that of Alexandria. The Goths, who had been introduced to the Scriptures in their own language by Ulfilas in the 4th century, began to pay some attention to Latin literature. Cassiodorus, the favourite minister of Theodoric, was a collector as well as an author, and on giving up the care of government retired to a monastery which he founded in Calabria, where he employed his monks in the transcription of books.

Henceforward the charge of books as well as of education fell more and more exclusively into the hands of the church. While the old schools of the rhetoricians died out new monasteries arose everywhere. Knowledge was no longer pursued for its own sake, but became subsidiary to religious and theological teaching. The prescription of the old classical literature, which is symbolized in the fable of the destruction of the Palatine library by Gregory the Great, was only too effectual. The Gregorian tradition of opposition to pagan learning long continued to dominate the literary pursuits of the monastic orders and the labours of the scriptorium.

During the 6th and 7th centuries the learning which had been driven from the Continent took refuge in the British Islands, where it was removed from the political disturbances of the mainland. In the Irish monasteries during this period there appear to have been many books, and the Venerable Bede was superior to any scholar of his age. Theodore of Tarsus brought a considerable number of books to Canterbury from Rome in the 7th century, including several Greek authors. The library of York, which was founded by Archbishop Egbert, was almost more famous than that of Canterbury. The verses are well known in which Alcuin describes the extensive library under his charge, and the long list of authors whom he enumerates is superior to that of any other library possessed by either England or France in the 12th century, when it was unhappily burnt. The incursions of the Northmen in the 9th and 10th centuries had been fatal to the monastic libraries on both sides of the channel. It was from York that Alcuin came to Charlemagne to superintend the school attached to his palace; and it was doubtless inspired by Alcuin that Charles issued the memorable document which enjoined that in the bishoprics and monasteries which had been founded in 774, and which all through the Middle Ages stood in great respect. Lupus Servatus, a pupil of Hrabanus Maurus at Fulda, and afterwards abbot of Ferrières, was a devoted student of the classics and a great collector of books. His correspondence illustrates the difficulties which then attended the study of literature through the paucity and dearth of books, the declining care for learning and the increasing troubles of the time. Nor were private collections of books altogether wanting during the period in which Charlemagne and his successors laboured to restore the lost traditions of liberal education and literature. Pepin le Bref had indeed met with scarcely response to the request for books which he addressed to the pontiff Paul I. Charlemagne, however, collected a considerable number of choice books for his private use in two places. Although these collections were dispersed at his death, his son Louis formed a library which continued to exist under Charles the Bald. About the same time Eberard, count of Friuli, formed a considerable collection which he bequeathed to a monastery. But the greatest private collector of the Middle Ages was doubtless Gerbert, Pope Sylvester II, who showed the truest zeal and spent large sums in collecting books, not only in Rome and Italy, but from Germany, Belgium, and even from Spain.

The hopes of a revival of secular literature fell with the decline of the schools established by Charles and his successors. The knowledge of letters remained the prerogative of the church, and for the next four or five centuries the collecting and multiplication of books were almost entirely confined to the monasteries. Several of the greater orders made these an express duty; this was especially the case with the Benedictines. It was the first care of St. Benedict, we are told, that in each newly founded monastery there should be a library, "at vult curia quædam illustrium auctorum." Monte Cassino became the starting point of a long line of institutions which were destined to be the centres of religion and of literature. It must indeed be remembered that literature in the sense of St. Benedict meant Biblical and theological works, the lives of the saints and martyrs, and the lives and writings of

the fathers. Of the reformed Benedictine orders the Carthusians and the Cistercians were those most devoted to literary pursuits. The abbots of Fleury, of Malm, and of St. Gall were remarkable for the splendour of their libraries. In a later age the labours of the congregation of St. Maur form one of the most striking chapters in the history of learning. The Augustinians and the Dominicans rank next to the Benedictines in their care for literature. The libraries of St. Geneviève and St. Victor, belonging to the former, were amongst the largest of the monastic collections. Although their poverty might seem to put them at a disadvantage as collectors, the mendicant orders cultivated literature with much assiduity, and were closely connected with the intellectual movement to which the universities owed their rise. In England Richard of Bury presses them for their extraordinary diligence in collecting books. Sir Richard Whittington built a large library for the Grey Friars in London, and they possessed considerable libraries at Oxford.

It would be impossible to attempt here an account of all the libraries established by the monastic orders. We must be content to enumerate a few of the most eminent.

In Italy Monte Cassino is a striking example of the dangers and vicissitudes to which monastic collections were exposed. Ruined by the Lombards in the 6th century, the monastery was rebuilt and a library established to fall a prey to Saracens and to fire in the 9th. The collection then reformed survived many other chances and changes, and still exists. It affords a conspicuous example of monastic industry in the transcription not only of theological but also of classical works. The library of Bobbio was famous for its palimpsests. The collection, of which a catalogue of the 10th century is given by Muratori,¹ was finally transferred to the Ambrosian library at Milan. Of the library of Pomposio, near Ravenna, Montauson has printed a catalogue dating from the 11th century.

Of the monastic libraries of France the principal were those of Fleury, of Cluny, of St. Riquier, and of Corbie. At Fleury Abbot Macharius in 1146 imposed a contribution for library purposes upon the officers of the community and its dependences, an example which was followed elsewhere. After many vicissitudes, its MSS., numbering 233, were deposited in 1753 in the town library of Orléans. The library of St. Riquier in the time of Louis the Pious contained 256 MSS., with over 500 works.² Of the collection at Corbie in Picardy we have also catalogues dating from the 12th and from the 17th centuries. Corbie was famous for the industry of its transcribers, and appears to have stood in active literary intercourse with other monasteries. In 1638, 490 of its choicest manuscripts were removed to St. Germain-des-Prés. The remainder were removed after 1794, partly to the national library at Paris, partly to the town library of Amiens.³

The chief monastic libraries of Germany were at Fulda, Corvey, Reichenau, and Speinheim. The library at Fulda owed much to Charlemagne and to its abbot Hrabanus Maurus. Under Abbot Sturmus four hundred monks were hired as copyists. In 1561 the collection numbered 774 volumes. The library of Corvey on the Weser, after being despoiled of some of its treasures in the Reformation age, was presented to the university of Marburg in 1811. It then contained 109 volumes, with 400 or 500 titles. The library of Reichenau, of which several catalogues are extant, fell a prey to fire and neglect, and its ruin was consummated by the Thirty Years' War. The library

¹ *Antiq. Bibl. Med. ævæ*, lib. 817-84.

² *Diatribæ Bibliocæ*, chap. xxii.

³ Catalogue printed in Edwards, *Memoirs of Libraries*, i. 397-401.

of Sponheim owes its great renown to John Trithemius, who was abbot at the close of the 15th century. He found it reduced to 10 volumes, and left it with upwards of 2000 at his retirement. The library at St Gall, formed as early as 816 by Goxbert, its second abbot, still exists.

England. In England the principal collections were those of Canterbury, York, Wearmouth, Whitby, Glastonbury, Croyland, Peterborough, and Durham. Of the library of the monastery of Christ Church, Canterbury, originally founded by Augustine and Theodore, and restored by Lanfranc and Anselm, a catalogue has been preserved dating from the 13th or 14th century, and containing 698 volumes, with about 3000 works. Bennet Biscop, the first abbot of Wearmouth, made five journeys to Rome, and on each occasion returned with a store of books for the library. It was destroyed by the Danes about 867. Of the library at Whitby there is a catalogue dating from the 12th century. The catalogue of Glastonbury has also been printed.¹ When the library of Croyland perished by fire in 1091 it contained about 700 volumes. The library at Peterborough was also rich; from a catalogue of about the end of the 14th century it had 344 volumes, with nearly 1700 titles. The catalogues of the library at the monastery of Durham have been printed by the Surtees Society, and form an interesting series.

These catalogues with many others² afford abundant evidence of the limited character of the monkish collections, whether we look at the number of their volumes or at the nature of their contents. We must remember that the beliefs and discipline imposed upon the monk hardly allowed of his caring for literature for its own sake; we must also remember that the transcription of manuscripts so industriously pursued in the monasteries was a mechanical employment. The scriptoria were manufactories of books and not centres of learning. Indeed the very pains bestowed upon carefulness and neatness of transcription, and especially upon the illustrating and ornamenting of the more beautiful manuscripts, were little calculated to divert the attention of the monks from the vehicle to the thought which it expressed. The pride taken by so many communities in the richness and splendour of their libraries was often doubtless the pride of the collector and not of the scholar. That in spite of the labours of so many transcribers the costliness and scarcity of books remained so great may have been partly, but cannot have been wholly, due to the scarcity of writing materials. It may be suspected that indolence and carelessness were the rule in most monasteries, and that but few of the monks keenly realized the whole force of the sentiment expressed by one of their number in the 12th century—"Cianstrum sine armario quasi castrum sine armamento." Nevertheless it must be admitted that to the labours of the monkish transcribers we are indebted for the preservation of Latin literature.

Arabians. The first conquests of the Arabians, as we have already seen, threatened hostility to literature. But, as soon as their conquests were secured, the caliphs became the patrons of learning and science. Greek manuscripts were eagerly sought for and translated into Arabic, and colleges and libraries everywhere arose. Baghdad in the East and Cordova in the West became the seats of a rich development of letters and science during the ages when the civilisation

of Europe was most obscured. Cairo and Tripoli were also distinguished for their libraries. The royal library of the Fatimies in Africa is said to have numbered 100,000 manuscripts, while that collected by the Omayyads of Spain is reported to have contained six times as many. It is said that there were no less than seventy libraries opened in the cities of Andalusia. Whether these figures be exaggerated or not—and they are much below those given by some Arabian writers, which are undoubtedly so—it is certain that the libraries of the Arabians and the Moors of Spain offer a very remarkable contrast to those of the Christian nations during the same period.³

The literary and scientific activity of the Arabians appears to have been the cause of a revival of letters amongst the Greeks of the Byzantine empire in the 9th century. Under Leo the Philosopher and Constantine Porphyrogenitus the libraries of Constantinople awoke into renewed life. The compilations of such writers as Stobaeus, Photius, and Suidas, as well as the labours of innumerable critics and commentators, bear witness to the activity, if not to the lofty character of the pursuits, of the Byzantine scholars. The labours of transcription were industriously pursued in the libraries and in the monasteries of Mount Athos and the Aegean, and it was from these quarters that the restorers of learning brought into Italy so many Greek *Recens.* manuscripts. In this way many of the treasures of ancient literature had been already conveyed to the West before the fate which overtook the libraries of Constantinople on the fall of the city in 1453.

Meanwhile in the West, with the reviving interest in literature which already marks the 14th century, we find arising outside the monasteries a taste for collecting books. St Louis of France and his successors had formed small collections, none of which survived its possessor. It was reserved for Charles V. to form a considerable library which he intended to be permanent. In 1375 he had amassed 910 volumes, and had a catalogue of them prepared, from which we see that it included a good deal of the new literature. In our own country Guy, earl of Warwick, formed a curious collection of French romances, which he bequeathed toordesley Abbey on his death in 1315. Richard d'Angervyle of Bury, the author of the *Philobiblon*, amassed a noble collection of books, and had special opportunities of doing so as Edward III.'s chancellor and ambassador. He founded Durham College at Oxford, and equipped it with a library a hundred years before Humphrey, duke of Gloucester, made his benefaction of books to the university. The taste for secular literature, and the enthusiasm for the ancient classics, gave a fresh direction to the researches of collectors. A disposition to encourage literature began to show itself amongst the great. This was most notable amongst the Italian princes. Cosimo de' Medici formed a library at Venice while living there in exile in 1433, and on his return to Florence laid the foundation of the great Medicean library. The honour of establishing the first modern public library in Italy had been already secured by Niccolò Niccoli, who left his library of over 800 volumes for the use of the public on his death in 1436. Frederick, duke of Urbino, collected all the writings in Greek and Latin which he could procure, and we have an interesting account of his collection written by his first librarian, Vespasiano. The ardour for classical studies led to those active researches for the Latin writers who were buried in the monastic libraries which are especially identified with the name of Poggio. For some time before the fall of that capital, the perilous state

¹ By Heame in his edition of John of Glastonbury.

² Many such catalogues may be found in the collections of D'Achery, Martene and Durand, and Pex, and in the bibliographical periodicals of Nazarian and Fethallah. The Rev. Joseph Hunter has collected some particulars as to the contents of the English monastic libraries, and Mr Edwards has printed a list of the catalogues known to exist (*Libraries and Founders of Libraries*, 1865, pp. 448-54). There are said to be over six hundred such catalogues in the Royal Library at Munich.

³ Among the Arabs, however, as among the Christians, theological bigotry did not always approve of non-theological literature, and the great library of Cordova was sacrificed by Almanzor to his reputation

of the Eastern empire had driven many Greek scholars from Constantinople into western Europe, where they had directed the studies and formed the taste of the zealous students of the Greek language and literature. The enthusiasm of the Italian princes extended itself beyond the Alps. Matthias Corvinus, king of Hungary, amassed a collection of splendidly executed and magnificently bound manuscripts, which at his death are said to have reached the almost incredible number of 50,000 volumes. The library was not destined long to survive its founder. There is reason to believe that it had been very seriously despoiled even before it perished at the hands of the Turks on the fall of Buda in 1527. A few of its treasures are still preserved in some of the libraries of Europe. While these munificent patrons of learning were thus taking pains to recover and multiply the treasures of ancient literature by the patient labour of transcribers and calligraphers, an art was being elaborated which was destined to revolutionize the whole condition of literature and libraries. With the invention of printing, so happily coinciding with the revival of true learning and sound science, the modern history of libraries may be said to begin.

MODERN LIBRARIES.

These are most conveniently described in geographical order, and a general survey on this method will be found in the tables at the end of this article. The following sketch supplies additional details.

The United Kingdom.

^{British Museum.} The British Museum ranks in importance before all the great libraries of the world, with the single exception of the Bibliothèque Nationale at Paris, and far exceeds the latter institution in the systematic arrangement and accessibility of its contents. Recent changes have somewhat limited its former universality of character, but it still remains the grand national repository of literature and archaeology. The library consists of over 1,550,000 printed volumes and 50,000 manuscripts. This extraordinary opulence is principally due to the enlightened energy of the late Sir Antonio Panizzi. The number of volumes in the printed book department, when he took the keepership in 1837, was only 240,000; and during the nineteen years he held that office about 400,000 were added, mostly by purchase, under his advice and direction. It was Panizzi likewise who first seriously set to work to see that the national library reaped all the benefits bestowed upon it by the Copyright Act.

The foundation of the British Museum dates from 1753, when effect was given to the bequest (in exchange for £30,000 to be paid to his executors) by Sir Hans Sloane, of his books, manuscripts, curiosities, &c., to be held by trustees for the use of the nation. A bill was passed through parliament for the purchase of the Sloane collections and of the Harleyan MSS., costing £10,000. To these, with the Cottonian MSS., acquired by the country in 1700, was added by George II., in 1757, the royal library of the former kings of England, coupled with the privilege, which that library had for many years enjoyed, of obtaining a copy of every publication entered at Stationers' Hall. This addition was of the highest importance, as it enriched the museum with the old collections of Archbishop Cranmer, Henry prince of Wales, and other patrons of literature, while the transfer of the privilege with regard to the acquisition of new books, a right which has been maintained by successive Copyright Acts, secured a large and continuous augmentation, the yearly average of which has now reached 8000 or 9000 volumes. A lottery having

been authorized to defray the expenses of purchases, as well as for providing suitable accommodation, the museum and library were established in Montagu House, and opened to the public 16th January 1759. In 1763 George III. presented the well-known Thomason collection (in 2320 volumes) of books and pamphlets issued in England between 1640 and 1662, embracing all the controversial literature which appeared during that period. The Rev. C. M. Cracherode, one of the trustees, bequeathed his collection of choice books in 1798, and in 1820 Sir Joseph Banks left to the nation his important library of 16,000 volumes. Many other libraries have since then been incorporated in the museum, the most valuable being George III.'s royal collection (18,000 volumes of tracts, and 65,259 volumes of printed books, including many of the utmost rarity, which had cost the king about £130,000), which was presented (for a pecuniary consideration, it has been said) by George IV. in 1823, and that of the Right Honourable Thomas Grenville (20,240 volumes of rare books, all in fine condition and binding), which was acquired under bequest in 1846. The Cracherode, Banksian, King's, and Grenville libraries are still preserved as separate collections. Other libraries of minor note have also been absorbed in a similar way, while, at least since the time of Panizzi, no opportunity has been neglected of making useful purchases at all the British and Continental book auctions.

The collection of English books is far from approaching completeness, but, apart from the enormous number of volumes, the library contains an extraordinary quantity of rarities. Few libraries in the United States equal either in number or value the American books in the museum. The collection of Slavonic literature, due to the initiative of the late Mr Watts, is a remarkable feature; after that of the St Petersburg Imperial Library it is believed to be the largest in existence. Indeed, in cosmopolitan interest the museum is without a rival in the world, possessing as it does the best Hungarian collection out of that country, the best Dutch library out of Holland, and in short the best library in any European language out of the territory in which the language is vernacular. The Hebrew books number over 12,000, the Chinese nearly 27,000, and the printed books in other Oriental languages about 13,000 volumes. Periodical literature has not been forgotten, and the series of newspapers is of great extent and interest. Great pains are taken by the authorities to obtain the copies of the newspapers published in the United Kingdom to which they are entitled by the provisions of the Copyright Act, and upwards of 1900 are annually collected, filed, and bound. Under the English Copyright Act there were received, in 1881, not counting single pieces, such as broadsides, songs, &c., 8567 volumes and pamphlets, and 31,792 parts of volumes, and through the international copyright treaties 941 volumes and 433 parts.

The department of MSS. is at least equal in importance to that of the printed books. The collection of MSS. in European languages ranges from the 2d century before Christ down to our own times, and includes the *ALEXANDRIAN MS. (g.a.)*. The old historical chronicles of England, the charters of the Anglo-Saxon kings, and the celebrated series of Arthurian romances are well represented; and care has been taken to acquire on every available opportunity the unprinted works of English writers. The famous collections of MSS. made by Sir Robert Cotton, and Harley and of Oxford, have already been mentioned, and from these and other sources the museum has become rich in early Anglo-Saxon and Latin codices, some of them exhibiting marvels of skill in calligraphy and ornamentation, such as the charters of King Edgar and Henry I. to Hyde Abbey, which are written in gold letters, others interesting for different reasons, such as the book of Durham, in Latin and Anglo-

Saxon, reputed to have been Bede's own copy. The Burney collection of classical MSS. furnished important additions, so that from this source and from the collection of Arundel MSS. (transferred from the Royal Society in 1831), the museum can boast of an early copy of the *Iliad*, and one of the earliest known codices of the *Odyssey*. There is likewise an extensive series of ancient Irish texts, with many modern transcripts, the Bridgewater MSS. on French history, and Lord Guilford's similar collection to illustrate the history of Italy. Special references may be made to the celebrated Bedford Missal, illuminated by the duke of Bedford, regent of France, and to Henry VI.'s copy of Hardyng's chronicle. The Oriental collection is also extremely rich and ample, including the library formed by Mr Rich (consul at Baghdad in the early part of this century), and a vast quantity of Arabic, Persian, and Turkish MSS.; the Chambers collection of Sanskrit MSS.; several other collections of Indian MSS.; and a copious library of Hebrew MSS. (including that of the great scholar Michaelis, and codices of great age, recently brought from Yemen). The collection of Syriac MSS., embracing the relics of the famous library of the convent of St Mary Deipara in the Nitrian desert, formed by the abbot Moses of Nisibis, in the 10th century, is the most important in existence; of the large store of Abyssinian volumes many were amassed after the campaign against King Theodore. The number of genealogical rolls and documents relating to the local and family history of Great Britain is very large. Altogether there are now over 50,000 MSS. (of which 8500 are Oriental), besides 45,000 charters and rolls.

The musical works comprise upwards of 11,000 volumes of vocal and nearly 6000 volumes of instrumental music, the number of separate pieces amounting to more than 70,000. The catalogue is in manuscript. The collection of maps, charts, plans, and topographical drawings is also a remarkable one. The maps are nearly 116,000 in number. Letter A of a printed catalogue of the maps is already in type.

The name of Furness is inseparably connected with his circular reading-room, opened in 1867. This is encompassed by the new library, with alcove-space for a million and a half volumes. The presses inside the reading-room, arranged in three tiers, contain upwards of 80,000 volumes, those on the ground floor (80,000) being books of reference to which readers have unlimited access. The comfortable accommodation for readers is briefly described below. Perhaps not the least convenient arrangement here is the presence of the superintendent, whose duty it is to help readers in their difficulties; the varied qualifications of the present holder of the office are well known. The electric light has been successfully used until 8 o'clock P.M. though the darker months from the earlier part of October. In order to enjoy the privilege of reading at the British Museum, the applicant (who must be over twenty-one years of age) must obtain a renewable ticket of admission through a recommendation from a householder addressed to the principal librarian. Formerly no person was admitted until the ticket had been presented at the entrance, but lately this rule has been considerably relaxed. During 1881 the number of readers was 198,842. In spite of the hostile criticism to which it has sometimes been subjected, it cannot be denied that the general catalogue of the printed books (which now runs to upwards of 2000 volumes in manuscript) is a marvellous work executed in a praiseworthy manner. Some slight notion of the extent of the catalogue may be derived from the fact that it contains the works of over 2400 authors of the name of Smith. But the rapidly increasing size of the catalogue has impelled the trustees to resort to print in order to diminish the bulk. Since 1880 the titles of all accessions have been printed, and as it becomes necessary to break the manuscript volumes, the titles contained in them are also printed, in course of time, therefore, the whole of the titles will have been put into type. The sheets are published at regular intervals, and can be purchased. It is proposed to issue separately headings of special interest, whether of subjects or of authors, e.g., Shakespeare, Bible, Liturgies, &c. Considerable progress has been made in the preparation for the press of a catalogue of English books printed before the year 1640.

The printed catalogues of books commence with one published in 2 vols. folio, 1787, followed by that of 1818-19 in 7 vols. 8vo; the next is that of the library of George III. in 2 vols. folio with

2 vols. 8vo, 1884, describing the geographical and topographical collections; and then the *Bibliotheca Grenvilliana*, 1845-74, 4 vols. 8vo. The first vol. (letter A) of a general catalogue appeared in 1841 in a folio volume which has never been added to. The octavo catalogue of the Hebrew books came out in 1867; that of the Sanskrit and Pali literature is in 4to, 1878, and the Chinese catalogue is also in 4to, 1877. There are also printed lists of the books of reference (1871) and bibliographies (1881) in the reading-room. Private enterprise has done a great deal towards cataloguing the American books (by Mr H. Stevens, 4 vols. 8vo), and the British topographical literature has recently been the subject of a similar publication by Mr J. P. Anderson, 8vo, 1881.

The printed catalogues of the MSS. are—that of the old Royal Library, 1794, 4to, the Sloane and others hitherto undescribed, 1782, 2 vols. 4to, the Cottonian, 1802, folio; the Harleian, 1808, 4 vols. folio, the Hargrave, 1813, 4to; the Lansdowne, 1813, folio; the Arundel, 1840, folio; the Burney, 1840, folio; the Oriental (Arabic and Ethiopic), 6 pts., folio, 1858-71; the Syriac, 1870-73, 3 pts., 4to, the Ethiopic, 1877, 4to, the Persian, 1879-80, 2 vols. 4to, and the Spanish, 1875-80, 3 vols. 8vo. There are also catalogues of the Greek and Egyptian papyri, 1859-48, 5 pts., folio. The additional MSS. from 1831-75 are described in 10 vols. 8vo, 1856-77, with indexes (1758-1835) in folio and (1864-76) in 8vo. A catalogue of the MS. museum was produced in 1842, 8vo; and one of the MS. maps in 1844, 2 vols. 8vo.

The binding is done upon the premises, and the sum expended each year is £2000. The average sum annually spent upon the purchase of books is about £10,000, and upon MSS. £2500. Since the catalogue ceased to be transcribed £5000 is annually spent on printing.

London is very badly off as regards public libraries, and other the largest general collection which is available without any tedious preliminary forms is that of the corporation of the city of London at the Guildhall. A library was established here by Sir Richard Whittington between 1421-26, and several notices in the civic records show how well in those times the citizens cared for their books. But it did not remain without accident; in 1522 the Lord Protector Somerset carried off three cart-loads of books, and during the great fire of 1666 the remainder was destroyed together with the library buildings. Nothing was done to repair the loss until 1824, when a committee was appointed, and rooms set apart for library purposes. In 1840 a catalogue of 10,000 volumes was printed, and in 1859 a second was prepared of 40,000 volumes. In consequence of the large and increasing number of the readers, the present fine building was commenced about ten years later, and, after having cost £90,000, was opened in 1873 as a free public library. There are now upwards of 80,000 printed volumes and 300 MSS. The contents are of a general character, and include a special collection of books about London, the Solomonian Hebrew and rabbinical library, and the libraries of the Clockmakers' Company and the old Dutch church in Austin Friars. The only rate-supported library in the metropolis is that of the united parishes of St Margaret and St John at Westminster (13,527 volumes), founded in 1837, principally by the influence of the late Lord Hathley, with a small branch at Knightsbridge. The Notting Hill Free Public Library (5000 volumes) is supported by Mr James Heywood, and the Bethnal Green Free Library and South London Free Library by voluntary subscriptions.

Of libraries of a more special character, those principally devoted to theology have perhaps the first claim to notice. The archiepiscopal library at Lambeth was founded in 1610 by Archbishop Bancroft, and has been enriched by the gifts of Laud, Tenison, Manners Sutton, and others of his successors; it is now lodged in the noble hall built by Juxon. The treasures consist of the illuminated MSS., and a rich store of early printed books; of the latter two catalogues have been issued by S.R. Maitland. The MSS. are described in H. J. Todd's catalogue, 1812. Stion College is a guild of the parochial clergy of the city and suburbs of London, and the library was founded in 1629 for their use; however, many also read (but not borrow) the

Of libraries of a more special character, those principally devoted to theology have perhaps the first claim to notice. The archiepiscopal library at Lambeth was founded in 1610 by Archbishop Bancroft, and has been enriched by the gifts of Laud, Tenison, Manners Sutton, and others of his successors; it is now lodged in the noble hall built by Juxon. The treasures consist of the illuminated MSS., and a rich store of early printed books; of the latter two catalogues have been issued by S.R. Maitland. The MSS. are described in H. J. Todd's catalogue, 1812. Stion College is a guild of the parochial clergy of the city and suburbs of London, and the library was founded in 1629 for their use; however, many also read (but not borrow) the

books when recommended by some benefited metropolitan clergyman. The library is especially rich in liturgies, Port-Royal authors, pamphlets, &c. The copyright privilege was commuted in 1835 for an annual sum of £363, 16s. 2d. The present building was erected immediately after the great fire. The chamber in the old cloisters, in which the library of the dean and chapter of Westminster is preserved, is well known from the charming description by Washington Irving in his *Sketch Book*. There are about 11,000 volumes, mostly of old theology and history, including many rare Bibles and other valuable books. The library of the dean and chapter of St Paul's was founded in very early times, and now numbers some 8700 volumes, mainly theological, besides over 10,300 pamphlets, with a good collection of early Bibles and Testaments, Paul's Cross Sermons, and works connected with the cathedral. Dr Williams's library was founded by the will of an eminent Presbyterian divine of that name; it was opened in 1729. The books (30,000 printed volumes and 1000 MSS.) are housed in a new building, completed in 1873. Theology of all schools of opinion is represented, and there are special collections of theosophical books and MSS., the works of Boehme, Law, and other mystical writers. The MSS. include the original minutes of the Westminster Assembly, letters and treatises of Richard Baxter, &c. The British and Foreign Bible Society has a remarkable collection of Bibles and Biblical literature, of which a printed catalogue was published in 1855. Perhaps the best library of Catholic theology in London is that of the Oratory at South Kensington, established in 1849.

Of the law libraries, that at Lincoln's Inn is the oldest and the largest. It dates from 1497, when John Netherleske, a member of the society, made a bequest of forty marks, part of which was to be devoted to the building of a library for the benefit of the students of the laws of England. A catalogue of the printed books was published in 1859, and the MSS. were catalogued by the Rev. Joseph Hunter in 1837. The library of the Inner Temple is known to have existed in 1540. In the middle of the 17th century it received a considerable benefaction from William Petyt, the well-known keeper of the Tower records. There are now about 36,000 volumes, including the pamphlets collected by John Adolphus for his *History of England*, books on crime and prisons brought together by Mr Crawford, and a selection of works on jurisprudence made by John Austin. A library in connexion with the Middle Temple was in existence during the reign of Henry VIII., but the date usually assigned to its foundation is 1641, when Robert Ashley left his books to the inn of which he had been a member. Gray's Inn Library was perhaps established before 1555. In 1669 was made the first catalogue of the books, and the next, still extant, in 1689. The Incorporated Law Society (1831) has a good law and general library (30,000 volumes), including the best collection of private Acts of Parliament in England, and a large number of pamphlets relating to Anglo-Catholic controversies brought together by the late Rev Joseph Mendham. The catalogue was printed in 1869.

The collegiate library at Dulwich dates from 1619, and a list of its earliest accessions, in the handwriting of the founder, may still be seen. There are now about 7000 volumes of miscellaneous works of the 17th and 18th centuries, with a few rare books. A catalogue of them was printed in 1880; and one describing the MSS. (567) and the muniments (606) was issued during the succeeding year. The last two classes are very important, and include the well-known "Alleyne Papers" and the theatrical diary of Philip Henslow. Soon after the foundation of the University of London in 1837, an endeavour was made to provide a library, but it has had to look to gifts rather

than to purchases for its accessions. In 1871 the university obtained, in this manner, the library of the historian Grote, and in the same year Lord Overstone purchased and presented the mathematical collection of De Morgan. A catalogue was printed in 1875. The books at University College (1828) are much more numerous, and here also a considerable proportion are donations, including the Morrison Chinese library of 10,000 volumes, the Daulby-Roscoe Icelandic books, the Graves mathematical and physical library, and the Barlow Dante bequest. A printed catalogue of the greater portion was brought out in 1879. The library at King's College includes a collection of works on Eastern subjects bequeathed by Dr Marsden, as well as the scientific books formerly belonging to Sir Charles Wheatstone. The medical library is distinct. The educational library at the South Kensington Museum numbers about 42,200 volumes, and may be consulted by teachers and students of the departmental schools, and by other persons on the same terms as the art library mentioned below. The ninth edition of the catalogue appeared in 1876.

The library of the Patent Office is the largest scientific and technical collection, indeed the only one which is readily open to the public. There are at present 80,000 volumes, including a very extensive series of the transactions and journals of learned bodies. A catalogue is now in the press. Transactions and proceedings of societies, with scientific periodicals, compose almost the whole library of the Royal Society, which extends to about 40,000 volumes. The diarist Evelyn induced the seventh duke of Norfolk to present to the Society the Arundel library, part of which had formerly belonged to Matthias Corvinus. The MSS., however, were sold to the British Museum in 1831 for £3559, and a quantity of rare printed books have also been disposed of. Scientific inquirers are freely admitted to the Museum of Practical Geology in Jermyn Street, where there are over 30,000 volumes on geology, mineralogy, mining, and metallurgy, including the former collections of De la Beche and Murchison. A printed catalogue was issued in 1878. For the libraries of other scientific institutions see the tables.

Medical and surgical libraries are attached to all the chief hospitals and medical societies (see the tables).

For the fine arts there is the National Art Library (1852) at the South Kensington Museum, which is now an excellent collection of 56,000 volumes, 66,000 photographs, 25,000 drawings, and 80,000 prints. Art students are admitted free, as are ordinary visitors on Museum pay days; otherwise a charge of 6d. per week is made to the latter. The library of the Royal Academy of Arts, after its journey from Somerset House to Trafalgar Square, has been lodged in the old ball-room of Burlington House since 1875. At the National Gallery is preserved for official use the library (3500 volumes) formerly belonging to Sir C. L. Eastlake, P.R.A., which is particularly rich in catalogues and descriptions of picture galleries. The Royal Institution of British Architects (1834) possesses over 6500 volumes on architectural and allied subjects, including an almost complete collection of editions of Vitruvius. The library of the Royal Academy of Music (1822) is almost exclusively musical, and, although numbering less than 1000 volumes, contains many rare and interesting works. The library of the Sacred Harmonic Society is said to be one of the best arranged and most valuable musical collections in England. A third edition of the printed catalogue appeared in 1872, when the library contained 4851 volumes.¹

¹ For a very complete account of the chief public and private musical collections both at home and abroad, see the article "Musical Libraries," in Grove's *Dictionary of Music*, v. 417.

The best library of archaeology and kindred subjects is that of the Society of Antiquaries, consisting of nearly 20,000 printed volumes and 500 MSS. It is rich in early printed books, topography, heraldry, and numismatics, and includes a curious collection of books on pageants presented by Mr Fairholt, and the remarkable assemblage of lexicographical works formerly belonging to the late Albert Way, given by his widow. There is a good muster of heraldic works at the Herald's College, and the library of Sir John Soane (15,000 volumes) is still preserved in the museum at his house in Lincoln's Inn Fields. The printed catalogue (1878) shows that it is a fairly good collection of books on architecture and antiquities.

Among subscription libraries, the London Library stands first in order of importance. It was founded in 1841 as a lending library for the use of scholars, and Dean Milman, Sir G. C. Lewis, Mr Gladstone, Thomas Carlyle, Henry Hallam, and other eminent men took part in its formation. By means of a moderate subscription, funds were raised for the purchase of books on general subjects, which now amount to about 90,000 volumes. The latest catalogue was printed in 1875, with a supplement in 1881. The London Institution (1808) is a proprietary library to which proprietor's nominees and yearly subscribers also have admission. For reference purposes reader's tickets are very liberally granted to other persons. The books now number about 70,000 volumes in general literature; the departments of history and topography are especially rich, and the number is rapidly growing. A complete catalogue was published in 1837-43; almost the whole collection, including reference and circulating libraries very minutely classified, is contained in one room. Porson filled the position of librarian here at the close of his life, but he proved no better a librarian than did Casanbon before him at Paris. The library of the Royal Institution of Great Britain was founded in 1803 by the subscriptions of the members, amounting, in 1806, to £3000. There are now 40,000 volumes in scientific and general literature; they are not lent out. There is an interesting series of 56 volumes of MS. correspondence relating to the American war.

The libraries of the two branches of the legislature may be named with those of the great public offices. The Foreign Office library contains about 70,000 volumes, including the old library of the Board of Trade (20,000 volumes); history, geography, and law are well represented, and the department of treaties and diplomacy is of course very complete. The India Office library was formed by a vote of the court of directors of the East India Company in 1801. The services in India were also invited to aid in the creation of an institution which should become a permanent repository of Oriental lore, and many munificent donations were received in consequence of the appeal. The printed books now number nearly 40,000, chiefly on Indian and Oriental subjects, with about 10,000 Sanskrit, Arabic, Persian, Farsi, and other Oriental manuscripts. Loth's excellent catalogue of the Arabic codices was published in 1877, and other catalogues are now ready for the press. At the Colonial Office there is a collection of about 12,000 works relating to colonial history and administration, and the Home Office possesses about 5000 volumes of parliamentary, historical, and legal works. The Admiralty library extends to about 25,000 volumes, chiefly voyages and travels; a printed catalogue was issued in 1875. At the War Office there are also 25,000 volumes, mainly topographical and military. The MS. records are estimated to extend to 100,000 volumes, but only those of the last twenty years are kept in Pall Mall, the remainder being at the Record Office. These records extend from the time of Queen Elizabeth, and there are some of earlier date. The older volumes belonged to the late Board of Ordnance,

and the series also includes the despatches from generals commanding armies on foreign service. All these libraries are for official use only, but at the India Office strangers are admitted upon proper introduction.

Many of the principal clubs possess libraries; that of the Athenæum is by far the most important. It now numbers about 48,000 volumes of books in all departments of literature, and is especially rich in well-bound and fine copies of works on the fine arts, archaeology, topography, and history. The pamphlets, of which there is a complete printed catalogue, as well as of the books, form a remarkable series, including those collected by Gibbon and Mackintosh. Next comes the Reform Club, with about 30,000 volumes, chiefly in belles-lettres, with a fair proportion of parliamentary and historical works. The Oxford and Cambridge Club has 20,000 volumes in general and classical literature. At the Garrick there is a small dramatic collection, and the United Service Club, besides a number of books on professional subjects, possesses the fine library which formerly belonged to Dugald Stewart.

A few libraries which could not be brought into any of the foregoing classes may now be spoken of. First comes the library of the Royal Geographical Society (1832), a valuable collection of 20,000 volumes of voyages and travels, and works on the sciences connected with geography, with many costly Government publications and geographical serials. The catalogue has been printed with supplements down to 1880. The maps and charts number 35,000, with 500 atlases and 240 large diagrams. Since 1864, in consideration of an annual grant of £500 from the treasury, the map room has been open for public reference. At the Royal United Service Institution there are also about 20,000 volumes, chiefly naval and military, with a printed catalogue, 1865. Besides the members, officers of both services are admitted. The Royal Asiatic Society has a library of nearly 8000 printed books, with 750 MSS. in Sanskrit, Persian, Turkish, &c, 5000 Chinese books, and 220 Japanese. Besides the art and educational libraries at South Kensington, there are also deposited at the museum, and open under the same regulations, the library of the Rev. Alexander Dyce, bequeathed in 1869, and the books of John Forster, left in 1876. The Dyce collection (15,000 volumes) is strong in the English drama and poetry, Italian literature, and classical authors. The Forster library (19,000 volumes) abounds in history, biography, travels, plays, and fiction, tracts, Americana, proclamations, ballads, &c; the manuscript includes three note-books of Leonardo da Vinci, and the Garrick correspondence in 39 volumes.

Notices of a considerable number of other metropolitan libraries, not mentioned in the preceding pages, may be found in the tables at the end of this article.

With one or two exceptions, libraries are attached to the cathedrals of England and Wales. Though they are of course intended for the use of the cathedral or diocesan clergy, they are in most cases open to any respectable person who may be properly introduced. They seldom contain very much modern literature, chiefly consisting of older theology, with more or less addition of classical and historical literature. They vary in extent from a few volumes, as at Llandaff or St David's, to 15,000 volumes, as at Durham. Together they possess nearly 150,000 printed and manuscript volumes. As a rule, very little is spent upon them, and they are very little used.

The library of Christ Church, Oxford, belongs alike to the college and the cathedral, but will be more properly described as a college library. The cathedral library of Durham dates from monastic times, and possesses many of the books which belonged to the monastery. These were added to by Dean Saurby, the second founder of the library, and Bishop Coeln. The collection has been considerably increased in more modern times, and now contains

15,000 volumes. It is especially rich in MSS., some of which are of great beauty and value; a catalogue of them was printed in 1825. The library has good topographical and entomological collections. The chapter spent £370 per annum in salaries and in books. The library at York numbers about 11,000 volumes, and has been very liberally thrown open to the public. It is kept in the former chapel of the archbishop's palace, and has many valuable MSS. and early printed books. The foundation of the library at Canterbury dates probably from the Roman mission to England, 598 A.D., although the library does not retain any of the books then brought over, or even of the books said to have been sent by Pope Gregory to the first archbishop in 601. It is recorded that among Leofric's buildings was a new library, and Becket is said to have collected books abroad to present to the library. The collection now numbers about 9000 printed books, with about 110 MS. volumes, and between 5000 and 7000 documents. A catalogue was printed in 1802. The present building was erected in 1367 on part of the site of the monastic dormitory. The library at Lincoln contains 7400 volumes, of which a catalogue was printed in 1859. It possesses a fine collection of political tracts of the age of Elizabeth, James, and Charles I. The present collection at Winchester dates from the Restoration only, that at Ely is rich in books and tracts relating to the non-union. The library at Exeter possesses many Saxon MSS. of extreme interest, one of them being the gift of Leofric, the first bishop. The treasure of Lichfield was destroyed by the Puritans during the civil war, and the existing library is of later formation. Frances, duchess of Somerset, bequeathed to it nearly 1000 volumes, including the famous *Evangelium* of St. Chad. The collection at Norwich is chiefly modern, and was presented by Dr. Sneyter. The earlier library at Peterborough having almost wholly perished in the civil war, Bishop White Kennett became the virtual founder of the present collection. Salisbury is rich in manuscripts, and a catalogue has recently been printed. Winchester Cathedral Library is mainly the bequest of Bishop Merley in the 17th century. The library at Bristol, then numbering 6000 or 7000 volumes, was burnt and pillaged by the mob in the riots of 1831. Only about 1000 volumes were saved, many of which were recovered, but few additions have been made to them. At Chester in 1691 Dean Aidenne bequeathed his books and part of his estate "as the beginning of a public library for the clergy and city." The library of Hereford is a good specimen of an old monastic library, the books are placed in the Lady Chapel, and about 230 choice MSS. are chained to oaken desks. The books are ranged with the edges outward upon open shelves to which they are attached by chains and bars. The four Welsh cathedrals were supplied with libraries by a deed of settlement in 1706. The largest of them, that of St. Asaph, has about 1750 volumes.

Oxford. The Bodleian Library, though it had been preceded by various efforts towards a university library, owed its origin to Sir Thomas Bodley. After a long and honourable career as a diplomatist he determined, as he says, to take his farewell of state employments, and concluded to set up his staff as the library door in Oxon. Contributing largely himself, and procuring contributions from others, he opened the library with upwards of 2000 volumes in 1602. In 1610 he obtained a grant from the Stationers' Company of a copy of every work printed in the country. The additions made to the library soon surpassed the capacity of the room, and the founder proceeded to enlarge it. By his will he left considerable property to the university for the maintenance and increase of the library. The example set by Bodley found many noble imitators. Amongst the chief benefactors have been Sir Henry Savile, Archbishop Laud, John Selden, Sir Kenelm Digby, Lord Fairfax, Richard Gough, Francis Douce, Richard Rawlinson, Rev. Robert Mason, and F. W. Hope. The library now contains almost 400,000 printed volumes, and about 30,000 manuscripts. The number of separate works exceeds a million. But the number of volumes conveys a very inadequate idea of the valuable character of the collection. In the department of Oriental manuscripts it is perhaps superior to any other European library; and it is exceedingly rich in other manuscript treasures. It possesses a splendid series of Greek and Latin *editiones principes*, and of the earliest productions of English presses. Its historical manuscripts contain most valuable materials for the general and literary history of the country.

The last general catalogue of the printed books was printed in 4 vols. folio, 1848-51. In 1859 it was decided to prepare a new

manuscript catalogue on the plan of the great catalogue at the British Museum, and this has recently been completed in duplicate. It extends to over 700 folio volumes, in which the books are entered on manifold slips. It is an alphabetical author-catalogue; and the Bodleian, like the British Museum, has no accessible subject index. A catalogue on subjects is now, however, in course of preparation. There are also printed catalogues of the books belonging to several of the separate collections. The MSS. are in general catalogued according to the collections to which they belong, and they are all indexed, although they are not all catalogued as yet. Five volumes have been published under the late Mr. Cooke's editorship of the "Catalogue Colmanianus. Bibliothecæ Bodleianæ," 1853-68, in quarto, and there is a folio catalogue of Oriental MSS.

In 1860 the beautiful building known as the "Radcliffe Library," now called the "Camera Bodleiana," was offered to the curators of the Bodleian by the Radcliffe trustees. It is used as a storeroom for the more modern books, including the new periodicals, which lie upon its tables, and it also serves as a reading-room. It is the only room open after the hour when the older building is closed owing to the rule as to the exclusion of artificial light. The separation of the books is a source of some inconvenience in practice, and it has been proposed of late years to remove the entire collections to a new building which should be erected for the purpose of accommodating them.

The library is open by right to all graduate members of the university, and to others (over eighteen years of age) upon producing a satisfactory recommendation. No books are allowed to be sent out of the library except by special leave of the curators, in which respect there is a marked contrast with the practice at the University Library at Cambridge, and still more so with the conspicuous liberality in this respect of the university libraries of Germany. The hours are from 9 to 4 and 9 to 10, according to the time of year, the Camera being open from 10 to 10 all the year round. The library is only closed altogether some twenty-two working days in the year. The general control of the library is committed to a board of thirteen curators. The permanent endowment is comparatively small, the ordinary expenditure, chiefly defrayed from the university chest, is about £4500.

The other important collections not connected with particular colleges are the Radcliffe Library and the library of the Taylor Institution. The former was founded by the famous physician Dr. John Radcliffe, who died in 1714, and bequeathed, besides a permanent endowment of £2850 a year, the sum of £40,000 for a building. The library was opened in 1715, and was at first intended to confine their purchases of books to works on medicine and natural science. When the university museums and laboratories were built in 1850, the trustees allowed the books to be transferred to the museum. The completeness and convenience of the arrangements make the Radcliffe works the most convenient of the university libraries. The Taylor Institution is due to the benefaction of Sir Robert Taylor, an architect, who died in 1788, leaving his property to found an establishment for the teaching of modern languages. The library was established in 1848, and is devoted to the literature of the modern European languages. It contains a fair collection of works on European philology, with a special Dante collection, about 1000 Masarnades and 400 Luther pamphlets. It contains altogether 80,000 volumes, with a few MSS. The French collection, left to the university in 1830, is also lent with the Taylor Library. Books are lent out to members of the university and to others on proper introduction. The endowment affords an income of £6000 to £1000 for library purposes, and about 2000 volumes are added yearly.

The libraries of the several colleges vary considerably in extent and character. That of All Souls was established in 1449 by Archbishop Chichele, and enlarged in 1710 by the munificent bequest of Christopher Codrington. It devotes special attention to jurisprudence, of which it has a large collection. It possesses 40,000 printed volumes and 300 MSS., and fills a splendid hall 200 feet long. The library of Brasenose College has a special endowment fund, so that it has, for a college library, the unusually large income of £2000. The library of Christ Church is rich in diversity and topography. It embraces the valuable library bequeathed by Charles Boyle, third earl of Orrery, amounting to 15,000 volumes, the books and MSS. of Archbishop Wake, and the Morris collection of Oriental books. The building was finished in 1791, and closely resembles the building of Antonine at Rome. The new Doge's Library possesses a fine collection of Aldine, many of them presented by its founder Bishop Fox, and a collection of 17th century tracts catalogued by Mr. Edwards, with about 400 MSS. Exeter College Library has 55,000 volumes, with special collections of classical dissertations and English theological and political tracts. The library of Jesus College has few books of later date than the early part of the last century. Many of them are from the bequest of Sir Leoline Jenkins, who built the existing library. There are also some valuable Welsh MSS. The library of Keble College consists largely of theology, including the MSS. of many of Keble's works. The library of Magdalen College has about 25,000 volumes (including

many volumes of pamphlets) and 250 MSS. It has scientific and topographical collections. The library of Merton College has of late devoted itself to foreign modern history. New College Library has about 17,000 printed volumes and about 350 MSS., several of which were presented by its founder, William of Wykeham. Oriel College Library, besides its other possessions, has a special collection of books on comparative philology and mythology, with a printed catalogue. The fine library of Queen's College is strong in theology, in English and modern European history, and in English county histories. St John's College Library is largely composed of the literature of theology and jurisprudence before 1760, and possesses a collection of medical books of the 16th and 17th centuries. The newer half of the library building was erected by Inigo Jones at the expense of Laud, who also gave many printed and manuscript books. The room used as a library of Trinity College formed part of Durham College, the library of which was established by Richard of Bury. Wadham College Library includes a collection of botanical books bequeathed by Richard Warner in 1776 and a collection of books, relating chiefly to the Spanish Reformers, presented by the executors of Benjamin Wiffen. Worcester College Library line of late specially devoted itself to classical archaeology. It is also rich in old plays.

It must be admitted that the college libraries as a rule have not been used to any great extent. Of late, however, there have been signs of awakening interest. About 1871 there was a meeting of college librarians, and it was agreed that the colleges, instead of making merely sporadic purchases from the whole field of literature, should rather husband their limited resources and restrict themselves each to some special department. But the idea has not been carried out very thoroughly, and a good deal must be done before the college libraries can be said to be as useful and efficient as they might be.

The history of the University Library at Cambridge dates from the earlier part of the 15th century. Two early lists of its contents are preserved, the first embracing 53 volumes dating from about 1423, the second a shelf-list, apparently of 330 volumes, drawn up by the outgoing proctors in 1473. Its first great benefactor was Thomas Scott of Rotherham, archbishop of York, who erected in 1475 the building in which the library continued until 1759. He also gave more than 200 books and manuscripts to the library, some of which still remain. The library received other benefactions, but nevertheless appeared "but mean" to John Evelyn when he visited Cambridge in 1654. In 1686 Tobias Rustat presented a sum of money to be invested by the college and made useful books. In 1715 George I. presented the library of Bishop Moore, which was very rich in early English printed books, forming over 30,000 volumes of printed books and manuscripts. The funds bequeathed by William Wote and John Manstre, together with that of Rustat, produce at present about £1000 a year. The share of university dues appropriated to library purposes amounts to £3000 a year. In addition the library is entitled to new books under the Copyright Acts. The number of printed volumes in the library cannot be exactly stated, as no recent calculation on the subject exists. It has been variously estimated at a quarter or half a million. The calendar states it as 200,000. It includes a fine series of *éditions principes* of the classics and of the early productions of the English press. The MSS. number 5723, in which are included a considerable number of adversaria or printed books with MS. notes, which form a leading feature in the collection. The most famous of the MSS. is the celebrated copy of the four gospels and the Acts of the Apostles, which is known as *Codex Beza*, and which was presented to the university by that Reformer. A catalogue of the MSS. has been published in 4 vols., 1856-61. There is no printed catalogue of the books, although the catalogue is in print, the accessions being printed and cut up and arranged in volumes. The regulations of the library with regard to the lending of books are very liberal, as many as ten volumes being allowed out to one borrower at the same time.

There is a library attached to the Fitzwilliam Museum bequeathed to the university in 1816. It consists of the entire library of Lord Fitzwilliam, with the addition of an archaeological library bought

from the executors of Colonel Leake, and a small number of works, chiefly on the history of art, since added by purchase or bequest. It contains a collection of engravings of old masters, a collection of music, printed and MS., and a collection of illuminated MSS., chiefly French and Flemish, of the 14th to 16th centuries. The books are not allowed to be taken out.

The Library of Trinity College, which is contained in a magnificent hall built by Sir Christopher Wren, has about 90,000 printed and 1918 MS. volumes, and is especially strong in theology, classics, and bibliography. It owes to numerous gifts and bequests the possession of a great number of rare books and manuscripts. Amongst these special collections are the Orelli collection of early dramatic and especially Shakespearean literature, the collection of German theology and philosophy bequeathed by Archdeacon Hare, and the Grylls bequest in 1843 of 9600 volumes, including many early printed books. There are printed catalogues of the Sunken and other Oriental MSS. by Dr. Aufrecht and Professor Palmer, and of the manuscripts by the present librarian, Mr. Sinker. The library is open to all members of the college, and the privilege of using it is liberally extended to properly accredited students.

None of the other college libraries rivals Trinity in the number of books. The library of Christ's College received its first books from the founders. Clare College Library includes a number of Italian and Spanish plays of the end of the 16th century left by Giorgio Ruggia. The library of Corpus Christi College first became notable through the bequest of books and MSS. made by Archbishop Parker in 1575. The printed books are less than 5000 in number, and the additions now made are chiefly in such branches as throw light on the extremely valuable collection of ancient MSS. which attracts scholars from all parts of Europe. There is a printed catalogue of these MSS. Gonville and Caius College Library is of early foundation. A catalogue of the MSS. was printed in 1849, with pictorial illustrations, and a list of the manuscripts in 1860. The printed books of King's College includes the fine collection bequeathed by Jacob Bryant in 1804. The MSS. are almost wholly Oriental, chiefly Persian and Arabic, and a catalogue of them has been printed. Magdalene College possesses the curious library formed by Pepys and bequeathed by him to the college, together with his collections of prints and drawings and of rare British portraits. It is remarkable for its treasures of popular literature and English ballads, as well as for the Scottish manuscript poetry collected by Sir Richard Martin. The books are kept in the library's own cases, and remain just as he arranged them himself. The library of Peterhouse is the oldest library in Cambridge, and possesses a catalogue of some 600 or 700 books dating from 1418, in which year it was completed. It is chiefly theological, though it possesses a valuable collection of college records on genealogy and natural science, and a unique collection of MSS. on the history of the college. The library of St John's College is rich in early printed books, and possesses a large collection of English historical tracts. Of the MSS. and rare books there is a printed catalogue. For the other college libraries see the tables.

Free Public Libraries.—In the year 1850 Mr. Ewart Free introduced the first Public Libraries Act into the House of Commons, and it has since been supplemented and amended by the Acts of 1856, 1866, 1871, and 1877. Mr. Ewart had previously carried through parliament the Museums Act of 1845, and small libraries had been established in connexion with museums under that Act at Salford and Warrington. The number of towns which have established rate-supported libraries, or in which the Acts have been adopted, now amounts to at least ninety-six, ten of these towns being in Scotland, and one only in Ireland. It is noticeable that the Acts have not been adopted in any of the great capital towns of the three kingdoms, except in one single parish of Westminster. Many of our largest towns are also in default. Glasgow may be considered to be sufficiently provided for by the magnificent Mitchell bequest. Of the libraries which have actually been opened sixteen are in places of over 100,000 inhabitants, twenty in towns of between 50,000 and 100,000 inhabitants, sixteen in towns of between 30,000 and 50,000, eleven in towns of between 20,000 and 30,000 inhabitants, seventeen in towns of between 10,000 and 20,000 inhabitants, and finally six in towns of less than 10,000 inhabitants.

Taking the latest returns we have been able to obtain,

which are with a few exceptions those of the year 1880-81, the number of volumes in stock and of the total issues is as follows. In eighty-one libraries returning their number of volumes, there is a total of 1,448,182 volumes in stock, while the total issues for the year in seventy-six libraries amounted to the enormous number of 9,033,742 volumes. Even these figures afford a very inadequate idea of the service rendered by these institutions in supplying popular reading. They take no account of the visits made to the newsrooms which are almost invariably connected with the libraries, or of the use made of the magazines and periodicals which lie upon the tables. The free public libraries generally consist of a lending department, with a reference library wherever the institution can provide one. A very large proportion of the issues from the lending departments consists of fiction, the percentage varying in different libraries from about 50 to as much as 75 per cent. of the whole. It is only in the case of the wealthier institutions, such as those in the great towns of Liverpool, Manchester, and Birmingham, that the reference departments are so important as to claim consideration here in respect of the intrinsic character of their collections. Even some of the smaller libraries, however, present features of interest in their collections of local books, or of books illustrating the trade or industry of the district, or the life and writings of some great man connected with or born in the locality.

The Salford Free Public Library was one of the libraries which were established under the Museums Act of 1845, and was opened in 1850 in connexion with the museum and picture gallery at Peel Park. The buildings are pleasantly situated in grounds of 46 acres in extent. The reference library now contains 85,600 volumes, and besides the central lending departments there are three branches in different parts of the borough. The income from the penny rate is about £2800, but this is found to be inadequate.

The Manchester Free Library was the first to be established under the Acts of 1850. A public subscription of nearly £13,000 was raised to defray the expenses of its establishment, and the library was opened in September 1852. The working of the library was a success from the first. The issue in the first year was 100,000 in the reference departments 61,080 volumes, and in the lending departments 77,232. The progress made since then may be measured by the number of volumes issued last year (1881), which amounted to 966,468, and by the fact that six branch libraries have been established. The rate produces an income of £21,000. The reference library now possesses a valuable collection of 65,000 volumes, chiefly of standard works. It contains several special collections, chiefly connected with the industries and history of the district. The library of the English Dialect Society, of which a catalogue has been printed, is deposited here. In addition, the library possesses a very extensive series of periodicals, and a larger collection of political and commercial tracts than can be found anywhere in the country except at the British Museum. A good catalogue was printed in 1864, and a new and extensive index has just appeared.

The library at Liverpool, which was established under a special Act passed in 1852, is the most successful of all the free public libraries, and is connected with a splendid museum and art gallery, the former formed around the nucleus of the ornithological specimens bequeathed to the town by the thirteenth earl of Derby. The rapid extension of museum and library soon rendered larger premises a necessity. The late Sir William Brown took upon himself the entire cost of the present extensive buildings, which were opened in 1860. In 1880 was opened the Pictorial Reading-Room. It is a circular room 100 feet in diameter, surmounted by a dome, the entire height being 55 feet. It contains 50,000 volumes, and will accommodate over 300 readers. Since April 1881 the electric light has been employed. Under the reading-room is a large circular lecture-room accommodating 1600 persons, in which lectures are regularly delivered. There is a numerous collection of local books and pamphlets. The library collection, consisting of maps, plans, drawings, portraits, &c., all having reference to the county of Lancashire, is very interesting and valuable. The issues from the reference library in 1880 were 876,716, and with the issues from the two lending departments make the enormous aggregate of 1,307,131. The rate produces an income of £18,000 per annum, of which more than £2000 is expended upon the libraries. An elaborate catalogue of the reference library was published in 1872, and a supplement is now being printed. In 1858 Bolton established a library which now has a circulation

of over 240,000 volumes. In 1855 libraries were established at Birkenhead and Sheffield. At Birkenhead the rate produces £1500, and 130,000 volumes were lent out last year. At Sheffield, where the rate produces £4750, there are three branches, and the total issues last year were 884,996. The reference library has only 6000 volumes.

The Acts, after having been rejected at Birmingham in 1852, were adopted in 1860. By 1868 four branches had been opened in addition to the central reference and lending libraries. The issues from the lending departments last year were 400,000 volumes. The reference library consisted of over 50,000 volumes. The Shakespeare Memorial Library consisted of about 7000 volumes. There were also the Staunton Walsley collection of books and MSS and the Cervantes books. All these collections were unfortunately destroyed by a fire on January 11, 1879. The inhabitants of Birmingham have shown much public spirit in repairing the losses then sustained, so far as is possible, and the new central reference and lending libraries are expected to be open early in 1882, when it is anticipated that there will be as many volumes ready to be placed in the reference library as there were when the former library was destroyed. No town in England is so surrounded with free libraries as Birmingham. The rate at Birmingham produces over £2600.

The free library at Nottingham (1867) has recently had new quarters found for it in the new university buildings. It has two branches, and its issue are about 160,000. The rate produces £2200. The local collections include a Byron library. The library at Leeds (1868) has no less than twenty-one branches, and together they count over 100,000 volumes. The issues last year, in addition to the use made of the central reference library, were 630,618. The rate produces nearly £5000. At Leicester there is only a halfpenny rate, which produces about £300. The issues last year were 192,317. At Bradford (Acts adopted 1871) the rate produces £2800, and there are five branches with a circulation of 291,276 volumes, besides the use made of the reference library. At Plymouth (Acts adopted 1871, library opened 1876) the circulation was 171,851 last year, at Boscaldale (Acts adopted 1872) 168,614. At each place there is a collection of local literature, and at Boscaldale a collection of works on the woollen manufacture. The library at Newcastle, opened in 1880, has issued from its lending departments, in its first year, no less than 801,925 volumes to about 14,000 readers. A splendid building in course of erection will accommodate the reference library. This department is intended to contain a complete collection of all standard works, and also a collection of books and manuscripts relating to Newcastle and the northern counties generally. The rate produces £2800. At Bristol a town library had been established in 1814 by Robert Redwood and his family. The library in this has formed the nucleus of the collections formed under the Acts when they were adopted in 1875. The total number of volumes is about 46,000. The issues were 422,646 at the central library and its three branches. At Southampton (1875) Mr Atkinson gave the building called after him for a library and art gallery. The issues last year were 110,778. The rate produced £775, and an additional voluntary rate produced a little over £100 besides.

It will be seen from this summary statement that the libraries established under the Acts have in the cases mentioned been abundantly used. The merit of these results is very largely due to the enlightened energy of those who are entrusted with their administration.

Amongst the English libraries that have not yet been described there are a few that call for special mention. Some of these have been founded by individuals, and still bear their names. The first notable of these is the fine old library established by Humphrey Chetham at Manchester in 1565, which is still housed in the old collegiate buildings where Raleigh was once entertained by Dr Don. The collection consists largely of older literature, and numbers 6000 volumes, with 300 MSS. It is freely open to the public, and may be said to have been the first free library in England. Dr Shepherd's library at Preston was bequeathed by the founder, a physician of the town, to the corporation of Preston in trust for the inhabitants in the year 1759. It is a library of reference, accessible on recommendation from an alderman. The William Salt Library, a special Staffordshire library with numerous MSS, and other collections, formed to bring together materials for a history of Staffordshire, was opened to the public in 1874.

Some mention should be made also of the more important subscription or proprietary libraries, which were formed for the most part in the latter half of the 18th century. It is difficult for us to realise how few collections of books were accessible to the public of the last century even in London. The earliest circulating library in the metropolis was established about the middle of the century. The first in Birmingham was opened by Hutton in 1767. The idea of a proprietary library appears to have been first carried out at Liverpool in 1768. The library then formed still flourishes at the Lyceum, and possesses a collection of 72,000 volumes and an income of £1200 a year. In 1760 a library was founded at Warrington which has been merged

in the Warrington Museum. The Leeds library was established in 1788, and now has 88,000 volumes, and an income of £1430. In 1775 the Bristol museum and library was formed, and numbered Coleridge, Southey, and Lander among its earlier members. It now reckons 50,000 volumes, and an income of £1400 a year. The Birmingham (old) library was formed in 1778, and its rules were drawn up by Dr Priestley, who had already taken an active share in the management of the libraries at Warrington and Leeds. The library has now 40,000 to 50,000 volumes, and an income of £1800. Many similar institutions are noted in the tables, while others have given place to the trade circulating libraries and to the libraries established under the Free Libraries Acts.

A few modern collegiate libraries, finally, claim a summary notice. The library of the university of Durham dates only from 1833, and was begun by a gift of books from Bishop Van Mildert, to which many other donations have since succeeded. The fourth collection includes a large collection of early tracts. The Winton collection is chiefly classical, and the Malby collection classical and theological. The library of the Owens College, Manchester, was formed on the establishment of the college in 1851 by a gift of books from Mr James Heywood, F.R.S. It has since been largely increased by donations and purchases, including the libraries of Bishop Lee, Mr Croxall, and others. It has an endowment fund of £2500. The library at Stonyhurst College has gradually grown since the establishment of the college in 1794. There is a printed catalogue of books printed before 1661. The Welshman Library at St Mary's College, Oscott, was established by Bishop Walsh in 1839, having been purchased by him from the Marchese Marni. It has 70 MSS., and many early printed books.

Scotland. The principal library in Scotland is that of the Faculty of Advocates, who in 1680 appointed a committee of their number, which reported that "it was fit that, seeing if the recusants could be made pay their entire money, there would be betwixt three thousand and four thousand pounds in cash; that the same be employed on the best and fittest lawyers and other law books, conforme to a catalogue to be consigned upon by the Facultie, that the samen may be a fonde for aene Bibliothecque whereto many lawyers and others may leave their books." In 1682 the active carrying out of the scheme was committed to the Dean of Faculty, Sir George Mackenzie of Rosehaugh, who may be regarded as the founder of the library. In 1684 the first librarian was appointed, and the library appears to have made rapid progress, since it appears from the treasurer's accounts that in 1688 the books and furniture were valued at upwards of £11,000 Scots, exclusive of donations. In the year 1700, the rooms in the Exchange Stairs, Parliament Close, in which the library was kept, being nearly destroyed by fire, the collection was removed to the ground floor of the Parliament House, where it has ever since remained. The library retains the copyright privilege conferred upon it in 1709. The number of volumes in the library is computed to amount to 265,000; of the special collections the most important are the Astorga collection of old Spanish books, purchased by the faculty in 1824 for £4000; the Thorckellin collection, consisting of about 1200 volumes relating chiefly to the history and antiquities of the northern nations, and including some rare books on old Scottish poetry; the Dietrich collection of over 100,000 German pamphlets and dissertations, including many of the writings of Luther and Melancthon, purchased for the small sum of £80; and the Combe collection.

The faculty appear early to have turned their attention to the collection of MSS., and this department of the library now numbers about 3000 volumes. Many of them are of great interest and value, especially for the civil and ecclesiastical history of Scotland before and after the Reformation. There are thirteen monastic chartularies which escaped the destruction of the religious houses to which they belonged. The MSS. relating to Scottish church history include the collections of Spottiswoode, Woodrow, and Calderwood. The Woodrow collection consists of 154 volumes, and includes his correspondence, extending from

1694 to 1726. Sir James Balfour's collection and the Bellocars papers consist largely of original state papers, and include many interesting royal letters of the times of James V., Queen Mary, and James VI. The Sibbald papers, numbering over 30 volumes, are largely topographical. The Biddel notebooks, numbering 166 volumes, contain collections to illustrate the genealogy of Scottish families. There are about one hundred volumes of Icelandic MSS., purchased in 1825 from Professor Finn Magnusson, and some Persian and Sanskrit, with a few classical manuscripts. The department has some interesting treasures of old poetry, extending to 73 volumes. The most important are the Bannatyne MSS., in 2 vols. folio, written by George Bannatyne in 1568, and the Auchinleck MSS., a collection of ancient English poetry, named after Alexander Boswell of Auchinleck, who presented it in 1774.

The first catalogue of the printed books was compiled in 1692, and contains a preface by Sir George Mackenzie. Another was prepared under the care of Riddiman in 1742. In 1853 the late Mr Halkett commenced a catalogue, which has been printed in 6 vols. 4to, with a supplement, and includes all the printed books in the library at the end of 1871, containing about 260,000 entries. It is an illustration of the public spirit with which they conduct their library, that the whole cost of printing this extensive catalogue, over £5000, has been borne by the members of the faculty. The library, managed by a keeper and staff, under a board of six curators, is easily accessible to all persons engaged in literary work, and is for all practical purposes the public consulting library of Scotland.

The origin of the University Library of Edinburgh is to be found in a bequest of his books of theology and law made to the town in 1580 by Clement Little, advocate. This was two years before the foundation of the university, and in 1584 the town council caused the collection to be removed to the college, of which they were the patrons. As it was the only library in the town, it continued to grow and received many benefactions, so that in 1615 it became necessary to erect a library building. Stimulated perhaps by the example of Bodley at Oxford, Drummond of Hawthornden made a large donation of books, of which he printed a catalogue in 1637, and circulated an appeal for assistance from others. In 1673 the library received a bequest of 2000 volumes from the Rev. James Naime. In 1709 the library became entitled to the copy privilege, which has since been commuted for a payment of £275 per annum. In 1831 the books were removed to the present library buildings, for which a parliamentary grant had been obtained. The main library hall (190 feet in length) is one of the most splendid apartments in Scotland. One of the rooms is set apart as a memorial to General Reid, by whose benefaction the library has greatly benefited. Amongst the more recent accessions have been the Halliwell-Phillips Shakespeare collection, the Laing collection of Scottish MSS., the Baillie collection of Oriental MSS. (some of which are of great value), and the Hodgson collection of works on political economy. The library now consists of about 140,000 volumes of printed books with 2000 MSS.

The library of the Writers to Her Majesty's Signet was established by the society in 1755. At first it consisted of law books exclusively, but in 1788 they began to collect the best editions of works in other departments of literature. During the librarianship of Maevay Napier (1805-37) the number of volumes was more than sextupled, and in 1812 the library was removed to the new hall adjoining the Parliament House. In 1854 the upper hall was devoted to the collection. This is a magnificent apartment

142 feet long, with a beautiful cupola painted by Stothard. The library now contains nearly 70,000 volumes, exclusive of pamphlets, and includes some fine specimens of early printing, as well as many other rare and costly works. It is especially rich in county histories and British topography and antiquities. A catalogue of the law books was printed in 1856. The late David Laing, who became librarian in 1837, published the first volume of a new catalogue in 1871. The second volume is nearly completed. The books are lent out to the Writers and even to strangers recommended by them. This library, like that of the Advocates, is most liberally opened to literary inquirers, and has thus acquired a quasi-public or national character.

There are various other important libraries in Edinburgh, but no considerable lending library open freely to the poorest of the people, and two attempts which have been made to introduce the Librarians' Acts have been unsuccessful.

The first mention of a library at St Andrews is as early as 1469. The three colleges were provided with libraries of their own about the time of their foundation—St Salvator's 1465, St Leonard's 1512, St Mary's 1537. The University Library was established about 1619 by King James VI, and in the course of the 18th century the college libraries were merged in it. The copyright privilege was commuted in 1837. The collection numbers 90,000 volumes exclusive of pamphlets, with about 200 MSS, chiefly of local interest. About 1200 volumes are added yearly. A library is supposed to have existed at Aberdeen since the foundation of King's College by Bishop Elphinstone in 1494. The present collection combines the libraries of King's College and Mansel College, now incorporated in the university. The latter had its origin in a collection of books formed by the town authorities at the time of the Reformation, and for some time kept in one of the churches. The library was bequeathed by the Merchants, chiefly of classical books, and those of Henderson and Wilson, and contains some very valuable books. The general library is located in Old Aberdeen, while the medical and law books are in the New Town. The library has a grant, in lieu of the copy privilege, of £320. The library of the university of Glasgow dates from the 16th century, and among George Buchanan and many other distinguished men amongst its early benefactors. A classified subject-catalogue is in progress. The annual accessions are about 1500, and the commutation-grant £707. Connected with the university, which is trustee for the public, is the library of the Hunterian Museum, founded by the eminent anatomist Dr William Hunter. It is a collection of great bibliographical interest, as it is rich in MSS and in fine specimens of the early printing, especially in Greek and Latin classics. The printed books number about 18,000 volumes, and the MSS some 600 volumes. All the Scottish university libraries lend books to students, on deposit of £1, to graduates, for an annual subscription of half a guinea, and to persons engaged in literary research, by permission of the senatus.

The Mitchell Library at Glasgow bids fair to be the most important public library outside Edinburgh. It was founded by a bequest of £70,000 from the late Mr Stephen Mitchell. The library was opened in 1837, in temporary premises, and already contains over 80,000 volumes. It includes a special collection of Scottish poetry called "The Poets' Corner," and a collection of Glasgow literature, including early specimens of Glasgow printing. The library is open to all persons over fourteen years of age, and the number of readers during the first three years in which the library has been opened is believed to be without precedent. The number of volumes issued in 1880 was 890,782.

The English Libraries Act of 1850 was extended to Scotland in 1854, and the first town to put it into operation was Ayr, in 1856. The largest of the libraries which have been opened under the Act is at Dundee, which possesses 36,500 volumes with a circulation of 252,314. The rate produces £2390. Although the resources of the other towns in which the Acts have so far been adopted do not enable them to rival the larger English towns, the results are proportionately quite as satisfactory. The turnover of their stock of books is generally large, and the reading done appears to be more solid and serious than in England. The percentage of fiction issued is at least 10 or 15 per cent. below the average rate in the English free libraries.

Ireland. The establishment of the Library of Trinity College, Dublin, is contemporaneous with that of the Bodleian at Oxford, and it is an interesting circumstance that, when Challoner and Usher (afterwards the archbishop) were in London purchasing books to form the library, they met Bodley there, and entered into friendly intercourse and co-operation with him to procure the choicest and best

books. The commission was given to Usher and Challoner as trustees of the singular donation which laid the foundation of the library. In the year 1601 the English army determined to commemorate their victory over the Spanish troops at Kinsale by some permanent monument. Accordingly they subscribed the sum of £1800 to establish a library in the university of Dublin. For Usher's own collection, consisting of 10,000 volumes and many valuable MSS, the college was also indebted to military generosity. On his death in 1656 the officers and soldiers of the English army then in Ireland purchased the whole collection for £22,000 with the design of presenting it to the college. Cromwell, however, interfered, alleging that he proposed to found a new college, where the books might more conveniently be preserved. They were deposited therefore in Dublin Castle, and the college only obtained them after the Restoration. In 1674 Sir Jerome Alexander left his law books with some valuable MSS, to the college. In 1726 Dr Fallisier, archbishop of Cashel, bequeathed over 4000 volumes to the library, and ten years later Dr Gilbert gave the library nearly 13,000 volumes which he had himself collected and arranged. In 1741 the library received a valuable collection of MSS, as a bequest from Dr Stearne. In 1802 the collection formed by the pensionary Pagel, which had been removed to England on the French invasion of Holland, was acquired for £10,000. It consisted of over 20,000 volumes. In 1805 Mr Quin bequeathed a choice collection of classical and Italian books. There have been many other smaller donations, in addition to which the library is continually increased by the books received under the Copyright Act. The library now contains 192,000 volumes and 1880 MSS, and about 3000 volumes are added every year. There is no permanent endowment, and purchases are made by grants from the board. The whole collections are contained in one building, erected in 1739, consisting of eight rooms. The great library hall is a magnificent apartment over 200 feet long. A new reading-room was opened in 1848. A catalogue of the books acquired before 1873 is now in course of printing. There is no printed catalogue of the MSS. Graduates of Dublin, Oxford, and Cambridge are admitted to read permanently, and temporary admission is granted by the board to any fit person who makes application. Books and MSS are lent out only under special regulations. A lending library has been established to make provision for the needs of the students.

The public library, St Patrick's, Dublin, sometimes called Marsh's Library after its founder, was established about 1694 by Archbishop Marsh, was incorporated by Act of Parliament in 1707, and endowed by its founder at his death in 1718. The building was erected by the founder, and the original oak fittings still remain. There is no room for additions, and a large collection of modern books was added a few years ago on that account. The endowment is too small to allow of purchases from the funds of the library, so that it still retains the character of a 17th century library. The books are chiefly theological, and in the learned languages; they include the libraries of Bishop Stillingfleet and of Elias Brouncker, a French refugee, who was the first librarian.

The library of the Royal Dublin Society was commenced shortly after the formation of the society in 1781. With the exception of about 10,000 volumes of the publications of learned societies and scientific periodicals, with a few early editions, its books were transferred to the state, in 1877, to assist in forming the national library of Ireland. The manuscript collections of Walter Harris on Irish history were purchased and placed in the library for public use by the Irish parliament. The library of the Royal Irish Academy was established on the formation of the Academy in 1785, for the purpose of promoting the study of science, literature, and antiquities in Ireland. The library possesses about 40,000 printed volumes and about 1400 MSS. There is a large collection of MSS and books relating to the history, ancient language, and antiquities of Ireland. They include the Berham collection, acquired partly by public subscription in 1851. The library is partly supported by a Government grant of £200 per annum, and is freely open to a proper introduction. Under the direction of the present librarian

library, the publication of Irish MSS in the library was begun in 1870, and has since continued. The library of King's Inns was founded, pursuant to a bequest of books and legal MSS, under the will of Mr Justice Robinson in 1787, to form the nucleus of a library for law students. It is partly supported from the funds of the benchers, but partly also by a treasury grant of £438, 8s. 6d. in 1856 of the copy privilege. No books are lent out, and the use of the library is confined to students and barristers; so that the public has no advantage in return for the annual contribution of public money.

There is no library in Dublin corresponding in extent and public accessibility to the British Museum in London, or the Advocates' Library in Edinburgh. About 1860 it was proposed to supply the deficiency by combining the libraries of the Dublin Society and the Irish Academy, both of which had long received grants of public money, together with the collection of Archbishop Marsh. Accordingly in 1864 an Act of Parliament was passed "for the establishment of a national gallery and for the care of a public library in Dublin." The scheme thus authorized has never been carried out. In 1877, however, the National Library of Ireland was established in the apartments of Leinster House. The library is under the Science and Art Department of South Kensington, and is superintended by a body of twelve trustees in Dublin. For the last two years it has received an annual vote of £1000 from parliament for the purchase of books. As already mentioned, the books of the Royal Dublin Society have been transferred to it. It is freely open to the public on a respectable introduction, and is much used.

The public library of Armagh was founded by Lord Farnham in 1770, who gave a considerable number of books and an endowment. The books are freely available, either on the spot, or by loan on deposit of double the value of the work applied for. At Belfast the Queen's College Library has about 36,000 volumes, with a special collection of books on the languages and literature of the East. The library of the Queen's College, Cork, contains about 26,000 volumes, 1600 of the most valuable of which have been presented by Mr Crawford. The library is easily accessible to literary inquirers, and is much used by strangers. The library of Maynooth College is chiefly theological, and contains the collections bequeathed by the late Dr. Milnes and Messrs Russell. There are about 40,000 volumes and a few MSS.

Dundalk is at present the only town that has a library under the Public Libraries Act, which were adopted there in 1866. The rate produces only about £80.

France.

French libraries (other than those in private hands) belong either to the state, to the departments, to the communes, or to learned societies, educational establishments, and other public institutions; the libraries of judicial or administrative bodies are not considered to be owned by them, but to be state property. Besides the unrivalled library accommodation of the capital, France possesses a remarkable assemblage of provincial libraries. The communal and school libraries also form striking features of the French free library system.

Five and twenty years ago (see *Tableau statistique des bibliothèques publiques*, 1857) there were in the departments,—exclusive of those not literally free, and of all Parisian libraries,—340 public libraries containing 3,734,260 volumes and 44,436 MSS. In 1857 there were only 32 provincial libraries which owned more than 30,000 volumes each; there are now 64 which are of that extent and upwards.¹ In Paris there are now 16 containing over 30,000 volumes each.

Libraries of Paris.—The Bibliothèque Nationale (still the most extensive library in the world) has had an advantage over all others in the length of time during which its contents have been accumulating, and in the great zeal shown for it by several kings and other eminent men. Ecclesiastical writers find the original of this library in the MS. collections of Charlemagne and Charles the Bald, but these were dispersed in course of time, and the few precious relics of them which the national library now possesses have been acquired at a much later date. Of the library which St Louis formed in the 13th century

(in imitation of what he had seen in the East) nothing has fallen into the possession of the Bibliothèque Nationale, but much has remained of the royal collections made by kings of the later dynasties. The real foundation of the institution (formerly known as the Bibliothèque du Roi) may be said to date from the reign of King John, the Black Prince's captive, who had a considerable taste for books, and bequeathed his "royal library" of MSS. to his successor Charles V. Charles V. organized his library in a very effective manner, removing it from the Palais de la Cité to the Louvre, where it was arranged on desks in a large hall of three stories, and placed under the management of the first librarian and cataloguer, Claude Mallet, the king's valet-de-chambre. His catalogue was a mere shelf-list, entitled *Inventaire des Livres du Roy nostre Seigneur estans au chasteau du Louvre*; it is still extant, as well as the further inventories made by Jean Blanchet in 1580, and by Jean le Bègue in 1411 and 1424. Charles V. was very liberal in his patronage of literature, and many of the early monuments of the French language are due to his having employed Nicholas Oresme, Raoul de Presle, and other scholars to make translations from ancient texts. Charles VI. added some hundreds of MSS. to the royal library, which, however, was sold to the regent, duke of Bedford, after a valuation had been established by the inventory of 1434. The regent transferred it to England, and it was finally dispersed at his death in 1435. Charles VII. and Louis XI. did little to repair the loss of the precious Louvre library, but the news of the invention of printing served as a stimulus to the creation of another one, of which the first librarian was Laurent Paumier. The famous minister Jean Fouquet of Tours was named the king's *entremetteur*, and although Louis XI. neglected to avail himself of many precious opportunities that occurred in his reign, still the new library developed gradually with the help of confiscation. Charles VIII. enriched it with many fine MSS. executed by his order, and also with most of the books that had formed the library of the kings of Aragon, seized by him at Naples. Louis XII., on coming to the throne, incorporated the Bibliothèque du Roi with the fine Orleans library at Blois, which he had inherited. The Blois library, thus augmented, and further enriched by plunder from the palaces of Pavia, and by the purchase of the famous Gruthuyse collection, was described at the time as one of the four marvels of France. Francis I. removed it to Fontainebleau in 1534, enlarged by the addition of his private library. He was the first to set the fashion of fine artistic bindings, which was still more cultivated by Henry II., and which has never died out in France. During the librarianship of Amyot (the translator of Plutarch) the library was transferred from Fontainebleau to Paris, not without the loss of several books coveted by powerful thieves. Henry IV. removed it to the Collège de Clermont, but in 1604 another change was made, and in 1622 it was installed in the Rue de la Harpe. Under the librarianship of J. A. de Thou it acquired the library of Catherine de' Medici, and the glorious Bible of Charles the Bald. In 1617 a decree was passed that two copies of every new publication should be deposited in the library, but this was not rigidly enforced till Louis XIV.'s time. The first catalogue worthy of the name was finished in 1622, and contains a description of some 6000 volumes, chiefly MSS. Many additions were made during Louis XIII.'s reign, notably that of the Dupuy collection, but a new era dawned for the Bibliothèque du Roi under the patronage of Louis XIV. The enlightened activity of Colbert, one of the greatest of collectors, so enriched the library that it became necessary for want of space to make another removal. It was therefore in 1686 installed in the Rue Vivienne (now Vivienne) not far from its present habitat.

¹ In 1877 a questionnaire was issued in order to obtain materials for a more complete report, but the results have not yet been made public.

The departments of engravings and medals were now created, and before long rose to nearly equal importance with that of books. Marolle's prints, Fouquet's books, and many from the Mazarin library were added to the collection, and, in short, the Bibliothèque du Roi had its future pre-eminence undoubtedly secured. Nic. Clément made a catalogue in 1684 according to an arrangement which has been followed ever since (that is, in twenty-three classes, each one designated by a letter of the alphabet), with an alphabetical index to it. After Colbert's death Louvois emulated his predecessor's labours, and employed Mabillon, Thvenot, and others to procure fresh accessions from all parts of the world. A new catalogue was compiled in 1688 in eight volumes by several distinguished scholars. This Abbé Louvois, the minister's son, became head of the library in 1691, and opened it to all students—a privilege which although soon withdrawn was afterwards restored. Towards the end of Louis XIV.'s reign it contained over 70,000 volumes. Under the management of the Abbé Bignon numerous additions were made in all departments, and the library was removed to its present home in the Rue Richelieu. Among the more important acquisitions were 6000 MSS. from the private library of the Colbert family, Bishop Huet's forfeited collection, and a large number of Oriental books imported by missionaries from the further East, and by special agents from the Levant. Between 1739 and 1753 a catalogue in eleven volumes was printed, which enabled the administration to discover and to sell its duplicates. In Louis XVI.'s reign the sale of the La Vallière library furnished a valuable increase both in MSS. and printed books. A few years before the Revolution broke out the latter department contained over 300,000 volumes and opuscles. The Revolution was servicable to the library, now called the Bibliothèque Nationale, by increasing it with the forfeited collections of the *émigrés*, as well as of the suppressed religious communities. In the midst of the difficulties of placing and cataloguing these numerous acquisitions, the name of Van Praet appears as an administrator of the first order. Napoleon increased the amount of the Government grant; and by the strict enforcement of the law concerning new publications, as well as by the acquisition of several special collections, the Bibliothèque made considerable progress during his reign towards realizing his idea that it should be universal in character. At the beginning of this century the recorded numbers were 200,000 printed volumes, 83,000 MSS., and 1,600,000 engravings. After Napoleon's downfall the MSS. which he had transferred from Berlin, Hanover, Florence, Venice, Rome, the Hague, and other places had to be returned to their proper owners. The MacCarthy sale in 1817 brought a rich store of MSS. and incunabula. From that time onwards to the present, under the enlightened administration of MM. Taschereau and Delisle, the accessions have been very extensive.

The official estimate of the number of volumes in the *Département des Imprimés* now reaches the extraordinary total of about 3,200,000, but the contents have not been actually counted since 1791, and so the above enumerates pieces of which many are included in one volume, perhaps something like 1,837,000 is nearer the proper number. The annual additions are about 45,000. The *réserve* (consisting of articles of the highest importance) extends to more than 60,000 volumes. The collection of books on French history is in itself an enormous library, amounting to 440,000 volumes. The maps and charts, added to number 800,000, are included in this department. The *Département des MSS.* comprehended, in 1876, 91,700 volumes. The *Département des Médailles* possessed, in 1875, 144,000 coins, medals, engraved stones, &c., and since that date has acquired many important accessions. More than 2,300,000 engravings are in the *Département des Estampes*, where 200,000 pieces are annually received under the copyright law. The annual vote for purchases and binding is 200,000 francs.

Admittance to the *Salle de Travail* is obtained by a *bulletin*

personnel, which is procurable without difficulty. Thus, the reading-room for students, was built in 1838, and affords accommodation for 344 readers. There are but few books of reference, and readers are only allowed five books a day. The *Salle publique* contains 40,000 books, which are freely available to the public. Plans are now under consideration for an enlargement of the Bibliothèque, and a sum of 3,700,000 francs is to be devoted to that purpose.

The Bibliothèque Nationale does not possess a general catalogue at the disposal of readers, the MS. catalogues of the various classes of the printed books are for official use only. Besides the old catalogue of 1789-99, there is the very elaborate *Catalogue de l'Édition de France* (1865-73, 11 vols. 4to), with a *Supplément*, the indexes will appear shortly. The third volume of the *Catalogue des Sciences Médicales* is now in the press, and that devoted to English history is nearly finished in manuscript. The vellum books have been described by Van Praet (1822-26, 6 vols. 8vo, and supplement 1877). The MSS. are much better provided for. The printed catalogues of these commence with that of Annet Molot, 1750-44, 4 vols. folio, continued in a way by the *Notices et Extraits des MSS. du Bibl. du Roi*, 1737-1875. The work of M. Paulin Paris, *Les MSS. Français; leur histoire et celle des textes antérieurs, anglais, italiens, et espagnols* (1880-86, 7 vols. 8vo), is well known. Catalogue of the Italian, Spanish, Belgian, Sanskrit, Ethiopic, and Chinese MSS. have also appeared between 1807 and 1844. The first and second volumes in 4to of a new *Catalogue des MSS. Français* have been printed, and two volumes of the *Revue de M. Delisle*, besides five parts of his *Revue des MSS. Latins* (1868-71). The authorities have also brought out a *Catalogue des Manuscrits Hébreux et Samaritains* (1868, 4to), besides those of *MSS. Syriques et Sabéens* (1874, 4to), *MSS. Ethiopiques* (1877), and *MSS. Espagnols* (1879).

Paris is much better provided than London or any other city in the world with great public libraries. Besides the Bibliothèque Nationale there are four libraries, each over 120,000 volumes (with others less extensive), to which the public have free access, the Bibliothèque de l'Arsenal being the largest of them. The collection of the Marquis de Paulmy d'Argenson was the basis of this library, which also acquired a portion of the books of the Duc de la Vallière in 1781. It is peculiarly rich in romances, the drama, French poetry, and possesses 80,000 volumes on French history alone. It is freely open, but there are not many readers.—The Bibliothèque Mazarine was founded by the great cardinal, who in 1643 placed about 12,000 volumes at the disposal of the public. The books were chiefly brought together by him. It was opened to the public in 1790, and at the time of the Revolution there were 80,000 printed volumes and 2000 MSS.; there are now 150,000 volumes and 2892 MSS. The reading-room is open in the evening, and is much frequented, especially by students. The library contains a good collection of incunabula, many of which have been described by Dibdin, a number of rare Italian and Spanish chronicles, and a very complete series of periodicals from the 17th century to the empire.—The Bibliothèque de l'Université (or the Sorbonne) was formerly restricted to the use of the members of the five faculties of Paris, but the public has been freely admitted since the time of the Revolution, was destroyed in 1871. It has since been entirely re-established in the Hôtel Carnavalet, which contains the historical museum of the city, and comprehends 80,000 volumes of books and 40,000 engravings, entirely relating to the history and description of Paris. The other public libraries are under the authority of the minister of public instruction, but the Bibliothèque de la Ville is under the control of the prefect of the Seine. The municipal libraries in Paris are 30 in number, with 70,000 volumes; there are besides 440 school libraries, with 44,120 books.

Of other libraries in Paris, not included in our tables, we may name the Bibliothèque de la Préfecture de Police (10,000 volumes, with various MSS. relating to the Revolution), Bibliothèque de

Nationale de première instance (28,900 volumes). Bibliothèque de l'École Polytechnique (50,000 volumes). Bibliothèque de l'École Normale (24,000 volumes, which acquired the library of Georges Cuvier in 1838). Bibliothèque des Javalais (23,000 volumes, a good collection on history and military affairs). Bibliothèque de l'École Nationale des Beaux Arts (11,000 volumes, 13,000 drawings, 100,000 prints and photographs). Bibliothèque du Conservatoire de Musique (30,000 volumes, one of the finest collections of musical literature in the world). Bibliothèque des Archives Nationales (founded by Danon in 1808, containing 26,000 volumes on paleography, history, and jurisprudence,—as this is the record office of France, the archives are very extensive). Bibliothèque du Luxembourg (25,000 volumes). Bibliothèque du Lycée Louis le Grand (30,000 volumes). Bibliothèque du Ministère de l'Intérieur (17,000 volumes, including Parisian and provincial history and documents).

Pro-
vinces of
France.

Besides the various collections belonging to learned and scientific societies, educational institutions, and other bodies, outside Paris, over 215 French provincial towns possess public libraries, which range in number of volumes from 2000 or 3000 to 180,000, as at Bordeaux. Most of them were founded at the end of the last or the beginning of the present century, but some are earlier. The library at Lyons was established by Francis I. in 1530, that at Nantes dates from 1558, La Rochelle from 1604, Albi, Clermont, Besançon, and Troyes from the latter part of the same century, and Orléans from the beginning of the 17th century. The large majority were formed by confiscation at the time of the Revolution. In February 1790 the Assemblée Nationale abolished the different religious communities, and in September of the same year the provincial tribunals and parliaments met with the same fate. The books (said to number 10 or 12 millions) of these corporations were declared national property, a committee was appointed to consider what should be done with them, and a general catalogue of all the sequestered effects ordered to be drawn up. In consequence of the recommendations of the committee, the Convention Nationale (January 27, 1794) decreed the establishment and augmentation of public libraries. The orders of the Convention were not carefully executed, and pitiable stories are told of valuable works sold by the yard as they lay upon the ground, of precious manuscripts and printed rarities left to rot in the rain or burnt for fuel. As the government became more settled, the libraries (when not destroyed) of condemned persons were restored to their representatives. A very large number of books still remained, however, and it is to them that the town libraries of France chiefly owe their riches. Theology, law, history, and the sciences before the 17th and 18th centuries consequently predominate, although for many years more modern requirements have been mainly considered in the acquisition of books. Many collections of local and provincial literature have been formed, as at Angers, Angoulême, Chartres, Grenoble, La Rochelle, Lille, Marseilles, Orléans, Rouen, Toulon, Troyes, and Versailles. Some of the libraries are very extensive. Douai and Troyes have 100,000 volumes each; Lyons and Rouen over 120,000; Besançon, 130,000; Aix and Nantes, 150,000; Grenoble, 170,000; and Bordeaux, 190,000 volumes. All have catalogues, mostly alphabetical; a few of them are in print. The *Catalogue général des MSS. des bibliothèques publiques des départements* is a noble undertaking on the part of the French Government. The first volume came out in 1846, and the latest, the sixth, in 1879; the treasures of eighteen libraries have now been catalogued (about 9500 MSS.), and there remain over 46,000 MSS. to be described. Besides this, Angers, Angoulême, Angoulême, Caen, Clermont, Chartres, Orléans, and Troyes possess separate printed catalogues of their MSS. The chambers annually vote large sums for books, which are distributed to the town libraries by the minister of public instruction. The sums granted by the different municipalities for their libraries vary in amount; for instance, Grenoble 170,000 volumes and eight persons employed gives 25,314 francs, Bordeaux (190,000 volumes and eight persons) 21,350 francs, and Nantes (160,000 volumes and four persons) 18,400 francs.

Popular libraries of every description, including military and women's libraries, were made to the "Société Franklin pour la propagation des bibliothèques populaires," which, founded in 1849, has since been of immense service in organizing and helping those institutions. Between 1868 and 1878 the Société had spent 560,000 francs on these purposes. It issues a *Catalogue Populaire* of a good selection of recommended books, and publishes a journal of its proceedings.

School libraries had an organized existence in France as far back as 1851, and by 1848 the books which had been distributed by the state amounted in value to 2 millions of francs, two years later, however, no trace of books or libraries could be found. In 1860 a question was again taken up, and in 1869 the minister of public instruction ordered that in every primary school a library should be established under the care of the schoolmaster. For some years the Government annually granted 120,000 francs, a sum which was raised to 200,000 francs in 1878, for their share

of the expenses the departments contributed in 1875 as much as 170,000 francs. As an instance of the rapidity with which the school libraries have increased, it may be stated that Haute-Marne, which only possessed 44 of them in 1866, ten years later had 548, in 1877 there were about 17,764 *bibliothèques scolaires* in France. The libraries, which are intended not only for the use of school children but also for their parents and other adults, are regulated by a commission sitting at the ministry of public instruction.

Germany (with Austria and Switzerland).

Germany is emphatically the home of large libraries; Germany her want of political unity and consequent multiplicity of capitals have had the effect of giving her a considerable number of large state libraries, and the number of her universities has tended to multiply considerable collections.

Berlin is well supplied with libraries, seventy-two being Berlin, registered by Petzholdt in 1875, with about 1,393,030 printed volumes. The largest of them is the Royal Library, which was founded by the "Great Elector" Frederick William, and opened as a public library in a wing of the electoral palace in 1661. From 1699 the library became entitled to a copy of every book published within the royal territories, and it has received many valuable accessions by purchase and otherwise. It is now estimated to contain upwards of 700,000 printed volumes and over 15,000 MSS. The amount yearly expended upon binding and the acquisition of books, &c., is 24800. The catalogues are in manuscript, and include a general alphabetical author-catalogue, and a systematic subject-catalogue in a handy form. The building, erected about 1780 by Frederick the Great, has long been too small, and a new one is in contemplation. The conditions as to the use of the collections are, as in most German libraries, very liberal. Any adult person is allowed to have books in the reading-room. Books are lent out to all higher officials, including those holding educational offices in the university, &c., and by guarantee to almost any one recommended by persons of standing; admission to the journal-room is more strictly limited. By special leave of the librarian, books and MSS. may be sent to a scholar at a distance, or, if especially valuable, may be deposited in some public library where he can conveniently use them. There appears to be no limit to the number of books which may be borrowed, although it is prescribed that not more than "three works" must be asked for on one day. Professor Lepsius reports the issues for last year as 71,400 works, to above 5000 readers. The University Library (1831) numbers 200,000 volumes with 353 MSS. The number of volumes lent out in 1830 was 40,101. The library possesses the right to receive a copy of every work published in the province of Brandenburg. Some of the governmental libraries are important, especially those of the Military Academy and the General Staff, which was increased in 1873 by acquiring the library of the "École d'Application" at Metz. In 1850 some popular libraries were established by a society for giving scientific lectures. There are now thirteen such libraries with over 54,000 volumes, but the yearly number of readers is only about 12,000.

The libraries of Munich, though not so numerous as those of Berlin, include two of great importance. The Royal Library, the largest collection of books in Germany, was founded by Duke Albrecht V. of Bavaria (1550-79), who made numerous purchases from Italy, and incorporated the libraries of the Nuremberg physician and historian Schedel, of Wilmannsstadt, and of J. J. Fugger. The number of printed volumes is estimated at about one million, although it is long since any exact enumeration has been made. The library is especially rich in incunabula, many of them being derived from the libraries of the monasteries closed in 1803. The Oriental MSS. are

¹ See Du Wettstein, *Rapport sur les Bibliothèques scolaires*, 1879.

numerous and valuable, and include the library of Martin Haug. The amount annually spent upon the library is £4600, of which £2080 is expended upon books and binding. The catalogue of the printed books are in manuscript, and include (1) a general alphabetical catalogue, (2) an alphabetical repertorium of each of the 195 subdivisions of the library, (3) biographical and other subject catalogues. A printed catalogue of the MSS. in 8 volumes is nearly complete; the first was published in 1858. The library is open only twenty-nine hours during the week, while the Royal Library at Berlin is, except in the three winter months, open for thirty-nine. The library of the British Museum is now open for sixty-six hours per week, but it lends no books out. The regulations for the use of the library are very similar to those of the Royal Library at Berlin. The building erected for this collection under King Louis I. in 1832-43 is regarded as a model library structure. The archives are bestowed on the ground floor, and the two upper floors are devoted to the library, which occupies seventy-seven apartments.—The University Library was originally founded at Ingolstadt in 1472, and removed with the university to Munich in 1826. It participated in 1803 in the division of the literary treasures of the disestablished monasteries. At present the number of volumes in the general library amounts to 290,000, besides which several special collections are also deposited in the library to the number of 32,800 volumes. The MSS. number 1744. The various libraries of Munich have upwards of 1,400,000 volumes.

Dresden. Dr Petzholdt has registered no less than 49 libraries in Dresden, where indeed his inquiries were likely to be particularly exhaustive. The Royal Public Library in the Japanese Palace was founded in the 18th century. Among its numerous acquisitions have been the library of Count Bunsen in 1764, and the manuscripts of Albert. Special attention is devoted to history and literature. The library does not claim to possess more than 800,000 volumes, although Petzholdt in 1875 reckoned them as at least 800,000 printed books, as well as 400,000 dissertations. The MSS. number 8500 volumes. Admission to the reading-room is granted to any respectable adult on giving his name, and books are lent out to persons qualified by their position or by a suitable guarantee. Here, as at other large libraries in Germany, works of belle-lettres are only supplied for a literary purpose. The number of persons using the reading-room in a year is about 3500, and about 10,000 works (not volumes) are lent to about 500 readers.—The "Französische Secundär-Gesamte" Library, now in the possession of Prince George of Saxony, and of which Dr Petzholdt, the Director of bibliographers, is librarian, is a private library to which access is permitted.

Stuttgart. The Royal Public Library of Stuttgart, although only established in 1765, has grown so rapidly that it now possesses about 425,000 "numbers" of printed works and 8500 MSS. There is a famous collection of Bibles, containing 7200 volumes. The annual expenditure is about £2540, of which £1254 is devoted to books and binding. The library also enjoys the copy-privilege in Württemberg. "The borrowing of books for home use is open to all members of the German empire resident in Stuttgart, whose personal and economic circumstances offer the necessary guarantee for the safety of the national property. The library may, moreover, be used from any part of Württemberg on payment of the cost of carriage." The annual number of borrowers is over 1800, who use nearly 17,000 volumes. The number used in the reading-room is at least twice as great. The number of parcels despatched from Stuttgart is nearly 900.—Admission is also freely granted to the Royal Private Library, founded in 1810, which contains about 50,000 volumes and 900 MSS. The other libraries of Stuttgart, of which Petzholdt reckons 11, are not of importance.—The Grand-ducal Library of Darmstadt was established by the grand-duke Louis I. in 1817, on the basis of the still older library formed in the 17th century. The number of volumes used in the course of the year is about 30,000, of which 8000 are lent out to about 5000 readers.—The Ducal Library of Gotha was established by Duke Ernest the Pious in the 17th century, and contains many valuable books and MSS. from monastic collections. It numbers about 240,000 volumes, with upwards of 6000 MSS. The catalogue, now in course of publication, of the Oriental MSS. chiefly collected by Seetzen, and forming one-half of the collection, is one of the best in existence. Other great Ducal Libraries are noticed in the tables.

Literatures of medicine, art and invention are attached to all

the twenty-one universities of Germany, most of them being several Universities with the universities themselves. Thus the oldest library is that of Strasbourg, which in its earlier form dates from 1386. In 1608 it became so important that Joseph Scaliger wrote of it "Lectio-plectus est meliorum librorum quam Vaticanum." In 1628 the library was carried to Rome as a present to the pope, but some of the treasures were ultimately restored. The later collection was first formed in 1703. The collection of MSS. is extremely valuable.

—The library of Leipzig university dates from 1409, although it was not until the middle of the 16th century that it was properly organized.—The library of Göttingen owes much to the labours of the illustrious Heyne. It ranks as one of the most complete and best arranged of the German libraries. New buildings for its accommodation are in course of erection.—The library at Strasbourg, although founded only in 1871 to replace that which had been destroyed in the siege, already ranks amongst the largest libraries of the empire. Its books and MSS. together amount to 513,000. The remaining university libraries are noticed in the tables.

Some of the town libraries of Germany mentioned in the tables were amongst the earliest established after the revival of learning. The oldest of them is perhaps that of Ratibon, which was founded at least as early as 1480. Since Ratibon has ceased to be an imperial city it has had to part with many of its treasures to the library at Munich.

The whole number of libraries in the German empire, as accounted by Dr Petzholdt in 1847, distributed amongst 584 towns

A report issued in 1873-74 by the Austrian Statistical Commission, furnishes an account of the condition of the libraries in those portions of Austria which are represented in the Reichsrath, as they were at the end of the year 1870. The number of libraries registered was 577, of which 23, however, were private libraries. Of the rest 159 belonged to religious corporations and seminaries, 105 were military libraries, 66 belonged to literary and scientific societies, 189 were of an educational and scholastic, and the remaining 45 of a public character.

The largest library in Austria, and one of the most important collections in Europe, is the Imperial Public Library at Vienna, apparently founded by the emperor Frederick III. in 1440, although its illustrious librarian Lambecius, in the well-known inscription over the entrance to the library which summarizes its history, attributes this honour to Frederick's son Maximilian. However this may be, the munificence of succeeding emperors greatly added to the wealth of the collection, including a not inconsiderable portion of the dispersed library of Corvinus. Since 1808 the library has also been entitled to the copy-privilege in respect of all books published in the empire. The sum devoted to the purchase of books is 26,250 florins annually. The main library apartment is one of the most splendid halls in Europe. Admission to the reading-room is free to everybody, and books are also lent out under stricter limitations.—The University Library of Vienna was established by Maria Theresa. The reading-room is open to all comers, and the library is open much longer than is the rule with university libraries generally. In winter, for instance, it is open from 5 to 8 in the evening, and it is even open from 9 to 12 on Sundays. In 1879, 159,768 volumes were used in the library, 16,800 volumes lent out in Vienna, and 4418 volumes sent carriage free to borrowers outside Vienna. The total number of libraries in Vienna enumerated by Dr Petzholdt is 101, and many of them are of considerable extent.

The number of monastic libraries in Austria is very considerable. Monastic Particulars are furnished, in the report already quoted, of 107 of libraries then, varying from a few hundreds of volumes to as many as 80,000. Many other such libraries are known to exist in the 468 monasteries.—The oldest of them, and the oldest library in Austria, is that of the monastery of St Peter at Salzburg, which was established by St Rupert in the 6th century. It possesses 60,000 volumes, with nearly 30,000 manuscripts. The four next in point of antiquity are Kremsmünster (50,000), Lambach (25,000), Admont (20,000), and Melk (16,000), all of them dating from the 11th century. Of the 147 libraries enumerated in the report, 56 possessed 5000 volumes or upwards at the end of 1870. For further particulars as to the large Austrian libraries the reader is referred to the tables.

The libraries in the Hungarian kingdom are not included in this

report, and, as will be seen from the tables, are not very numerous. The most important of them are at Ruda-Pest.

Switzer-
land.

The public libraries of Switzerland have been very carefully registered by Dr. Ernest Hatz, as they existed in 1868. Altogether no less than 2066 libraries are recorded, four-fifths of these belong to the class of "bibliothèques populaires et écoles pour la jeunesse," and few are of literary importance. Only eighteen have as many as 30,000 volumes. The largest collection of books in Switzerland is the University Library of Basel, founded with the university in 1460. The monastic libraries of St Gall and Einsiedeln date respectively from the years 830 and 846, and are of great historical and literary interest.

ITALY.

Italy.

As the former centre of civilization, Italy is of course the country in which the oldest existing libraries must be looked for, and in which the richest and most valuable MSS. are preserved. The Vatican at Rome and the Laurentian Library at Florence are sufficient in themselves to entitle Italy to rank before most other states in that respect, and the venerable relics at Vercelli, Milan, and La Cava bear witness to the enlightenment of the peninsula in times when other nations were slowly taking their place in the circle of Christian polity. The local rights and interests which so long helped to impede the unification of Italy were useful in creating and preserving at numerous minor centres many libraries which otherwise would probably have been lost during the progress of absorption that results from such centralization as exists in England. In spite of long centuries of suffering and of the aggression of foreign swords and foreign gold, Italy is still rich in books and MSS., there are probably more books in united Italy than in any other country except France. When the Italian Government published its valuable report on "Biblioteche" in the *Statistica del Regno d'Italia* in 1866, a table of relative statistics was given, which professed to show that, while the number of books in Austria (2,408,000) was greater than the total contents of the public libraries in any one of the countries of Great Britain, Prussia, Bavaria, or Russia, it was surpassed in France (4,389,000) and in Italy (4,149,281), the latter country thus exhibiting a greater proportion of books to inhabitants than any other state in Europe, except only Bavaria. The opulent libraries of Rome and Venice had not yet become Italian, and were not included in the report.¹

Public
Libraries.

The public libraries (*biblioteche governative*) are under the authority of the minister of public instruction, and are subject to certain regulations finally agreed upon during the ministry of Signor Ruggiero Bonghi in 1876.² They are classed under the headings of (1) national libraries of Florence, Naples, Turin, Palermo, Vittorio Emanuele of Rome, the Brevin of Milan, and the Marciana of Venice; (2) the libraries of the universities of the first class—Bologna, Naples, Padua, Pavia, Pisa, and Rome; (3) those of the universities of the second class—Cagliari, Catania, Genoa, Messina, Modena, Parma, and Sassari; (4) those of academies and institutions of fine arts; the last, although under Government control, are ruled by special regulations of their own. Small collections are sometimes handed over to the local authorities, should this be considered desirable, and the state will take into its own hands the administration of provincial or communal libraries if necessary. The librarians and subordinates are divided into (1) prefects, librarians, and sub-librarians; (2) assistant librarians; (3) attendants, or book distributors; (4) ushers, &c. Those

¹ The *Statistica* describes 210 libraries, of which 164 were open to the public and 46 not accessible; 171 were general and 39 special libraries, the latter including 25 devoted to sacred theology, 11 to science and literature, and 8 to the fine arts. Tuscany, Sicily, and Emilia were the richest in books, the latter province alone containing one quarter of the whole number.

² See the "Regolamento delle Biblioteche Pubbliche," by Count Ugo Balzani, *Library Journal*, iv. pp. 138-47.

of class I constitute the "board of direction," which is presided over by the prefect or librarian, and meets from time to time to consider important measures connected with the administration of the library. The candidates for posts in classes 1 and 2 must possess certain scholastic qualifications and serve for a specified time as *aspirant* on probation. An important feature of the regulations consists of the scheme (unfortunately not yet in working order) which is eventually to supply Italy with a body of young librarians properly trained in all the theoretical and technical branches of their profession. Each library is to possess, alike for books and MSS., a general inventory or accession-catalogue, an alphabetical author-catalogue, and a subject-catalogue. When they are ready, catalogues of the special collections are to be compiled, and these the Government intends to print, together with the subject-catalogues of the MSS. Various other small registers are provided for. The sums granted by the state for library purposes must be applied to (1) salaries and maintenance; (2) binding and repairs; (3) purchase of books, MSS., &c. Books are chosen by a committee nominated by the minister, which, in the national libraries, includes the members of the council of direction. In other libraries two members only of the council form part of the committee. In the university libraries two-fifths of the expenditure is decided by the committee, and the remainder by a council formed by the professors of the different faculties. The rules for lending books and MSS. allow them to be sent to other countries under very special circumstances.

The *biblioteche governative* are now 32 in number, and annually spend about 150,000 lire in books. From the three sources of gifts, copyright, and purchases, their accessions in 1879 were 35,541, being 2187 more than the previous year. The number of readers is now gradually increasing. In 1879 there were 896,749, who made use of 1,164,853 volumes, showing an increase of 10,393 readers and 180,061 books as contrasted with the statistics of the previous year.³

The minister of public instruction has kept a watchful eye upon the literary treasures of the suppressed monastic bodies. In 1876 there were 1700 of these confiscated libraries, containing two millions and a half of volumes. About 660 of the collections were added to the contents of the public libraries already in existence; the remaining 1050 were handed over to the different local authorities, and served to form 371 new communal libraries, and in 1876 the number of new libraries so composed was 415.

The Biblioteca Vaticana stands in the very first rank Vatican among European libraries as regards antiquity, since from the middle of the 6th century we have evidence of the existence of a pontifical library at Rome; and Pope Zachary (d. 752), himself a Greek, is known to have added considerably to the store of Greek codices. The Lateran Library shared in the removal of the papal court to Avignon, and it was on the return of the popes to Rome that the collection was permanently fixed at the Vatican. Nicholas V. (d. 1455) may, however, be considered the true founder of the library, and is said to have added 5000 MSS. to the original store. Calixtus III. also enriched the library with many volumes saved from the hands of the Turks after the siege of Constantinople. So large a proportion of the printed books of the 15th century having been produced by the Italian presses, it is natural to expect that a great number of specimens may be found in the papal library, and, but for the wholesale destruction of books and MSS. during the sack of Rome by the duke of Bourbon in 1527, the

³ Lists of foreign accessions to the *biblioteche governative* are published by the minister of public instruction from time to time. In 1877 R. Nordstedt made proposals for a general catalogue of their contents, and issued a specimen of *Evangelica*.

Vatican Library would have been as rich in early printed literature as it is now rich in manuscripts. Sixtus V. erected the present building in 1588, and considerably augmented the collection. Gregory XV. received as a gift from Maximilian, duke of Bavaria, the library of the elector Palatine seized by Tilly at the capture of Heidelberg in 1622. The greater part of the library at Urbino, founded by Duke Federico, was acquired in 1655 by Alexander VII. for the sum of 10,000 scudi, and some of the famous palimpsests from the Benedictine monastery of Bobbio were also added to the treasures of the Vatican. After the death of Christina, queen of Sweden, her collection of books and manuscripts, formed from the plunder seized at Prague, Wurtzburg, and Bremen by her father Gustavus Adolphus, became by succession the property of the Ottoboni family, the head of which, Alexander VIII., in 1689 placed 1900 of the MSS. in one of the galleries. Clement VII. and Pius II. also enriched the Vatican with valuable manuscripts, including many Oriental. In 1740 Benedict XIV. united with it the Ottoboniana, and in the same pontificate the Marchese Aless. Capponi bequeathed his precious collections. Clement XIII. in 1758, Clement XIV. in 1769, and Pius VI. in 1775 were also important benefactors. For over two hundred years the history of the Vatican was one of unbroken prosperity, but it suffered a serious blow at the close of the 18th century, when MSS. dating before the 8th century, and the most choice artistic specimens, altogether to the number of 600, were carried off by the French to Paris in 1798. The greater part were, however, restored in 1815, and most of the Palatine MSS., which formed part of the plunder, ultimately found their way to the university of Heidelberg in 1816. Pius VII. acquired for the Vatican the library of Cardinal Zelada in 1800; Leo XII. was able to add the noble collection of fine art literature of Count Cloguarn in 1823; and Gregory XVI. also largely augmented the library. Pius IX. in 1856 added 40,000 volumes belonging to Cardinal Mai.

Few libraries are so magnificently housed as the Biblioteca Vaticana. The famous *Codici Vaticani* are placed in the *salone* or great double hall, which is decorated with frescoes depicting ancient libraries and councils of the church. At the end of the great hall an immense gallery, also richly decorated, and extending to 1200 feet, opens out from right to left. Here are preserved in different rooms the *codici Palatini*, *Regni*, *Ottoboniani*, *Capponiani*, &c. Most of the printed books are contained in a series of six chambers known as the *Appartamento Borgia*. The printed books only are on open shelves, the MSS. being preserved in closed cases.

The present official estimate of the number of printed volumes is about 220,000, including 2500 15th century editions, of which many are vulgus copies, 500 Aldines, and a great number of bibliographical rarities.¹ There are 25,000 MSS., of which 19,641 are Latin, 3613 Greek, 609 Hebrew, 900 Arabic, 460 Syriac, 78 Coptic, &c. Among the Greek and Latin MSS. are some of the most valuable in the world, alike for antiquity and intrinsic importance. It is sufficient to mention the famous Biblical *Codex Vaticanus* of the 4th century, the *Vergil* of the 4th or 5th century, the *Terence* equally ancient, the palimpsest *De Republica* of Cicero, conjectured to be of the 3d century, discovered by Cardinal Mai, and an immense number of richly ornamented codices of extraordinary beauty and costliness. The archives are apart from the library, and are quite inaccessible to the public; no catalogue is known to exist. Leo XII. has appointed a committee to consider what documents of general interest may expediently

be published, and a greater liberality in the use of them is said to be contemplated.

The Biblioteca Vaticana is now open from 8 to 12 every morning between November and June, with the exception of Sundays, Thursdays, and the principal feast days. Permission to study is obtained from the cardinal secretary of state. The want of proper catalogues for the use of readers is a great drawback. There are imperfect written lists (for the use of the librarians alone) of the printed books, and various catalogues of special classes of the MSS. have been published. New catalogues, however, are in course of preparation. The Oriental MSS. have been described by J. S. Assemani, *Bibliotheca orientalis Clementino-Vaticana*, Rome, 1719-28, 4 vols. folio, and *Bibl. Vat. cod. MSS. catalogus ab S. E. et J. S. Assemano relictus*, id., 1768-69, 3 vols. folio, and by Cardinal Mai in *Script. Vat. nova collectio*. The Coptic MSS. have been specially treated by G. Zoega, Rome, 1810, folio; and by F. G. Bonjourn, Rome, 1699, 4to. There are printed catalogues of the Capponi (1747) and the Cloguarn (1820) libraries.

Next in importance to the Vatican library is the Casanatense, other so called from the name of its founder, Cardinal Casanati (1700). Rome. It contains about 130,000 volumes of printed books, including a library of large number of 15th century impressions and early editions with woodcuts, as well as about 2500 MSS., amongst which are one of the 7th century and several of the 8th, 9th, and 10th centuries. They are carefully arranged in eleven rooms, the large central hall being one of the finest in Rome. Books are not allowed to be taken out of the reading-rooms, but admission is freely granted, and the annual number of readers is about 18,000. The subvention is a small one, but additions continue to be made, and the library is well administered. All the officials, in accordance with the founder's will, belong to the Dominican order. The incomplete catalogue of the printed books, prepared by A. Audifredi (Rome, 1761-88, 4 vols. folio), still remains a model of cataloguing.—The Biblioteca Vittorio Emanuele forms part of the Collegio Romano, and was made up from the old Jesuit library, enriched by accessions from a number of other suppressed institutions. It comprises a total of 860,000 volumes, with 5000 MSS., and is united to the Casanatense by a bridge. The entire edifice is spacious enough to contain a million of volumes, besides the Kircherian and other museums which are already located in it.—The Biblioteca Angelica possesses all the authentic works of the Gregorians in Latin, and the precious collections of Cardinal Passionei and Lances. Huetz.—The Biblioteca Alessandrina della R. Università di Roma, founded by Alexander VII., is considerably used by students: there were in 1876 67,000 readers. The greater part of the printed books formerly in the collection of the dukes of Urbino is now in this library.—The Biblioteca del Senato is very rich in collections of municipal history and statutes of Italian cities. The printed catalogue (1878) describes no less than 1067 statutes or volumes containing them, relating to 443 localities.—The Biblioteca Valliniana was founded by S. Filippo Neri, and contains some valuable manuscripts, including a Latin Bible of the 4th century attributed to Aleuin, and some incised writings of Beronius.—In 1877 Professor A. Sarti presented to the city of Rome his collection of fine-art books, 10,000 volumes, which was placed in charge of the Accademia di San Luca, which already possessed a good artistic library.—Of private libraries accessible to the public, we note the Biblioteca Barberina, including many rare editions with valuable autographs, but especially remarkable for its MSS.; these were chiefly collected by Cardinal Fr. Barberini, the nephew of Urban VIII., and comprehended the letters and papers of Galileo, Bembo, and Bellarmine, the reports on the state of Catholicism in England in the time of Charles I., and a quantity of incited materials for the history of the Stanzas. A catalogue was published at Rome in 1681, 8 vols. folio.—The Corsiniana, founded by Clement XII. (Lorenzo Corsini), is also a private library; it is rich in incunabula, and includes one of the most remarkable collections of pictures in Italy, the series of Marco Antonio being especially complete.—The library of the Collegium de Propaganda Fide was established by Urban VIII. in 1623, and in 1867 the rector Andrea Bonvicini obtained permission to preserve in it prohibited books. It was

¹ See *Collegio Romano, Discorso di Ruggiero Bonghi*, Rome, 1876.

² Signor R. Michoud produced a catalogue of the other three Oriental in 1877. The Casanatense, Vat. Emanuele, Angelica, Alessandrina are Governmental, and in 1878 the minister of public instruction published a catalogue of the Oriental MSS. in the three last. The Oriental MSS. of the other *Bibliotheca generalis* will be treated in subsequent volumes.

¹ The books have never been actually counted, and this estimate has been reduced by some persons to half the number.

destroyed by the French army in 1798, and owes its present richness almost entirely to testamentary gifts, among which may be mentioned those of Cardinals Borgia, Colonna, and Estro. It is a private collection for the use of the congregation and of those who belong to it, but permission may be obtained from the superiors. There are at least 15 libraries in Rome which are more or less accessible to the public. One is now in course of formation which will include everything relating to the emancipation of Italy.

Subiaco.

At Subiaco, a few miles from Rome, the library of the Benedictine monastery of Santa Scolastica is not a very large one, comprising only 6000 printed volumes and 400 MSS., but the place is remarkable as having been the first seat of typography in Italy. It was in this monastery that Schweyheilm and Farnart, fresh from the dispersion of Fust and Schoeffer's workmen in 1439, established their press and produced a series of very rare and important works which are highly prized throughout Europe. The Subiaco Library, although open daily to readers, is only visited by students who are anxious to behold the cradle of the press in Italy, and to inspect the series of original editions preserved in their first home.

National
libraries
Florence.

The great national libraries are as follows:—

The Biblioteca Nazionale di Florence, formed from the union of Magliabechi's library with the Palatina, the largest under Government control in Italy. The Magliabechi collection became public property at his death in 1714, and with the accessions made from time to time, held an independent place until 1862, when the Biblioteca Palatina (formed in 1816 from the old Pitti Library and the collections of Poggiali and Kozovsky) was incorporated with it. An old statute, by which a copy of every work printed in Tuscany was to be presented to the Magliabechi Library was formerly much neglected, but has been maintained rigorously in force since 1860. There are many valuable autograph originals of famous works in this library, and the MSS. include the most important extant copies of Dante and later poets, as well as of the historical works of Villani, Machiavelli, and Guicciardini. Amongst the printed books is a very large assemblage of rare early impressions, a great number of the *Rappresentazioni* of the 16th century, at least 200 books printed on vellum, and a copious collection of municipal histories and statutes, of tests of geographical and topographical maps. The MSS. portion, 25 in number, are for the most part of great importance; the oldest is dated 1417, and several seem to be the original charts executed for Sir Robert Dudley (duke of Northumberland) in the preparation of his *Arconte del Mare*. The annual increment of books in this library is about 15,000, and is open freely to the public, and about 50,000 readers annually make use of it. About 80,000 printed volumes and 2500 MSS. are consulted annually, not including some 1600 books and 80 MSS., which are lent out yearly to certain students.—The Biblioteca Nazionale at Naples, though only opened to the public in 1804, at the suggestion of this city, the nucleus from which it developed was the collection of Cardinal Seripando, which comprised many MSS. and printed books of great value. Acquisitions came in from other sources, especially when in the year 1846 many private and conventual libraries were thrown on the Neapolitan market.¹ The Biblical section is rich in volumes, commencing with the Mainz Bible of 1462, printed on vellum. Other special features are the collection of *testi di lingua*, that of books on volcanoes and that of works printed at famous presses, particularly those executed by the typographers of Naples. The MSS. include a palimpsest containing writings of the 8d, 9th, and 10th centuries under a grammatical treatise of the 8th, 2 Latin poetry of the 9th century, over 50 Latin Bibles, and a great number of illuminated books with miniatures. There are more than 40 books printed on vellum in the 16th and 17th centuries, including a fine first Homer. There are several MS. maps and portolan, one of them dating from the 14th century. About 16,000 readers use this library, consulting some 140,000 books yearly.

Naples.

Milan.

The Biblioteca Nazionale di Milano, better known as the Brera, founded in 1770 by a decree of the empress Maria Theresa, consists of 168,138 printed volumes and 3648 MSS., with a yearly increment of about 6000 volumes, with miniatures representing the advance of the amount to 46,000. It comprises nearly 2500 books printed in the 16th century (including the rare *Monia Santo di Dio* of Bizzini, 1477), 918 Aldine impressions, and a xylographic *Bibbia Pauperum*. Amongst the MSS. are an early Dante and autograph letters of Galileo, some poems in Tasso's autograph, and a fine series of illustrated service-books, with miniatures representing the advance of Italian art from the 12th to the 16th century. These were formerly

Palermo.

Turin.

in the Certosa at Parma.—The Biblioteca Nazionale di Palermo, founded from the Collegio Massimo of the Jesuits, with additions from other libraries of that suppressed order, is rich in 16th century books, which have been elaborately described in a catalogue printed in 1876, and in Aldine and bibliographical curiosities of the 16th and following centuries.—The Biblioteca Nazionale di Turin is extensively used by readers, whose annual

number amounts to 120,000. The majority of the books are works for scientific study, but amongst them are several rarities, comprising a Soderini MS. of the 5th century, the celebrated MS. of the *De Institutione* (on which the assignment of its authorship to Cicero is founded,—see Keuvrgh), and several productions of the earliest German and Italian printers.—The Biblioteca Marciana, or library of St Mark at Venice, was founded Venice in 1802 by a donation of MSS. from the famous Petrusch (most of them now lost), and constituted as a library by Cardinal Bassano in the 16th century. It is open daily, and is used by about 4000 readers annually. The precious contents include Greek MSS. of great value, of which more than 1000 were given by Cardinal Bessarion, important MS. collections of works on Venetian history, rare manuscripts, and a great number of volumes, unique or exceedingly rare, on the subject of early geographical research. Amongst the MSS. is a Latin Homer in the autograph of Boisson, an invaluable copy of the laws of the Lombards, and the autograph MS. of Sargi's *History of the Council of Trent*. Since the fall of the republic and the suppression of the monasteries afterwards, a great many private and conventual libraries have been incorporated with the Marciana.

Of the remaining libraries under Government control it is unnecessary to notice the Biblioteca della Università at Bologna, since founded in 1719 by Count Luigi F. Marzighi or Marsili. The library MSS. comprise a rich Oriental collection of 547 MSS. in Arabic, 173 in Turkish, and several in Persian, Armenian, and Hebrew. Amongst the Latin codices is a *Lectiones* of the 6th or 7th century. The other noteworthy articles include a copy of the Armenian gospels (12th century), the *Arriani*, with miniatures dated 1194, described in Montfaucon's *Diploma Gallicum*, and some unpublished Greek texts. Amongst the Italian MSS. is a not uninteresting of municipal histories. Mazzuchini, for a long time the custodian here, and his own collection of books, has been incorporated in the library, which is remarkably likewise for the number of early editions and Aldines which it contains. It possesses the Mainz Latin Bible dated 1462; the *Lectiones* and *Augustine De Civitate Dei* printed by Schweyheilm and Farnart, the Foligno Dante of 1474, and a copy of Henry VIII.'s *despatches*. The other noteworthy articles include a copy of the drawings by Agostino Caracci as another special feature of worth. The Manfredi palace, in which the library is arranged, is a fine building begun in 1714 and finished in 1744. The grand hall with its fine furniture is valued more than particular attention. The library is open to the public; and yearly a number of readers is about 25,000, and of books consulted 40,000.²

Of the remaining Government libraries the following may be named.—The Biblioteca del Monastero della S. Trinità, at La Cava dei Treveri in the province of Salerno, is situated the Biblioteca dell' Archivio Capitulare which is the most ancient library in the Italian kingdom, its foundation being said to be contemporaneous with that of the Benedictine abbey itself (beginning of the 11th century). It only contains some 10,000 volumes, but these include a number of MSS. of very great rarity and value, ranging from the 8th to the 14th century. Amongst these is the celebrated *Codex Legum Longobardorum*, dated 1004, besides a well-known geographical chart of the 12th century, over 100 Greek MSS., and about 1000 charters beginning with the year 840, more than 500 of which belong to the Lombard and Norman periods.—At Florence the Marcioni Library, founded in 1752, is remarkable for its series of early woodcuts and metal engravings. The number of these and of original drawings by the old masters amounts to 80,000 pieces.—At Modena is the famous Biblioteca Palatina, sometimes called *Modena* the Biblioteca Estense from having been founded by the Este family at Ferrara in 1358; it was transferred to Modena by Cesare D'Este in 1698. Muratori, Zaccaria, and other great librarians here, and made good use of the treasures of the library. It is particularly rich in early printed literature and valuable codices.—The oldest library at Naples is the Biblioteca Brancacciana, with many valuable MSS. relating to the History of Naples. Two palimpsests by Constantine the Great have been found in 1878 by Cardinal J. M. Brancaccio.—The Regia Biblioteca di Parma, founded definitively in 1770, owes its origin Parma to the grand-duke Philip, who employed the famous scholar Reisch to organize it. It is now a public library containing 218,494 volumes, including 4000 MSS., with an annual increment of nearly 1000 volumes. Amongst its treasures is De Rossi's magnificent collection of Biblical and rabbinical MSS.

Chief among the great libraries not under Government control comes the world-famed Biblioteca Mediceo-Laurenziana at Laurentine, formed from the collections of Cosimo the Elder, Pietro de' Medici, and Lorenzo the Magnificent (who bequeathed the remainder of the family after the expulsion of the Medici from Florence, and were repurchased by Cardinal Giovanni afterwards Leo X.). It was first constituted as a public library in Florence by

¹ A palimpsest by the present chief librarian, Vito Bonazzi, Naples, 1874, gives many useful details, although he there overstates the number of MSS. as 10,000 (there may be some confusion between volumes and works).

² Notices of other libraries of this class will be found in the table.

Clement VII, who charged Michelangelo to construct a suitable edifice for its reception. It was opened to the public by Cosimo I in 1571, and has ever since gone on increasing in value, the accessions in the 18th century alone being enough to double its former importance. The printed books it contains are probably no more than 30000 in number, but are almost all the highest rarity and the most interesting. It is the collector's library, and contains up to about 7000 autographs, which gives it their chief importance to this library. They comprise some of its most valuable codices in the world—the famous *Vulgar* of the 4th or 5th century, *Justinian's Pandects* of the 7th, a *Homær* of the 10th, and several other very early Greek MSS. of the 11th and 12th centuries, as well as some of the best handwritings of Petrarch, about 100 copies of *Don Quixote*, *Desnoyers*, copied by a contemporary from Boccaccio's own MS, and Cellini's MS of his autobiography. Bandini's catalogue of the MSS comprises 18 vols folio, printed in 1764–78.—At Genoa the *Biblioteca Franeschini*, founded about 1770 for the purpose of collecting the MSS of the *Franceschini* family, has a fine humanæ library, printed and unprinted, for the use of graduates.

Ambrosiana. The famous Biblioteca Ambrosiana at Milan was founded in 1809 by Cardinal Fed. Borromeo. It contains 184,000 printed volumes and 8100 MSS. Amongst the MSS are a Greek Pentateuch of the 5th century, the famous *Peshito* and Syro-Hexaplar from the Nitrian convent of St Maria Deipara, a Josephus written on papyrus, supposed to be of the 5th century, several palimpsest texts, including an early *Platine*, and *St Jerome's* commentary on the *Psalms* in a volume of 7th century execution, full of contemporary glosses in Irish, Gothic fragments of *Ulfilas*, and a *Virgil* with notes in Petrus's handwriting.¹ Noteworthy amongst the MSS is the *Mariner's Eusebius* of 1471, as well as the *Virgil* of 1470 (Venice), and the *editio princeps* of Isocrates, both printed on vellum. Cardinal MSS, *ms*

cups of coffee; and the pastiche here is by 1879 Professor C. Managatti, president of the "Biblioteca Europea," consisting of 2500 volumes, 300 maps, and 6000 pieces, all relating to the literatures and linguistics of European countries.—The Latin and Trivulzio libraries should not pass without mention here, although they are private and inaccessible without special permission. The former is remarkable for its collection of books and manuscripts with notes written in the hands of 1481 twenty deacons by Paolo Bandinelli. The latter is rich in MSS with miniature of the finest and rarest kind, and in printed books of which many are unique or nearly so. It consists of 70,000 printed volumes.—The foundation of the monastery of Monte Cassino is due to St Benedict, who arrived there in the year 529, and established the prototype of monasteries in western Europe. He brought with him a few manuscripts, four or five of which are still to be seen. The library of printed books now extends to about 20,000 volumes, chiefly relating to the theological sciences, but including some rare editions. A collection of the books belonging to the monks is in course of formation ; it contains about the same number of volumes as the great glory of the Vatican—namely, the entire contents of the library of the Vatican. This includes 80,000 or 40,000 latins, diplomas, charters, and other documents, besides 100,000 MSS dating from the 6th century downwards. The latter comprehend some very early Bibles and important codices of patristic and other medieval writings. There are good written catalogues, and a calendar is now being published, *Bibliotheca Cassinensis*, of which I have procured a copy. These publications enjoy no special revenues, and their expenses entirely to donations.—At Ravenna the Biblioteca Classense has a 10th century code of Aristophanes and two 14th century codes of Dante. Here are also the autograph correspondences of Muratori, and many unpublished letters of modern writers.—At Vercelli the Bibliotheca Gelfi Alessandrini Covattone, the most valuable one, has been assigned to the certain date, but will be referred to the early days of our barbarous conquerors of Italy had become Christianised, comprises nothing but MSS, all of great antiquity and value. Among them is an Evangelium in Russian in Latin, supposed to be of the 4th century; also the famous code containing the Anglo-Saxon *Lomlives* which have been published by the *Zellio Society*.—The public library at Verona is the richest in the north of Italy, the invaluable state paper records of the Venetian republic.

Brussels. The national library of Belgium is the Bibliothèque Royale at Brussels, of which the basis may be said to consist of the famous Bibliothèque des Ducs de Bourgogne, the library of the Austrian sovereigns of the Low Countries, which had gradually accumulated

³ Ceriani has published many of the unique treasures of this collection in his

* This, as well as the Brera library, is exhaustively described in *ON Italian antiquities, letters, and artists of Milan*, published by the Società Storica Lombarda in 1880; a special treatise on the Brera was published in 1872 by the librarian G. Sacchi. See also Roschi, *De origine et statu Bibliothecae Ambrosianae*, 1873.

* A most interesting & accurate account of the history of this library may be read in the introduction to *Catalogue des MSS. de la Bibliothèque royale des arts de Paris*, by M. Marchal, Brussels, 1842, 4 vols. etc.

Scaliger, Isaac Voss, Heubner, and Heuserius. The MSS comprehend many of the most important; the Oriental codices number 2400. The library of the Society of Netherland Literature has been placed here since 1877; this is rich in the national history and literature. The Arabic and Oriental MSS. known as the Legation Warmermann are of great value and interest, and the collection of maps bought in 1870 by J. J. Boel Nijmhus is also noteworthy. The library is contained in a building which was formerly a church of the Bégimes, adapted in 1860 somewhat after the style of the British Museum. The catalogues (one alphabetical and one classified) are on slips, the titles being printed. A catalogue of books and MSS was printed in 1716, one of books added between 1814 and 1817 in 1846, and a supplementary part of MSS. only in 1860. A catalogue of the Oriental MSS was published in 6 vols., 1851-77.

Utrecht. The University Library at Utrecht dates from 1628, when certain conventual collections were brought together in order to form a public library, which was shortly afterwards enriched by the books bequeathed by Hub Bachelius and Kv. Polius. Upon the foundation of the university in 1636, the town library passed into its charge. Among the MSS. are some interesting older MSS and the famous "Utrecht Psalter," which contains the oldest text of the Athanasian creed. The last edition of the catalogue was in 9 vols. folio, 1854, a supplement in 1845, index from 1846-55 in 8vo, and additions 1856-70 in 2 vols. 8vo. The titles of accessions are now printed in sheets and pasted down for insertion.

Amsterdam. The basis of the University Library at Amsterdam consists of a collection of books brought together in the 16th century and preserved in the Nieuwe Kerk. At the time of the Reformation in 1578 they became the property of the city, but remained in the Nieuwe Kerk for the use of the public till 1632, when they were transferred to the Athenaeum. Since 1877 the collection has been known as the University Library, and in 1881 it was removed to a building designed upon the plan of the new library and reading-room of the British Museum. The library includes the best collection of medical works in Holland, and the Bibliotheca Rosenbachiana of Hebrew and Talmudic literature is of great fame and value; a catalogue of the last was printed in 1875. The libraries of the Dutch Geographical and other societies are preserved here. A general catalogue was issued in 6 vols. 8vo, Amsterdam, 1858-77; one describing the bequests of J. de Bosch Kemper, E. J. Poegeler, and P. W. Rive, in 8 vols. 8vo, 1878-79; a catalogue of the MSS. of Professor Mall was published in 1880, and one of those of P. Camper in 1881.

Denmark, Norway, and Sweden

Copenhagen. The commencement of the admirably managed national library of Denmark, this great Royal Library at Copenhagen, may be said to have taken place during the reign of Christian III. (1533-58), who took pride in importing foreign books and choice MSS., but the true founder was Frederick III. (1648-70); to him is mainly due the famous collection of Icelandic literature and the acquisition of Tycho Brahe's MSS. The present building (in the Christiansborg Castle) was commenced in 1667. Among notable accessions may be mentioned the collections of O. Reizner, the count of Darneskjöld (3000 volumes and 600 MSS.) and Count de Thott; the last bequeathed 6389 volumes printed before 1681, and the remainder of his books, over 100,000 volumes, were eventually purchased. In 1788 the library was opened to the public, and it has since remained under state control. Two copies of every book published within the kingdom must be deposited here. The manuscripts and block books form an important series. There is a general classified catalogue in writing in 295 folio volumes for the use of readers; and an alphabetical one on slips arranged in boxes for the officials. A good catalogue of the De Thott collection was printed in 13 vols. 8vo, 1789-95; a catalogue of the French MSS. appeared in 1844. Of Oriental MSS., 1846; of the Danish collection, 1875, 8vo. Annual reports and accounts of notable MSS. have been published since 1864. There were 7000 additions in 1880.

The University Library, founded in 1459, was destroyed by fire in 1728, and re-established shortly afterwards. A copy of every Danish publication must be deposited here. The MSS. include the famous Arns-Magnæsen collection (see vol. xi. p. 628).

Christiania. The chief library in Norway is the University Library at Christiania, established at the same time as the university, September 2, 1311, by Frederick II., with a donation from the king of many thousands of duplicates from the Royal Library at Copenhagen, and since augmented by important bequests.

Stockholm. The Royal Library at Stockholm was first established in 1656. The original collection was given to the university of Upsala by Gustavus II., that formed by Christina at the fall of Sweden, and the library brought together by Charles X. was destroyed by fire in 1697. The present edifice was organized shortly afterwards. The Bonatzleria-Ringsström Library, 14,500 printed volumes and 1200 MSS., rich in materials for Swedish history, is now annexed to it. Natural history collections and mathematical are left to other

libraries. Among the MSS. the *Codex Aureus* of the 6th or 7th century, with its interesting Anglo-Saxon inscription, is particularly noteworthy. The catalogues are in writing, and are both alphabetical and classified. Printed catalogues have been issued of portions of the MSS. The present building was opened in 1882.

The University Library at Upsala was founded by Gustavus Upsala Academicus in 1699, from the remains of several convent libraries; he also provided an endowment. The MSS. chiefly relate to the history of the country, but include the *Codex Argenteus*, containing the Gothic gospels of Ulfilas. The general catalogue is in writing. A catalogue was printed in 1814, special lists of the foreign accessions have been published each year from 1860, the Arabic, Persian, and Turkish MSS. are described by C. J. Tornerberg, 1848. The library at Lund dates from the foundation of the university in 1668, and was based upon the old cathedral library. The MSS. include the De la Gardie archives, acquired in 1849.

Spain and Portugal

The chief library in Spain is the Biblioteca Nacional (formerly Madrid the Biblioteca Real) at Madrid. The printed volumes number 400,000 volumes, with 200,000 pamphlets; the accessions in 1880 amounted to 25,840 volumes. Spanish literature is of course well represented, and, in consequence of the numerous accessions from the libraries of the suppressed convents, the classes of theology, canon law, history, &c., are particularly complete. The number of bibliographical rarities was largely increased by the acquisition of the valuable collection formed by the well-known bibliographer Don Luis de Usar. There are 30,000 MSS., contained in 10,000 volumes and bundles; they include some finely illuminated codices, historical documents, and many valuable autographs. The collection of prints extends to 124,000 pieces, and was principally formed from the important series bought from Don Yáñez Cardenas in 1855. In 1830 54,874 books were issued to 51,946 readers. The annual revenue is only £1800. The printed books have one catalogue arranged under authors' names, and one under title, the departments of music, maps and charts, and prints have subject-catalogues as well. There is a general index of the MSS., and special catalogues of the Greek and Latin codices and genealogical documents. The first (and only) volume of a printed catalogue of the Greek MSS. appeared in 1769. This cannot be made as most valuable and well arranged. Of the other Madrid libraries (see the tables) it is enough to mention the Biblioteca de Academia de Historia (20,000 volumes and 1500 MSS.), which contains some printed and MS. Spanish books of great value, including the well-known Salazar collection.—The history of the library of the Escorial has been given at vol. viii. p. 541. Escorial. In 1603, before the invasion, the Escorial is estimated to have contained 80,000 printed volumes and 3400 MSS.; Joseph removed the collection to Madrid, but when it was returned by Ferdinand 10,000 volumes were missing. There are now 32,142 printed volumes, with 538 Greek, 1905 Arabic, 73 Hebrew, and 2050 Latin MSS. The Arabic MSS. have been described by M. Casiri, 1760-70; and a catalogue of the Greek codices by Müller was issued at the expense of the French Government in 1848. There is an imperfect writer's catalogue of the printed books, and the present librarian is now engaged upon a catalogue of the Latin MSS. Permission to study at the Escorial, which is one of the royal private libraries, must be obtained by special application.

Among the libraries of Portugal the Biblioteca Nacional at Lisbon. Lisbon naturally takes the first place. In 1841 it was largely increased from the monastic collections, which, however, seem to have been little cared for according to a report prepared by the principal librarian three years later. There are now said to be 200,000 volumes of printed books, among which theology, canon law, history, and Portuguese and Spanish literature largely predominate. The MSS. number 8416, including many of great value. There is also a cabinet of 40,000 coins and medals.—The Bibliotheca de Academia, founded in 1780, is preserved in the suppressed convent of the Ordem Terceira da Penitência. In 1836 the Academy acquired the library of that convent, numbering 30,000 volumes, which have since been kept apart. The Archive Nacional, in the same building, contains the archives of the kingdom, brought here after the destruction of the Torre do Castelo during the great earthquake.

The Bibliotheca Publica Municipal at Oporto is the second largest Oporto. In Portugal, although only dating from July 8, 1858, the anniversary of the proclamation of D. Pedro, and when the memorable siege was still in progress; from that date to 1874 it was styled the Real Bibliotheca do Porto. The regent (ex-emperor of Brazil) gave to the town the libraries of the suppressed convents in the northern provinces, the municipality undertaking to defray the expense of keeping up the collection, but only £150 is yearly spent on books and bindings, and £250 on salaries. Recent accessions consist

¹ Guichard, *Les Bibliothèques de Madrid et de l'Escorial; notices et extraits des MSS. qui composent l'histoire de Philippe, Bruneau, 1876, 4to.* Ch. Guizot, *Essai*

mainly of Portuguese and French books. The important Caracoe collection is described in a printed catalogue, Oporto, 1850. A notice of the MSS. may be found in *Catálogo dos MSS da B. Publica do Rio de Janeiro*, by H. da Cunha Rivara, Lisbon, 1850-70, 3 vols. folio, and the first part of an *Index preparatus ad Catalogo dos Manuscriptos* was produced in 1850.

Russia

St. Petersburg. The Imperial Public Library at St. Petersburg is the third largest library in the world, and now claims to possess 1,000,000 printed volumes. The commencement of this magnificent collection may be said to have been, the books sent by the Czar Peter during his invasion of Courland in 1714, the library did not receive any notable augmentation, however, till the year 1795, when, by the acquisition of the famous Zolnaki collection, the Imperial Library suddenly attained a place in the first rank among great European libraries. The Zolnaki Library was formed by the Polish count Joseph Zolnaki, who collected at his own expense during forty-three years no less than 200,000 volumes, which were added to by his brother Andrew, bishop of Cracow, by whom in 1747 the library was thrown open to the public. At his death it was left under the control of the Jesuit College at Waisaw, on the suppression of the order it was taken care of by the Commission of Education, and finally in 1795 it was transferred by Suwaroff to St. Petersburg as a trophy of war. It then extended to 260,000 printed volumes and 10,000 MSS, but in consequence of the withdrawal of many useful and illustrated works to enrich other institutions, hardly 238,000 volumes remained in 1810. Literature, history, and theology formed the main features of the Zolnaki Library, the last class alone amounted to one-fourth of the whole number. Since the commencement of this century, through the liberality of the sovereigns, the gifts of individuals, careful purchases, and the application of the law of 1810, whereby two copies of every Russian publication must be deposited here, the Imperial Library has attained its present extensive dimensions. Nearly one hundred different collections, some of them very valuable and extensive, have been added from time to time. They include, for example, the Tolstoi Slavonic collection (1800), Tischendorf's MSS (1858), the Dolgorouki Oriental MSS (1859), and the Karamzin collection (Karamzin collection (1859-65), the libraries of Adelung (1858) and Tobler (1877), that of the Slavonic scholar Jungmann (1856), and the national MSS. of Karamzin (1867). This system of acquiring books, while it has made some departments exceedingly rich, has left others comparatively meagre.

The library was not regularly opened to the public until 1814; it is under the control of the minister of public instruction. In the printed book department the yearly average of readers is now 107,000, and of books consulted 235,800. The annual grant from the treasury is 75,174 roubles; an income of 1848 roubles is derived from other sources. The official estimate of the number of printed books is 1,000,000 volumes, with 19,059 maps and 74,000 prints and photographs. The yearly accessions amount to about 50,000. The Russian books number 100,000 and the Russian 80,000 volumes, the Arian and Elsevier form a nearly perfect collection, and the innumerable sea numerous and very meticulously cared for.

The manuscript include 26,000 codices, 41,840 autographs, 4689 charters, and 576 maps. The glory of this department is the celebrated *Codex Bezae Cantabrigiae* of the Greek Bible, brought from the convent of St. Catherine on Mount Sinai by Tischendorf in 1859. Other important Biblical and patristic codices are to be found among the Greek and Latin MSS, the Hebrew MSS include some of the most ancient that exist, and the Samaritan collection is one of the largest in Europe; the Oriental MSS. comprehend many valuable texts, and among the French are some of great historical value.

The general catalogues are in writing, but the following special catalogues of the printed books have been published—the *Voltaire* collection of early printed Russian books, 1829; the *Altdine*, 1854, the *Elzevir*, 1865, and another in 1864, by C. F. Walther; editions printed during the reign of Peter the Great, by Bytchkoff, 1847; the foreign books relating to Peter the Great by P. Minckoff, 1872; and the Russian, vol. 1, 1873. Lists of the foreign books have been issued since 1863, and the *Comptes Rendus* published since 1850 contain notices of the most important acquisitions.

The following catalogues of the MSS. are in print—the *Tolstoi Slavonic collection*, 1826; *Dom's catalogue of the Oriental MSS*, 1832; old German, 1850; the Greek, by Murik, 1854, the *Elzevir*, 1865; the *Hebrew MSS*, 1875, *Slavonic and Russian miscellanea*, parts 1 and 2, 1878-80.

The nucleus of the library at the Hermitage Palace was formed by the empress Catherine II., who purchased the books of the MSS. of Voltaire and Diderot. In the year 1801 the collection amounted to 160,000 volumes, of which nearly all not relating to the history of art were then transferred to the Imperial Library.

Moscow. The second largest library in Russia is contained in the public museum at Moscow. The class of history is particularly rich, and

Russian early printed books are well represented. The MSS. number 5000, including many ancient Slavonic codices and historical documents of value. One room is devoted to a collection of Masani MSS, which comprehend the archives of the lodges in Russia between 1810 and 1821. There is a general alphabetical catalogue in writing, the catalogue of MSS has been printed, as well as those of some of the special collections.

For other Russian libraries see the tables.

India, China, and Japan.

Of Indian libraries it is sufficient to notice those that have India.

Superintendent for Oriental Letters. At Calcutta the Sanskrit college has 1669 printed Sanskrit volumes and 3799 Sanskrit MSS, some as old as the 14th century, there is also a large collection of Jan. MSS. A catalogue is now being prepared for publication.—The Arabic library attached to the Arabic department of the Madras was founded about 1781, and now includes 731 printed volumes, 148 original MSS and 151 copies, the English library of the Anglo-Persian department dates from 1864, and extends to 8254 volumes.—The library of the Asiatic Society of Bengal was founded in 1784, and now contains 15,000 printed volumes, chiefly on Eastern and philological subjects, with a valuable collection of 9500 Arabic and Persian MSS. A catalogue is now passing through the press.

At Bombay the library of the Bombay branch of the Royal Asiatic Society, established in 1804 as the Literary Society of Bengal, is now an excellent general and Oriental collection of 40,000 printed volumes and 200 MSS, described in a printed catalogue of 1875. The Moolla Faizul Library was bequeathed for public use by Moolla Faizul, head priest of the law of the Kodri sect, in 1831, and consisted chiefly of MSS. in Arabic and Persian on history, philosophy, and astronomy, some additions of English and Gujarati works have been made, as well as of European books on Zoroastrianism. A catalogue has been printed.

The library of Tanjore Sahib, consisting of 2000 MSS, fell into the hands of the British, and a descriptive catalogue of them by Charles Stewart was published at Cambridge in 1809, 4to. A few were presented to public libraries in England, but the majority were placed in the college of Fort William, then recently established. The first volume, containing Persian and Hindustani poetry, of the *Catologue of the Libraries of the King of Oudh*, by A. Sprenger, was published at Calcutta in 1854. The compiler shortly afterwards left the Indian service, and no measures were taken to complete the work. On the annexation of the kingdom in 1855 the eking is believed to have taken some of the most valuable MSS. to Calcutta, but the largest portion was left behind, by the King of Oudh, to be used as the books were used to block up windows, &c., and those which were not destroyed were abandoned, and plundered by the soldiers. Many were burnt for fuel, a few, however, were rescued and sold by auction, and of these some were purchased for the Asiatic Society of Bengal.

Perhaps the most remarkable library in India is that of the raja of Tanjore, which dates from the end of the 18th or beginning of the 17th century, when Tanjore was under the rule of the Taluqa Naika, who collected Sanskrit MSS written in the Telugu character. In the 18th century the Marathas conquered the country, and since that date the library increased but slowly. By the greater portion of the store was acquired by Sheroobahadur Raja during a visit to Bonares in 1820-30, his successor Sivaji added a few, but of inferior value. There are now about 18,000 MSS. written in Devanagari, Nagari, Telugu, Kannada, Grantha, Malayalam, Bengali, Pali, or Kashmiri, and Uru; 8000 are on palm leaves. Dr. Burnell's printed catalogue describes 19,575 articles.

Thanks to the enlightened policy of the Government of India, we are beginning to know much more respecting native literatures than was possible a few years ago, and since 1868 a yearly sum of 24,000 rupees has been granted to carry on the work of searching for Sanskrit MSS. The first part of a list of these in private lands in southern India has been published by Dr. G. Oppert; it contains a description of 8376 MSS, and another volume is in course of preparation. Dr. Buhler, in his investigation of Sanskrit's library at Bombay, found 800 MSS. of great antiquity, six dating from the beginning of the 13th century. A resident has examined the Samghavina Peda Library in Pithan, and a catalogue has been prepared for printing. A copy of the oldest Sanskrit dictionary, the *Sanskrit Kosha*, of which only one other copy (at the Bodleian) is known, was found here. Dr. Buhler also obtained 490 Sanskrit MSS. for the Government. Inquiries made in Bihar have not met with much result. Notices of Sanskrit MSS in the presidency of Bengal have been prepared under the direction of Dr. Rajendralal Mitra; seven fasciculi (1000 pp.) have been printed, describing 842 articles. The same scholar has also printed a catalogue (746 pp.) of the library of the maharaja of Bikaner, describing 2000 Sanskrit MSS and his analysis of the Sanskrit Buddhist literature of Nepal will shortly be published. The total number of Sanskrit MSS. acquired in this presidency in 1861, some of which are new to Europeans. Two catalogues of 180 Sanskrit MSS. discovered in the North-Western Provinces and Oudh during 1878-80 have been projected,

and the following libraries (containing many important texts) of the Punjab have been acquired.—That of Pandit Rikhkoshia, of 600 books, Pandit Jyoti Datta Pressda, 2690 MSS., the largest collection in the province, and Pandit Dularam, 430 MSS. The efforts of Dr. Fockhammer will probably bring to light many valuable Sanskrit MSS., both in Upper and Lower Burma.

The Balfour Library at Singapore was established as a proprietary institution in 1844, taken over by the Government in 1874, and given legal status by an ordinance passed in 1878. It now contains 11,000 volumes in general literature, but books relating to the Malay Peninsula and archipelago have been made a special feature, and since the acquisition of the collection of J. R. Logan in 1879 the library has become remarkably rich in this department.

The library of the Genootschap van Kunsten en Wetenschappen at Batavia contains books printed in Nederlandsch India, works relating to the Indian Archipelago and adjacent countries, and the history of the Dutch in the East. There are now 30,000 printed volumes and 1630 MSS., of which 219 are Arabic, 445 Malay, 303 Javanese, 60 Batak, and 517 on lontar leaves in the ancient Kawi, Javanese, and Bali languages, &c. The last edition of the catalogue appeared in 1877, printed catalogues of the Arabic, Malay, Javanese, and Kawi MSS. have also been issued.

China.—The Great Imperial Library was founded by K'iu Lung, 18th century, and from its catalogue which has been issued up to date have been counted about 12,000 works, extending to 158,000 volumes. There are now many provincial libraries in China, and the chief Buddhist monasteries also possess collections of books.

Japan.—The library of the Tokio Zu (municipality of Tokio) at Leido, in the old Chinese university, contains 65,000 Chinese and Japanese volumes, and 5900 European, principally English and Dutch. The reading-room is supplied with native daily papers, and the chief foreign periodicals. The library is open for purposes of reference, and books may be borrowed by special permission. The Asakusa Library, now occupying the former fireproof rice storehouses of the shogun, is one of the oldest in the country, and is reported to contain 143,000 volumes, including many ancient books and MSS., an entrance fee of about 3d is charged here. The Imperial University has a good collection of European and Japanese sciences and general literature. The libraries of the large temples often contain rare books of value to the philologist, and many of the leading towns throughout the country are provided with free libraries. Lending libraries of native and Chinese literature have existed in Japan for many very early times.

British Colonies.

Of such libraries as may be found in the British colonies there are very few that call for particular mention here.

The largest collection of books in Canada is the library of parliament at Ottawa. Though founded in 1815, it contained very few books until 1841, when the two libraries of Upper and Lower Canada were joined. After being destroyed by fire, the library was re-established in 1855, chiefly for parliamentary use. It now contains 100,000 volumes, and is open to the public except when parliament is sitting. Books are lent out. The main library is a handsome octagonal apartment with beautiful carved work in Canadian white wood.

In the South African Public Library at Capetown, which was established in 1818, there are 39,000 volumes, including the collection bequeathed by Sir George Grey, comprising, besides MSS. and early printed books, an unrivalled collection of works in the native languages of Africa, Australia, &c. The library is open to any respectable person.

The largest library in the Australian colonies is the Public Library of Victoria at Melbourne, which was established in 1853. In 1881 it numbered 39,887 volumes with 22,257 pamphlets; it possesses a collection of works on Australasia. The library has a printed catalogue (1880). It is supported by an annual parliamentary vote, which amounted last year to £5495. Readers are admitted without any formality, and have free access to the shelves. Although books are not lent out of the library individually, there is a system by which parcels of from 100 to 400 books are lent to libraries, mechanics' institutes, &c., in the inland towns of Victoria. There are several other not inconsiderable libraries in Melbourne. Next in importance to the Melbourne Library is the Sydney Free Public Library, which is said to contain the largest collection of works on Australasia anywhere to be found. It has a lending as well as a reference department, and is much used.

Particulars of other colonial libraries will be found in the tables.

United States.

The libraries of the United States, as we should expect to find in a country where intelligence and education are so widely diffused, are exceedingly numerous. A great mass of information with regard to them has been published by the Bureau of Education, particularly in

the comprehensive *Special Report on Public Libraries* issued in 1876. From this report, and the annual reports of the commissioners of education which have since appeared, we learn that the number of public libraries already registered is 3813, with upwards of 12,569,450 volumes. It is of course true that the great majority of these libraries are not numerically important. On the other hand, many of them are very rapidly growing, and their very youth implies that their shelves are not burdened with much obsolete literature. The recent development of American libraries is indeed very striking. Of the libraries reported in 1875, about 64 appear to have been established before 1800, and 30 of these between 1775 and 1800. Between 1800 and 1825 there were established 179 libraries, between 1825 and 1850 as many as 351, and finally between 1850 and 1875 no less than 2340, which in the latter year contained as many as 5,481,068 volumes. It will be convenient to deal with these libraries in groups according to the historical order of their development. The earliest libraries formed were in connexion with educational institutions, and the oldest is that of Harvard (1638). It was destroyed by fire in 1764, but active steps were at once taken for its restoration. From that time to the present, private donations have been the great resource of the library. In 1840 the collection was removed to Gore Hall, which was erected for the purpose with a noble bequest from Christopher Gore, formerly governor of Massachusetts. There are also nine special libraries connected with the different departments of the university. The total number of volumes in all these collections is 259,000, exclusive of over 200,000 pamphlets. The annual increase is about 7000 volumes, and the library has an endowment fund of over \$200,000. There is a MS. card-catalogue in two parts, by authors and subjects, which is accessible to the readers. The only condition of admission to use the books in Gore Hall is respectability; but only members of the university and privileged persons may borrow books. The library of Yale.

Yale College, New Haven, was founded in 1700, but grew so slowly that, even with the 1000 volumes received from Bishop Berkeley in 1733, it had only increased to 4000 volumes in 1766, and some of these were lost in the revolutionary war. During the present century the collection has grown more speedily, and now the main library numbers 102,000 volumes, while the special libraries in the control of the college bring up the total to 143,000 volumes. The yearly increase is about 4500 volumes, and the library has a book fund of \$100,000. Amongst the other important university libraries are those of the college of New Jersey (Princeton), Dartmouth College (Hanover), Amherst College, Cornell University, and Brown University (Providence, R. I.). In 1875 the number of college libraries (not reckoning academy and school libraries) was 312, besides 393 libraries belonging to college students' societies.

The establishment of proprietary or subscription libraries begins back into the first half of the 18th century, and is very connected with the name of Benjamin Franklin. It was at Philadelphia, in the year 1731, that he set on foot what he calls "his first project of a public nature, that for a subscription library. . . . This institution soon manifested its ability, was imitated by other towns and in other provinces." The Library Company of Philadelphia was soon regularly incorporated, and gradually drew to itself other collections of books, including the Loganian Library, which was tested in the company by the State legislature in 1792 in trust for public use. Hence the collection combines the character of a public and of a proprietary library, being freely open for reference purposes, while the books circulate only among the subscribing members. It numbers at present 123,000 volumes of which 11,000 belong to the

Loganian Library, and may be freely lent. The printed catalogues of the library has been praised by Brunet and Albion. In 1859 Dr James Rush left a bequest of over one million dollars for the purpose of erecting a building to be called the Ridgway branch of the library. The building is very handsome, and has been very highly spoken of as a library structure. Philadelphia has another large proprietary library—that of the Mercantile Library Company, which was established in 1821. It possesses 143,135 volumes, and its members have always enjoyed direct access to the shelves. The library of the Boston Athenæum was established in 1807, and numbers 122,000 volumes. It has recently published an admirable dictionary-catalogue. The collection is especially rich in art and in history, and possesses a part of the library of Washington. The Mercantile Library Association of New York, which was founded in 1810, has the largest of all the subscription libraries, counting over 193,000 volumes. New York possesses two other large proprietary libraries, one of which claims to have been formed as early as 1700 as the "public" library of New York. It was organized as the New York Society Library in 1754, and has been especially the library of the old Knickerbocker families and their descendants, its contents bearing witness to its history. It contains about 80,000 volumes. The Apprentices' Library has about 63,000 volumes, and makes a special feature of works on trades and useful arts. It is maintained by the General Society of Mechanics and Tradesmen. Finally, the Brooklyn Library deserves mention, if only for its very useful and admirable catalogue, the printing of which was completed in December 1880, and which embraces 60,000 volumes.

Although the State Libraries of Pennsylvania and New Hampshire are known to have been established as early as 1777, it was not until some time after the revolution that any general tendency was shown to form official libraries in connexion with the State system. It is especially within the last thirty years that the number of these libraries has so increased that now every State and Territory possesses a collection of books and documents for official and public purposes. These collections depend for their increase upon annual appropriations by the several States, and upon a systematic exchange of the official publications of the general Government and of the several States and Territories. The largest is that of the State of New York at Albany, which contains 116,000 volumes, and is composed of a general and a law library, of which a printed catalogue has been published with full subject-indexes. The State libraries are libraries of reference, and only members of the official classes are allowed to borrow books, although any well-behaved person is admitted to read in the libraries.

In addition to the libraries maintained by the several States, there are the collections belonging to the general Government, most of which are at Washington. The most important of them is of course the Library of Congress, but there are also considerable libraries attached to the houses of representatives, the senate, the department of state, the patent office, and the office of the surgeon-general.

The Library of Congress was first established in 1800 at Washington, and was burned together with the Capitol by the British army in 1814. President Jefferson's books were purchased to form the foundation of a new library, which continued to increase slowly until 1861, when all but 20,000 volumes were destroyed by fire. From this time the collection has grown rapidly, and now consists of 396,000 volumes with 130,000 pamphlets. In 1866 the library of the Smithsonian Institution, consisting of 40,000 volumes, chiefly in natural science, was transferred to the library of congress. The library is specially well provided in history, jurisprudence, the political sciences, and

Americana. Since 1832 the law collections have been constituted into a special department. This is the national library. In 1870 the registry of copyright was transferred to it under the charge of the librarian of congress. As two copies of every publication which claims copyright are required to be deposited in the library, the receipts under this head are nearly 25,000 articles per annum. The sum annually appropriated by congress for the management and increase of the library is \$52,840. The present accommodation is inadequate, and a separate building is to be erected of size to contain two million volumes. There is an alphabetical card-catalogue kept constantly up to date, and a printed catalogue of subject-matters. The library is open every day in the year, except on four legal holidays, from 9 A.M. to 4 P.M., and admission is granted to all persons over sixteen years of age without formality or introduction, but books are only lent to members of the official classes.

Since the organization of the Government in 1789, no less than one hundred and sixty historical societies have been formed in the United States, most of which still continue to exist. Many of them have formed considerable libraries, and possess extensive and valuable manuscript collections. The oldest of them is the Massachusetts Historical Society, which dates from 1781.

The earliest of the scientific societies owes its origin to Franklin, and dates from 1743. The most extensive collection is that of the Academy of Natural Sciences of Philadelphia, which consists of 36,000 volumes and 40,000 pamphlets. For information as to the numerous professional libraries of the United States—(theological, legal, and medical—the reader may be referred to the report already mentioned.

Of all the libraries of the United States none have achieved a Town greater fame, and none are more zealously and skilfully conducted, libraries than those which are supported from the public funds of some of the great cities. Legislation on the subject of free public libraries was almost synchronous in England and America. Of the free town libraries of America, much the largest and most successful is the Boston Public Library, which was established in 1822. Besides the liberal appropriations made by the city for its support, it has been the object of a long series of splendid gifts in money and books. Among the more conspicuous of its benefactors have been Joshua Bates, Theodore Parker, and George Ticknor. Since the library has been opened to the public there has thus been gathered "the largest collection of books, under one administration, upon this continent." The number of volumes in the library on July 1, 1881, was 305,478, and the annual accessions are over 17,000 volumes. In addition to the income available from trust funds, the annual appropriation by the city is \$116,000. Besides the central library, with the Bates Hall and Lower Hall, there are eight branches, and the total circulation is considerably over 1,000,000 volumes per annum. Any inhabitant of Boston over fourteen years of age is admitted to read in the library and to borrow books. The principal catalogues of the library is upon cards, in addition to which there are printed catalogues of special collections, and a perfect multitude of useful class catalogues and bibliographical helps of various kinds. The number of persons engaged in the service of the library is one hundred and forty-three. The library is open to readers from 9 A.M. to 6 P.M. from October to March, and until 7 P.M. during the rest of the year. Books are delivered for home use until 6 in the evening. The periodical room is open from 9 A.M. to 9 P.M. on week days, and on Sundays from 3 to 9. A new building is in contemplation.

Of the remaining free town libraries, the most important are those of Cincinnati and Chicago. The public library of Cincinnati, which was established on its present footing in 1837, has 122,000 volumes besides pamphlets. Its expenditure last year was \$21,465, and its total issues, including those from the two branches, were 768,566. The reading-rooms are open every day in the year from 8 A.M. to 10 P.M. The library buildings were completed in 1873 at a cost of about \$400,000, and are "among the handsomest in the world."

The Chicago Public Library was established in 1837, and owed its origin to the sympathy felt for Chicago in England after the great fire of 1871. The number of volumes now in the library is 76,120. There is a very full and minute card-catalogue, in one alphabet, of authors and subjects; the contents of collections, volumes of essays, &c., are analysed under their subjects. The reading-room is open three hundred and sixty-five days in the year from 9 A.M. to 9 P.M., and is not even closed for the purpose of taking stock or cleaning. The library has not yet an appropriate building. Of smaller free town libraries there is a considerable number, especially in Massachusetts. Of the entire number ten only supply over 50,000 volumes each. It is the opinion of the city engineer and

enlightened managers of these libraries that a free public library is the proper corollary of a free system of public education, and it is their aim as far as possible to direct the taste and to methodize the reading of those who use the collections under their charge.

Acator
library

We cannot conclude this brief sketch without mentioning some notable illustrations of that public-spirited sentiment which is nowhere perhaps so frequently found as in the United States. The Astor Library in New York was founded by a bequest of John Jacob Astor, whose example was followed successively by his son and grandson. The library was opened to the public in 1854, and at the end of 1889 the collection due to their joint benefactions contained 192,547 volumes. It consists of a careful selection of the most valuable books upon all subjects. It is a library of reference, for which purpose it is freely open, and books are not lent out. It is "a working library for studious persons," and such persons on a proper introduction are allowed to pursue their studies in the alcoves. In 1880 the number of general readers was 45,970, and the number of visits to the alcoves was 7901. The total endowment is over \$1,100,000. There is a printed catalogue for about half the library, with a printed index of subjects, and a similar catalogue for the rest is in preparation. The Lenox Library was established by Mr. James Lenox in 1870, when a lady of the name was incorporated by an Act of the legislature. In addition to the funds intended for the library building and endowment, amounting to \$1,247,000, the private collection of books which Mr. Lenox has long been accumulating is extremely valuable. Though it does not rank high in point of mere numbers, it is exceedingly rich in early books on America, in Bibles, in Shakespeare, and in Elizabethan poetry. The Peabody Institute at Baltimore was established by Mr. George Peabody in 1857, and contains a reference library open to all comers, numbering about 72,000 volumes. The institute has an endowment of \$1,500,000, which, however, has to support, besides the library, a conservatory of music, an art gallery, and courses of popular lectures. The largest legacy yet made for a public library has recently fallen to the citizens of Chicago. The Newberry bequest of over \$3,000,000 for the founding of a free public library in the north division of Chicago.

Lenox
library.

South American and Mexico

Argen-
tine
Republic

The importance of public libraries has been fully recognized by the Argentine, and at present more than two hundred of them are in the country. They are due to benefactions, but the Government is every year adding an equal sum to any endowment. A central commission exists for the purpose of facilitating the acquisition of books and to promote a uniform excellence of administration. The most considerable is the Biblioteca Nacional at Buenos-Ayres, which contains at present 40,000 volumes, and has been almost doubled since 1872. It is especially rich in MSS., some of great interest, concerning the subjects of the Spanish colonies.

Brazil.

The chief library of Brazil is the Biblioteca Publica Nacional at Rio de Janeiro, founded in 1807, and now comprising 120,000 printed volumes with 1000 MSS. National literature and works connected with South America are special features of this collection. The Royal Library of Ajuda (founded 1600 MSS.) was taken to Brazil by King João VI, but was sent to Portugal on the declaration of independence. Since 1873 the annual Government grant has been largely increased. Among other libraries of the capital may be mentioned those of the Faculty of Medicine (18,000 volumes), Marine Library (19,600 volumes), National Museum (9000 volumes), Portuguese Library (63,000 volumes), Biblioteca Fluminense (48,000 volumes), Benedictine Monastery (9000 volumes), and the Biblioteca Municipal (16,500 volumes). In the official report on Brazil, submitted at the Philadelphia Exhibition in 1876, it was stated that the aggregate number of volumes in all the libraries of the empire accessible to the public was then 480,272 volumes. In 1875 the libraries were visited by 86,044 persons.

Chili.

Mexico.

The Biblioteca Nacional at Santiago is the chief library in Chili. The catalogue is printed, and is kept up by annual supplements.

Only sixteen out of the twenty-nine states and territories of the Mexican republic have public libraries, and only a small proportion of the contents consist of modern literature. Many, however, possess rare and valuable books, of interest to the bibliographer and historian, which have come from the libraries of the suppressed religious bodies. It is calculated that books in all the public libraries amount to about 250,000 volumes. There are about seventy-three scientific and literary associations in the republic, each possessing books. The Society of Geography and Statistics, founded in 1851, is the most important of them, and owns a fine museum and excellent library. After the triumph of the Liberal party the cathedral, university, and conventual libraries of the city of Mexico came into the possession of the Government, and steps were taken to form them into one national collection. No definite system was organized, however, until 1887, when the church of San Augustin was taken and fitted up for the purpose. Two copies of every book printed in Mexico must be presented to this library. The only other public library in the city is the Biblioteca Cisneros de Mayo, which is under the management of the Lancasterian Society.

The Biblioteca Nacional at Lima was founded by a decree of the Peru. The liberator San Martin on August 28, 1821, and placed in the house of the old convent of San Pedro. The nucleus of the library consisted of those of the university of San Marcos and of several monasteries, and a large present of books was also made by San Martin. The library is chiefly interesting from containing no more MSS. and rare books relating to the history of Peru in viceroyal times. The volumes marked "Papeles varios" contain reports on the superstitions of the Indians, abstracts of the ecclesiastical councils of Lima, and memoirs on provincial administration and petitions. It is reported (1881) that the whole library has been seized by the Chulinos and transferred to Santiago.

LIBRARY MANAGEMENT

Library Buildings.—The conditions of no two libraries being Buildings precisely alike, it is impossible to lay down rules to suit all, but certain principles of general application may be stated. In the first place the internal arrangements ought to be devised by a person thoroughly acquainted with the practical working of such a library as the building is intended to accommodate. The reading-rooms, book-rooms, work-rooms, and offices should be made to fall into the most convenient relations one to the other. And as libraries grow with wonderful rapidity the plan ought to admit of easy development. The site should be dry and airy, and permeable to the air of the town, which should be constructed of fire-proof materials, iron being preferable to stone, and brick to either. Every floor should be laid upon rolled iron beams, supported by lattice girders, the space between the beams being fitted in with porous terra cotta, and the beams covered with concrete. To protect them against fire, girders and pillars must be covered with terra cotta. Iron doors, or better still, stout wooden doors plated with thin iron) should separate the different rooms. The safety and convenient disposal of the books must never be sacrificed to outside show. The old form of library, the museum like room with alcove and a large block of recent space in the centre, or the series of apartments with bookshelves on the walls only, is no longer in favour. The reading-room, commodious, well lighted, and supplied with works of reference, should be away from the main collection, and the lending department should be kept apart from the reference library. It is convenient to have separate rooms for indices and for readers to whom special facilities may be granted, and for the provision of newspapers, and a reading room, office, catalogue room, and a library if necessary. The chief portion of the books (at any rate those in most demand) should be on the ground floor, and more than two stories are to be avoided. Plenty of light and good ventilation are two conditions of great importance. The basement should be raised above the ground level, or that in which the main collection is deposited, is one to which readers have seldom the right of access, the greatest economy as to drainage and passage may be effected. Bookcases may be placed against the walls, but not too close to them, and double presses, about 8 feet apart, arranged across the floor. To prevent the objectionable use of high ladders, no shelf should stand more than 8 feet above the ground. If the room be sufficiently lofty it may contain one or more perforated iron floors, sustained by the upright portion of the presses, also of iron. Spiral staircases are to be avoided. Lifts may be introduced with advantage. In many college libraries in America (e.g. at Princeton) the circular form, with access radiating from the centre, has been adopted successfully. The spacious rotundas of the British Museum and that of the Liverpool Free Public Library are good examples of the circular reading-room.

Mr. Justin Winsor has devised an excellent plan for a library of one million volumes capacity (see "Library Buildings," in *Report on Public Libraries of U.S.*, p. 446), and the same system might be applied to one much less extensive. Another distinguished American librarian, Mr. W. E. Froole of Chicago, has made some novel suggestions on library architecture which have met with considerable approval. He objects to the vastness of the circular plan, and to the large library rooms, to the difficulty of ventilating and heating them, to shuffling books in galleries on the walls, to the destruction of bindings from gas and heat ("books cannot live where man cannot live"), to the excessive labour of procuring books from long distances, the insecurity from fire, the inconvenience of keeping many volumes (other than those of reference) in the public reading-room, and the unnecessary cost of the present system. To remedy these defects a plot of land is required 200 feet square, and surrounded with open spaces. At the middle of the principal side may be placed the main building, 60 feet front and 15 feet deep, devoted to administrative and working purposes. The books will be stored, not in one central reading-room, but in a series of rooms thrown out in wings from the central edifice, and

¹ Plans of most of the chief libraries in Europe may be seen in the *Bibliothèques de France* of Mr. Edwards (7 vols., 1859), and in the *Kataloge der Bibliotheken der Preussischen Staaten* (1871); the volumes of the *Library Journal* contain representations of many new American libraries.

² A recipe to make wood incombustible, and other suggestions, are given by C. Welford in *Manchester Times Libr. Assoc.*, 1886, p. 65.

extending round the four sides of the quadrangle with a vacant space in the middle. Each room is 60 feet wide, 15 feet high, and as long as convenient. Ten of these rooms will occupy the ground floor, so that, carrying the same construction four stories high, there will be forty different rooms in the whole structure. Each will be devoted to one large, or two or more small, classes of books. Aisles and galleries are not to be permitted, but the books will be shelved on the walls or on double passages within reach. Every room will receive light on two sides, will be furnished with tables and chairs for readers, and provided with an attendant; no general reading-room will therefore be wanted. As a protection against fire, the roof will be cut off by means of brick fire-walls extending to the roof, and access from one room to the other will be by a light iron corridor on the inside of the quadrangle. At the rear of the central building will be a lift for readers, and there will be staircases as well. In this way, on one story there will be about 26,250 square feet in the different wings, which, after deducting sufficient space for readers' tables, &c., will give about 20,200 square feet for books. As each square foot will shelve 25 volumes, each story will hold 505,000 volumes, or on the four stories 2,020,000 volumes. One of the front rooms (to hold 67,500 volumes) might serve as a circulating library. Mr. Peole estimates the cost of such a library in America at \$530,000, or complete with shelving and furniture \$840,000. (See *Library Journal*, vi. 59.) In the same volume, p. 77 et seq., is a description of the proposed plan for a new national library building at Washington. In this scheme the architect has in view the centralization towards a circular reading-room, good light, the possible expansion of the library for one hundred years, accessibility to all parts, economical administration, and division into different fire-proof compartments.

Heating. Of the various systems for heating libraries open fire-places have the best appearance, are very safe, and best convey heat; close stoves are the cheapest at first hand. Perhaps steam heating is the safest and most economical for large buildings. Unprotected gas jets are very injurious to the books. If gas be used at all, the open-light system or the Denham light is the best means of conveying away the fumes and heated air. The electric light is used with great success at Liverpool and the Museum of Natural History.

Shelves. *Bookcases and Shelves, Furniture and Appliances.*—For presses and shelves, should wood be preferred, English oak or the cheaper deal (well seasoned) as the best material; or the presses may be made of iron and the shelves of slate or galvanized iron. At the British Museum the presses are all of one size and of the same model—the standards being of galvanized iron, with holes for brass pins, which are so shaped that the space is altered by merely turning them half-way round. The shelves are also of galvanized iron, covered with leather, on wooden frames; movable pads covered with leather at the ends of the books at either end being rubbed, and there are leather falls to keep the dust out. In the Radcliffe room bookcase, invented by Dr. Adams, the framework is of iron, and the shelves of wood, faced with leather. It is 7 feet high, and stands on any floor-space 48 inches by 18 inches; books are placed on both sides to the number of 600 volumes. Danner's revolving bookcase is useful for reference books; it is square, stands about 5 feet high, occupies no more space than a chair, and holds about 950 volumes. Economy of space is also a feature in Mr. Virgo's bookcase, the front of which is a door, itself shelved, which, on being swung round, discloses another row of shelves behind. The Radcliffe portable bookcase is taken to pieces, and is made to stand against a wall. In providing for shelf room it is usual to allow about 110 square feet of shelving to 1000 volumes; and in giving directions for presses and shelves it is well to have them planned upon a uniform scale. Perhaps the best supports for the shelves are Tuck's movable book-rests, consisting of two rows of metal strips, with oblong perforations at intervals of 2 inch, in which are inserted small metal plates. The tops of reading tables, trays and barrows for carrying books, and such shelves as may be intended for heavy or choice books, should be padded. Very large volumes had better be kept flat in sliding trays. There is much diversity of opinion as to whether the fronts of the presses should be glassed or not, or whether they should be protected by wooden doors, curtains, or wire screens; many libraries object to glass doors as harbouring dirt, and to any opaque screen as concealing the books.

**teading-
room.** The arrangements of the reading-room of the British Museum furnishes a good example of perfect execution combined with every consideration for the comfort of readers. The tables are arranged as the spokes of a wheel, with smaller square tables between them for large volumes. Each reader at the radiating tables has a separate place 4 feet 3 inches long, and is screened from his opposite neighbour by a division running along from one end to the other; in front is a hinged desk, with racks, inkstand, and a folding shelf for books. The framework of each table is of iron, forming channels by which air is conveyed through screens at the top of the longitudinal divisions. A tubular foot-rest affords facility for warming the feet in cold weather. The catalogue-shelves (which

presses of special bibliographies near them) are placed in two concentric circles around the enclosure of the superintendent, who can thus observe every reader in the room.

A speedy supply of books is ensured by the use of the automatic Supply-book-delivery contrived for the Harvard bookstore (of six stores) by Mr. Justin Winsor. At the delivery-desk a key-board shows the digits which combine the various shelf-marks; and the number of the book wanted, being struck upon it, is repeated at the floor on which the work is located, where it is sought for by an attendant and placed in a box attached to an endless belt, which carefully deposits it on a cushioned receptacle close by the delivery-desk.

Many English lending libraries find that a great saving of time and trouble both to officials and readers is made by the use of the indicator for public reference. There are many varieties of this invention, but the main principle is a frame containing a series of small pigeon-holes, each numbered and referring by fixed number to a book, when a volume is lent out, the borrower's card, &c., is placed in the pigeon-hole and signify that it is absent. This roughly describes the Birmingham indicator (Mr. Morgan's) in that of Mr. Elliot, the title of the book is pasted against each pigeon-hole, Mr. W. H. K. Wright uses at Plymouth a system which serves as a catalogue and register of books lent as well, and Mr. J. C. Cotgrave has improved the original idea by his indicator-board, a sort of ledger of the persons to whom each volume is lent, which is placed in the small pigeon-hole previously spoken of. The card-keeper of Mr. G. Parr, used at the London Institution, is for the use of the librarians close and not for the readers, it is applied to a borrowing system which permits several volumes to be taken away by the same person, and also acts as a register of borrowers.

For the purpose of stamping the name of the library on the books, Minor &c., some persons prefer the embossing stamp, and some the ink-planes stamp now very conveniently made in india-rubber. Props, either to screw upon the shelves, or made of thick blocks of wood, or of its folded at right angles, are useful for preventing books falling about in a slovenly manner. Reading cases are necessary for periodicals and choice bound volumes; periodical cases are made conveniently of wood with strong leather backs. In order to keep the consecutive numbers of current periodicals and newspapers clean and in good order, some kind of temporary holder is required. The contents of the different shelves or presses may be printed on labels made of leather or cloth. The "Van Everen" printed numbers and letters for the marks on the shelves and the backs of the books are to be purchased at a small cost.

Classification and Shelf-Arrangement.—The defect of most classification systems, especially of those which profess to be particularly turn, philosophical and logical, is that they are better adapted for a systematic review of human knowledge than for the arrangement of a miscellaneous collection of books. A small library will not require so extensive a scheme as a larger one, and a popular library needs less minute classification than one for reference or for the use of more learned readers. Again, the classes which are best represented in the library, and its special or local collections, deserve more elaborate treatment than the classes in which it possesses but few volumes. The same system cannot invariably be used in all respects both for its shelves and for the catalogue, as a book can have but one position in the presses, but the title may appear under many numbers of headings in different parts of the catalogue. For these reasons, the natural order should be followed as far as possible. That is to say, the books should suggest their own classification, which should be made to harmonize with the requirements of the library, and the various classes should not be strained to fit some arbitrary method, however logical in theory. As the title of a book is often an unsafe guide to its contents, no one should attempt classification by the title alone. The *Index Librorum*, vol. i. *Index Librorum*, &c. gives a number of schemes both on philosophical and on natural or practical principles; and Petzhold, in his *Bibliotheca Bibliographica* (Leipzig, 1805), has drawn up an account of no less than one hundred and seventeen different methods of classification, a number which could now be largely increased, as the practical necessity of American libraries alone has added many to the roll. Some of these schemes have been elaborated with great care, but, however interesting on account of the useful hints they may now and then supply, most of them are useless either for the catalogue or the shelves. All these are systems to classify the whole range of literature, but there are many classified catalogues, and many other guides useful for the scientific arrangement of special departments.⁴

Books are usually arranged upon the shelves either in order of (1) their sizes, (2) authors' names, (3) subjects, or sometimes (4) of accession, or by a modification of two or more of these systems. The arrangement by subjects is that which displays

⁴ See the *Oxford Treat. Lib. Assoc.*, 1876, p. 70; *Manchester Treat.*, 1880, p. 12.

⁵ For instance, in the class of fine arts may be comprised the *Bibliothèque des Beaux-Arts* (Paris, 1874-75), which the *Index Librorum* lists in complete; and *Library may be classified with the help of Dr. J. C. Cotgrave's* *Index Librorum* (London, 1881). In the *Memoria Librorum* (1921) may be found a useful classification for MSS. and further on an account of printed MSS. and systems for printed copies, being those of the *Bibliothèque* and the *Index Librorum*.

dressing may be found necessary. The volumes must be rubbed with chamois leather when dry. Nail-foot or olive oil has been suggested for the same purpose, but it ought to be used with a sparing hand. Much has been written about the effect of gas and heat upon binding. The question is still undecided, but it seems likely that the deterioration of the leather is caused more directly by the over-heated air, so that thorough ventilation, especially as regards the upper shelves, is most important for the well-being of a library. Morocco, vellum, and buckram resist this action best, and calf, russet, and roan worst. Professor H. A. Hagen has studied the various kinds of bookworms and other insect pests of libraries.¹ Most libraries of the first class find on the premises, and M. Hippé Ganel of the Bibliothèque de Grenoble is persuaded, after a very careful inquiry, that any library which finds as many as nine hundred volumes a year will save largely by keeping up a binding establishment of its own.²

his-
tories

Catalogues and Cataloguing.—A library is useless without a proper equipment of good catalogues, which to be thoroughly efficient should be compiled upon a well-considered plan, carefully kept up to date, and made accessible to every reader. The variety of different catalogues is very great, and no one form can be adopted alike by libraries for study and those for popular reading, nor yet by those which combine the two functions in whatever proportion. It regards the amount of information necessary to be given, the titles of the books may be either short, or not more than a single line to each, as in the *London Library Catalogue* (1875), medium, or several lines to each, as in the *Royal Academy Library Catalogue* (1877); or full, as in the *Catalogue of the Hertz Library*, 5 vols. large 8vo (1880), where the title is copied in extenso and a quantity of bibliographical details are added.

The chief questions to be answered by a catalogue are—1. Has the library a certain work by a certain author? 2. What has it by any given author? 3. Has it a certain book of which the title only is known to the inquirer? 4. Has it a certain book of which the subject only is known to the inquirer? 5. What has it on a given subject? 6. What works in certain classes or languages has it? To supply this information, catalogues are arranged sometimes under the names of the authors in alphabetical order (1 and 2), or under the first words of the titles, or classified under subjects, whether in alphabetical or systematic order (4 and 5), or by a combination of two or more of these methods. A dictionary-catalogue answers all six questions under the names of authors, the titles of books, the subjects and forms of literature (i.e., essays, or French, German, or Latin, or in one alphabet). A subject-catalogue is connected one with the other by a complete system of cross-references. A modified form of short-title dictionary-catalogue, with the names of authors, titles of books, and subjects in one alphabet, is a useful type for a popular library to adopt. No author-catalogue can be considered complete without an index of subjects,³ and every classified catalogue requires an index of authors, if alphabetical, and of both authors and classes if systematic. An ideal catalogue would furnish references under each name and subject to every work, part of work, or even magazine article contained in the library which illustrated it. This can rarely be attempted, but a near approach to perfection is shown by the new catalogues of the Boston Athenæum and the Brooklyn Mercantile Library; the last is a model of thoroughness. It is becoming a laudable practice to give the contents of collected works and periodicals in catalogues; and good examples of the value of annotations are the catalogues of the classes of history, biography, travel, and historical fiction in the Boston Public Library.

In making choices of a form of catalogue the way is sufficiently plain should the alphabetical system under authors be adopted, neither can there be much cause for discussion in fixing upon an alphabetical subject-catalogue, but should it be decided to compile a systematic subject-catalogue, the question becomes a much more serious one. A subject-index of some sort is an indispensable supplement to any catalogue merely arranged under authors. The reference list better be strictly alphabetical in form; for instance, a work on ants should be indexed under that word and not under the general heading of insects or entomology; but there is no reason why there should not be cross references under the latter to the smaller headings. In an appendix to Mr. Cutter's article on "Library Catalogues,"⁴ there is a descriptive list of more than a thousand printed catalogues of American libraries, among which many useful types might be selected. All the printed catalogues of European libraries which were published before 1860 are mentioned in Vogel's *Literatur-corp. off. Corporations-Bibliothek* (Leipzig, 1860).

Librarians should take a share in the compilation of their catalogues at any sacrifice of time and trouble, for by no other means can they obtain so exact an acquaintance with their collections. No

cataloguer should be allowed to prepare a title except from the very copy of the book which he is cataloguing.

In order to secure precision and uniformity in the descriptions of the books and in the headings under which they are placed, some well-considered code of rules is absolutely necessary as a guide to the cataloguer. All such rules are founded upon the regulations of the British Museum, printed in 1841,⁵ which have been followed with modifications by Professor Jewett (in the *Southwestern Report on the Construction of Catalogues*, 1853), by Mr. E. Edwards (*Memoirs of Lais*, 1859, vol. ii.), by Mr. F. B. Perkins (in the *American Publisher*, 1869), with many additions by Mr. C. A. Cutter (in his *Rules for a Practical Dictionary-Catalogue*, 1876),⁶ by the condensed rules of the American Library Association (*Library Journal*, vol. 13), and by the Library Association of the United Kingdom (as finally agreed upon and printed in their *Monthly Notes*, no. 51). The authorities of the Cambridge University Library have also printed their rules in drawing up a set of rules the special wants of the library and the readers should be first considered, and then the most suitable rules chosen from one or other of the schemes mentioned above. But when rules are decided upon, no alteration should be permitted during the compilation of the catalogue, as bad rules uniformly followed are better than good rules without uniformity.

Among disputed questions, that of how best to describe the sizes of books is perhaps the most difficult. What is wanted is a system that can be understood by every one, and which is capable of being applied to old as well as to new books.⁷ For books printed before the introduction of machine-made paper about the beginning of the century, the correct bibliographical size may be derived from the fold of the sheet, that is, roughly speaking, a quarto is a sheet folded four times, an octavo eight times, &c. The great variety of modern papers (a different sort of sizes being used in each country) renders this method no longer available, and it seems generally admitted that some system of fixed measurements of heights to denote certain sizes is wanted for library purposes. A report on the subject, giving details of three rival schemes, including that of the American Library Association, an ingenious adaptation of the "demy" scale paper, and one following the ordinary binder's scale, may be found in *Trans. &c., of Manchester Meeting*, 1880 (p. 11). The Library Association, a committee of which was subsequently deputed a plan which endeavoured to embrace the different merits of all three schemes, but it has not yet been generally adopted.⁸

Printed catalogues are doubtless costly, and they soon become out of print or a higher price is demanded to consult them; manuscript catalogues, and possess the great advantage that they admit of being enlarged or altered away from the library. On the whole the balance of convenience is strongly in their favour, and few libraries of any importance fail to print as soon as they can. For free public libraries printed catalogues are absolutely necessary, and they are extremely useful in those a more learned or special character.

As regards the form of catalogue most suitable for library reference, card-catalogues are used comparatively little in England, but are found to not satisfactorily in many American libraries. They possess many peculiar advantages, among others being the facility with which they may be added, withdrawn, or rearranged. Readers do not object to turning over the cards as the labour is shortened by indexes standing above the rows, and there are many contrivances to prevent the unauthorized removal of the title.⁹

It is obvious that, if a universal catalogue of printed literature existed, it would be only necessary for each library to mark in a copy of this universal catalogue the particular works it possessed. Such a plan is small scale has been adopted in many cathedral and college libraries, where a copy of the Bodleian printed catalogue is used for the purpose. A satisfactory step in the direction of co-operative cataloguing has been made by Mr. Henry Stevens in his proposals for a "bibliographical clearing-house,"¹⁰ which shall supply exact copies of the title pages of rare (and eventually of more common) books by means of photography. Mr. Stevens has now many thousands of these "photographs" of titles, which are all reduced to a uniform scale, with the full titles and collations added in ordinary type. They are very convenient for card-catalogues.

Thus far the wants of readers have been principally considered; but librarians ought to possess two other kinds of very important catalogues, which they must keep up in their own interests. The first is the accession-catalogue, or record of every book, part of book, pamphlet, or periodical as it comes in; and the second the shelf-catalogue, or stock-book of the library, a register of the con-

¹ Prefixed to the printed catalogue of Mr. A. The rules, which were compiled by Mr. A. and printed by The West & Wither Journals, have been conveniently arranged by Mr. Nichols in *Handbook for Readers at the British Museum*, 1860, and have been reprinted with additional rules by Mr. Ry. Stevens in *Ms. Catalogues of the American Library at the British Museum*, 1860.

² See C. E. Evans, in *Report on Public Libraries of U.S.*, Washington, 1874.

³ See C. E. Evans, in *Report on Public Libraries of U.S.*, Washington, 1874.

⁴ See *Monthly Notes*, vol. 13, p. 62.

⁵ The *Inventory and other systems of card-catalogues* are described in *Report on Public Libraries of U.S.*, Washington, 1874.

⁶ *Transactions of Conference of Librarians*, London, 1875, p. 70.

¹ See *Cut. of Lib.*, 1879, p. 232; also *Library Journal*, 13, 134; 14, 64, 238; 15, 455, 458; 16, 50, 100, 101, 202.

² See *ibid.*, p. 216, 448.

³ See *ibid.*, p. 216, 448.

⁴ See *ibid.*, p. 216, 448.

⁵ See *ibid.*, p. 216, 448.

⁶ See *ibid.*, p. 216, 448.

tracts of every press and every shelf. These tell the source and date of every addition, and enable all the books to be checked at any time. A novel form of accession-catalogue is that of the Liverpool Free Public Library, which is a sort of large photographic album to show printed titles of accessions in alphabetical order. Loose sheets are filed into the body of the catalogue to provide for any number of additions as quickly as possible. In the same library the titles of new books are also pasted upon blocks arranged in a frame for the information of readers.

Accounts.—Administration.—In any library which manages its own financial transaction, however small, all accounts should be as carefully kept as those of a trading establishment. In the same way a permanent steel-taking should be made by means of the self-catalogue. It is a great convenience to display recent accessions for a short time in some place just apart for the purpose. A recommendation and complaint-book are both useful. The loyal and efficient supply of books is greatly promoted by returning that all demands should be made in writing and not verbally. The books should be carefully dusted from time to time by experienced persons, and the leaves of all new books, &c., should be cut by the library staff.

In issuing and taking notes of books lent, either the ledger or the slip-system may be used, or a combination of the two, something like a self-catalogue. Accounts are kept either against the borrower, against the book, or against time; the first, with the ledger system, may be well for small libraries, but in larger institutions the slip-system must be resorted to, and it is better to keep the accounts against the books, with perhaps a ledger-index of borrowers. Where more than one volume is lent at a time a small card is sometimes placed in a pocket in each book; the card, whether marked with borrower's name, &c., or not, being retained as a voucher, as at the "card-ledge" spoken of on p. 137, which is on the slip-system with the account against the borrower. The special feature of the "card-ledge" is that no writing whatever is required. It is necessary to introduce some device for overdrawn or reserved books.

Besides furnishing the materials for reading, it is now recognised that a popular library has also the function of indicating the method of reading and study. A collection of well-chosen books suitable for adults and boys is one thing; and leading in many English free libraries. At the Providence Public Library, Rhode Island, Mr W. E. Foster issues daily notes on current topics and events, with detailed references by which the subject may be illustrated by the resources of the library; more complete special lists, e.g., on Helbig Spencer, Irish landless and towns, &c., are issued from time to time. Library lectures are now given at several free libraries in England, but, to make these efforts distinctly useful in adding to the good work of the institution, they should be restricted to lectures on books and courses of reading, so that, by illustrating certain works or departments of the library, these lectures may gradually lead readers to a more careful consideration of literature. Aimless and purposeless reading is the bane of a free public library, and it should be the desire of its authorities to do what can be done to induce people to use with due discrimination books of a higher class and of a more useful and informing character. The admirable catalogue of history, geography, and travel of the Boston Public Library, with its suggestive notes and illustrations, had the effect of lowering the reading of fiction from 74 per cent. to 69 per cent. In the same library even the reading of novels has been elevated by the catalogue of English prose fiction arranged on the same plan.

Experience shows that in all that relates to such questions as preliminary forms, age of readers, days and hours of admission, Sunday-opening, access to catalogue, shelves, and libraries, fine loans of books, guarantees, number of volumes allowed, time of reading, &c., a liberal tendency is always beneficial both to the library and the public.

Precautions against fire.—In view of the outbreak of fire, some well considered plan should be fixed upon. Extinctors and hand-pumps should be kept ready for use in central positions. The means for extinguishing fire should be familiar to the members of the staff, who should all be practised in fire-drill, in order that each may know his proper place and duty in case of emergency. Full directions should be suspended in conspicuous places. In the case of fire breaking out after library hours, it should be thoroughly understood where the keys are to be found, what officials should be sent for, and what apparatus is ready for use within the building.

Librarians.—Without insinuating upon quite so wide a range of subjects as did F. A. Herbert in his *History des Bibliothécaires* (London, 1820), one may expect the librarian of a great library to be a man of liberal education, and specially endowed with sympathy with books and reading, a practical acquaintance with bibliography, including palaeography, and bibliography, is also necessary, as well as with the theory and practice of library management. To be thoroughly qualified, a librarian should have had the practical experience of library-work which it is impossible to obtain from any amount of book-reading. Besides this, he ought to be a man of business habits and a good administrator.

These requirements imply qualifications of a somewhat higher

character than may perhaps be necessary in all public libraries; but some knowledge of languages and literatures, bibliography, bibliography, and general library management should be possessed by any person holding the chief position in the administration of any library, however small. As regards the qualifications of the librarian of a popular institution or of library-assistants, it may be useful to give the outline of a plan recently proposed by a committee of the Library Association for their examination (see *Monthly Notes*, vol. ii.). There should be a preliminary examination, chiefly in the subjects of a sound English education, special attention being paid to English literature, proficiency in the elements of one or more classical or modern languages would be specially indorsed upon the certificate, one language to be necessary. The suggested subjects for the preliminary examination are—athletics, English grammar and composition, English history, geography, and English literature. After having been engaged in library work for not less than one year, a second-class certificate might be awarded to any librarian or assistant who should pass a satisfactory examination in English literature, especially of the last hundred years, some one other European literature, principles of the classification of the sciences, elements of bibliography, including cataloguing and library management,—a cataloguing knowledge of at least two languages being essential, to be necessary. A first-class certificate would be given, after a satisfactory examination, to a librarian or assistant of at least two years' experience, for an advanced knowledge of the subjects last mentioned, with the addition of general literary history. A cataloguing knowledge of at least three languages would be necessary for the higher certificate,—an acquaintance with any other, as well as proficiency in any subjects (not more than two in number) offered by the candidate, being specially indorsed.

Women are gradually making their way in libraries. At Manchester and elsewhere they are successfully employed as assistants, and in several other places in England the chief charge of the library is maintained in a very efficient manner by a lady. In the United States the majority of the librarians are ladies (at the Boston Public Library no less than two-thirds of the staff), and many of the most accomplished cataloguers are of the same sex.

The first general meeting of librarians took place at New York, September 15 to 17, 1863, upon an invitation extended by Professor C. J. Jewett, Mr F. F. Poole, and others "for the purpose of conferring together upon the means of advancing the prosperity and usefulness of public libraries, and for the suggestion and discussion of topics of importance to book collectors and readers." About eighty persons attended, many questions were debated, and the suggestion was made, a permanent association met with considerable favour. Nothing came of it, however, and twenty-three years had elapsed when, having in view the Centennial Exhibition of 1876, a second meeting was convened on October 4 to 6, at Philadelphia, which was attended by one hundred and two Americans and one English representative.

At the Philadelphia conference of 1876, the American Library Association, which has since done so much good work in practical librarianship, was founded. In October 1877 a conference of librarians was held in London, under the presidency of the late Mr J. Winter Jones, and attended by two hundred and sixteen librarians and others, including representatives of the French, German, and Greek Governments, all the chief libraries of the United Kingdom, as well as certain of those of the United States, Belgium, Denmark, France, Italy, and Austria. Altogether one hundred and forty different libraries sent representatives, and nearly the whole field of library-science was reviewed at the different sittings. *The Transactions and Proceedings of the Conference of Librarians* (London, 1878) is the title of the official report of the meeting. The chief result of the conference was perhaps the foundation of the Library Association of the United Kingdom, of which the "main object shall be to unite all persons engaged or interested in library work for the purpose of promoting the best possible administration of libraries; it shall also aim at the encouragement of bibliographical research." Monthly meetings of the association take place at the London Institution, and the members hold an annual conference in some one or other locality, where the different libraries are inspected, various questions of library economy are discussed, and new library appliances are exhibited. Full reports of these meetings have been published. *Monthly Notes* are also issued. Every important British library is now represented in the association, which numbers over 350 members.

Guides to Selection of Books.—As it is not only necessary to find out Selection the best treatises on given subjects, but also to decide upon the respective numbers of different editions and even of different translations or copies of the same edition, an acquaintance with bibliography, or the science dealing with the technical features of books and MSS., and with bibliography, or that which deals more especially with their literary aspect, as to be expected in those forming a library.¹

¹ The article *BRITANNICA* (vol. iii. p. 631, pp.) will afford a general idea of the immense extent of this literature, in addition to the special works there mentioned. Reference may be made to Bain's *Bibliography of Bibliography*, New York 1877.

So necessary is bibliography in library selection that Dr Cogswell, as a preliminary step to collecting books for the Astor Library, formed a bibliographical apparatus of five thousand volumes to help him in his arduous task. To assist librarians and collectors in their choice, among earlier works may be mentioned that of G. Pagnet, *Manuel Bibliographique, ou guide des livres*, Dijon, 1828, still interesting on account of the descriptions of the favourite reading of eminent men. *Catalogue of my English Library* (London, 1863) is the title of a little volume prepared by Mr Henry Stevens to assist in getting together the best editions of the standard English authors. The idea was followed on a larger scale by M. Hector Bosangue, *Ma Bibliothèque Française* (Paris, 1866). The best guide for ordinary purposes, but far from perfect, is *The best Reading, hints on the selection of books, on the formation of libraries, public and private*, by F. B. Perkins (4th ed., New York, 1877). The list is restricted to books now in the market; prices are appended. The titles are very brief, and are arranged in an alphabet of subjects, and a selection is appended of the chief French, German, Italian, and Spanish authors. A new edition of Porter's *Books and Reading* appeared in 1881. Current German literature is well looked after in G. Schwab and K. Klüppel's *Wegweiser durch die Literatur der Deutschen* (4th ed., Leipzig, 1870), with several supplements. The leading literary reviews, as well as the publishers' trade journals, will guide in the acquisition of the books of the day. The careful cataloguing and excellent descriptive notes in the *New York Publishers' Weekly* are good examples of what book committees are glad to have before them. An examination of the authorities quoted by authors of repute will frequently help in deciding upon the merits of rival treatises, and the printed catalogues of well-chosen libraries are also useful. To his practical little treatise, *Five Libraries and Newsrooms*, Mr J. D. Mulline appends a list of books he considers desirable for five public libraries, and to form the basis of a collection of high-class fiction. Mr F. B. Perkins has drawn up a list of the best hundred novels procurable in English (*Library Journal*, 1, 166). *The Coming Catalogue*, about which we hear now and then from America, will contain selected lists of books, with short notes.

Acquisition

Acquisition of Books—Public libraries must look to purchases as their chief means of getting the books that want raising. The best system is to draw up lists of the desired works and editions, and circulate this lists among the leading booksellers, who will notify the prices and conditions of the copies they may be able to supply; announcements of books wanted can also be inserted in the booksellers' trade organs. Second-hand booksellers will willingly furnish their catalogues if they are not required to purchase them, are always useful for reference. It is usually more convenient to give commissions for books at sales than for the librarian to attend in person; but an occasional visit to the auction room will give much information as to current prices of books, a matter which, coupled with frequent visits to the shops of second-hand booksellers and the diligent study of their catalogues, will be carefully attended to by the capable librarian. The works of Brunet, Lowndes, and Gessner may also be consulted for the prices of old books. It is perhaps needless to add that the state of condition and binding makes a great difference in the market value of copies of the same book. Libraries will frequently despatch their duplicate or surplus copies to other institutions at a low price. For new books, periodicals, newspapers, &c., special terms may always be arranged with local tradesmen.

From time to time the Governments of Great Britain, France, and the United States have had under consideration various schemes for the international exchange of books upon a systematic basis, but the proposals were never carried into effect, and it was left to the public spirit of a French gentleman, M. Alexandre Vattemare, to devise and carry out for some years a large scheme for the interchange of books among the chief public institutions of Europe and America. In 1883 M. Vattemare was able to state that one hundred and thirty such establishments had participated in the benefits of the system, but unfortunately it gradually fell off. Earlier than 1861, however, a similar agency was in full working order at the Smithsonian Institution, and it has been kept up with efficiency to the present time. The institution acts as a medium for the exchange of their publications among the chief learned bodies and other public institutions of Europe and America, and undertakes the cost of receiving and sorting the parcels, and the remuneration of the agents in the chief countries of the Old World to whom they are sent; and by whom they are distributed free of charge. The corresponding societies are only required to deliver their parcels without expense at Washington.

On several occasions the United States Congress has passed special Acts directing the exchange of Government publications with those of other countries, and in 1848 the joint committee on the Library was authorized to appoint agents for the exchange of books and public documents. As the scheme did not appear to work satisfactorily, the Act was repealed four years later. But since 1867 it has been ordered that fifty copies of all documents printed by either House of Congress or by any Government department be placed

with the joint committee on the library, to be exchanged for foreign works. It is most unfortunate that this enlightened policy is not followed by the English authorities.

Many learned bodies which issue their proceedings willingly present them to libraries, and authors find this a useful means of spreading knowledge of their works, while they can secure for the public interest to ensure a large or rapid sale. Library committees may often secure valuable additions by a discreet application; indeed, privately printed works and local publications (unless given spontaneously) are almost only to be had in this manner.

Many valuable works are issued at the expense of Governments. It might be mutually expected that these should be sent, free of charge, to all public libraries of any importance. In England, however, this is not done. In countries where the public libraries are subject to the minister of public instruction, as in France and Italy, more is done in this direction, especially as regards expensive volumes. In 1858 a select committee of the House of Commons recommended that parliamentary papers should be sent free of charge to free public libraries, but the recommendation has never been carried out.

In America official publications can be obtained without charge by public institutions from the secretary of the interior upon the order of a senator or representative, but the system is said not to be a satisfactory condition.

Many valuable English Government publications, notably the state papers and chronicles, and the fine art handbooks of the South Kensington Museum, are easily to be had at less than the cost of production, and parliamentary papers are neither unobtainable nor highly priced. Although there is no fixed rule as to distribution, some of the departments may now and then be induced to present copies of their publications on being applied to in a proper manner.

The privilege of demanding copies of all books, periodicals, news, Copyrights, musical publications, maps, and prints, when published, right under the provisions of the various Copyright Acts, is enjoyed by Acts only a very few, generally only by one, of the chief national libraries in each country. This system has grown up under the different enactments of the ownership of the press. The first Act of Parliament passed in England to enrich printers to present their publications was that of 14 Charles II. c. 24, which provided that three copies should be sent, one to his Majesty's library, and one to each of the universities of Oxford and Cambridge. By 8 Queen Anne c. 20 the number was increased to nine, and by the 41 George III. c. 107 to eleven, viz., to (1) the Royal Library; (2) the University Library of Cambridge; (3) the Bodleian; (4) Edinburgh University Library; (5) Glasgow University Library; (6) King's College Library, Aberdeen; (7) University Library, St Andrews; (8) Queen's College Library, London; (9) Advocates' Library, Edinburgh; (10) Trinity College Library, Dublin; (11) King's College Library, Dublin. This was in force till 1835, when by 5 & 7 William IV. c. 110 the privilege was abolished as regards six of the eleven libraries mentioned, and a yearly grant, estimated at £8008, allowed in compensation. The Act under which five libraries, viz., the British Museum, the Bodleian, the Cambridge University, the Advocates', Edinburgh, and Trinity College, Dublin, now receive the copyright books is 5 & 6 Vict. c. 45 (See Copyright, vol. vi. p. 358).

As instances of the variety in practice in different countries, it may be mentioned that in France the Bibliothèque Nationale is entitled to a copy of every book, &c., printed within the dominion of the republic; in Belgium and the Netherlands one copy must be sent to the respective national libraries in order to secure the advantage of copyright; in Spain the Biblioteca Nacional of Madrid enjoys the privilege of one copy; in Portugal two copies are claimed, one by the Biblioteca Nacional at Lisbon, and one by the Biblioteca da Publica de Oporto; in the Cape of Good Hope every work must be sent to the library of Congress; the Imperial Library at St Petersburg receives two copies of every book printed in Russia; by the Brazilian law the Biblioteca Nacional do Rio de Janeiro is entitled to a copy of everything published within the municipality; and in Mexico two copies have to be delivered to the National Library.

Authorities—There have been many books written about library management; a complete list of those published down to about 1866, with critical notes, is given in *Fachschule Bibliothekswissenschaft*, by Dr J. G. Schneider. Besides the valuable works of Mr Edward Edwards, *Managers of Libraries* (1859, 3 vols. 8vo), *Five Seven Libraries* (1860), *Libraries and Founders of Libraries* (1868), *History of the Foundation of the British Museum* (1871, 3 vols. 8vo)—which are in the hands of all librarians. *Fachschule Bibliothekswissenschaft* (Leipzig, 1871) is a practical little volume. The report of the Bureau of Education on *Public Libraries of the U.S.* (Washington, 1874, 3 parts 8vo), besides giving an exhaustive account of all the American libraries, also includes a great variety of valuable information on library economy. The volume is so well illustrated, and contains so much that is useful for practical librarianship; it is a well edited periodical. *Fachschule Bibliothekswissenschaft* is a well edited periodical. The different publications of the Library Association include a great deal of interesting matter.

¹ In the recent *Report of the Royal Commission on Copyright*, 1875, a recommendation is made that the privilege should in future be granted to the British Museum alone.

Name	Founded	Special Character and Remarks	No. of Vols.		To whom Accessible	Name	Founded	Special Character and Remarks	No. of Vols.		To whom Accessible
			Print	MS					Print	MS	
DURHAM						MULL					
Bishop Cochrane's Lib.	1689	Chief Theol., little used	4,458	118	Open, cler. borrow.	Lyceum Library	1857		17,000		Sub
Cathedral Library.		Monastic, pr ext of MSS	15,000	670	O b l.	Subscription Lib.	1770	Act printed 1878	40,000		Sharehold
	1833	Motiv., Room and Winter-bottom bequests	21,168		(o b l.)	INVERNESS					
EDINBURGH						Free Public Lib.		Act adopted 1877			
Facult. of Actuaries	1860	Congregat. priv. pr ext.	265,000	2,000	To Inquir.	IRVING	1848	Sci., ref lib only; L. A.	8,000	20	Open
	1860	Professionl., large col. of pamphlets	1,200		Men and Stud	ATKINSON					
Library Institute	1875				Sub	Mechanics' Inst.	1819		7,000		Sub
Mesh Ness Lib.	1876		22,400		Sub	KEBO Library	1781		5,000		Open
New College Lib.	1876	Theol., & c, cat pr 1808	40,000	800	Sub	ADKINSON'S					
Philosophic Inst.	1840		80,000		Sub	Free Public Lib.	1890	Ref lib with non-res.	1,000		Open
Boy Coll. of Phys.	1881	Med.; MS descriptions	30,000		Mem	KILMARNOCK					
Med. Soc. Sec.	1873	Ref. Trans., Thorne's MSS	16,500		Mem	Library	1797		14,000		Sub
Royal Society Lib.	1737	Gen., Pump	20,000		Mem	LAWHAGH (Dum.)	1800	Unfound. bequest.	7,000		Sub
Sigset Library	1773	Sci., Law, and cat. printing	68,800		Men	ELIAS					
					Men	LEAMING					
Soc. of Antiquar. L.		Chiefly Scot. Arch.; Drummond and Riddell MSS	8,000		Inquir	Free Public Lib.	1887	L.	11,240		Fav.
S & S Library	1868	Law, Gen. Lib.	12,000		Men	LEKES	1778		85,000	20	Sharehold
Subscription Lib.	1794		40,000		Sharehold	Mechanics' Inst.	1848		20,000		Open
United Free Coll. L.	1847	Mainly Theol., classed cat. printed lib.	21,000		Lib. and Ministers	Public Library	1848	L. A., 27 branches	108,210		Open
University Library	1860	Drummond's, Hollowell-Phillips, and Laing coll. Chemistry	140,000	2,000		Yorkshire College.	1874	Chiefly Sci.	5,000		Open
Wells Inst. and School of Arts	1838		2,800		Stud.	LEKX					
						Lib. and Mech. Inst.	1837	Gen., Local	4,500		Sub
Gloucester Library		Monas. Misc., little used			By leave	LAMONTSE					
EXETER						Free Library	1778	Gen., Locales, L. A.	20,200		Fav.
Cathedral Library	1810	Theol. and Hist.	5,000		Clergy only	FORBES Lib.	1889		10,000		Open
Der. and S. Free Lib.	1817	L. A.	12,070		Open	LAWES					
Institute			22,000		Sharehold and Sub	Library Society	1750	In Flitney Memorial.	6,000		Sub
FOPHAR						LAURELLED					
Free Library.	1870	L. A.	4,400		Open	Cathedral Library					
GALASHIELS						Free Lib. and Men	1874	L. A.	5,000		2 Clerg. (o b l.)
Genie Library	1874	L. A.	21,000		Open	LEINCOLN		Monastic, Theol., political tracts, Euseb. to Chas. L.	7,400		Clergy of diocet.
GALWAY						LEINCOLN					
Queen's Coll. Lib.		Gen. coll. course, town council records	23,000		Mem., Reson. b. l.	LEINCOLN					
GARMON					Sub.	LEINCOLN					
Garmone's Library	1871		2,700			LEINCOLN					
GLASGOW						LEINCOLN					
Anderson's Coll.	1878	Made, printed cat.	5,800		Mem., or by payt	LEINCOLN					
St. Patrick's Lib.	1878		2,870		Stud., or by payt	LEINCOLN					
(o) Managers' L.	1808		7,108		Mod. or by payt	LEINCOLN					
(o) Mech. Class. L.					Mod. or by payt	LEINCOLN					
Coll. of Sci. and Art.	1820	For use of Students.	20,000		Mod. or by payt	LEINCOLN					
Family of Phys. and Surgeons	1820	Med., Sci., Loc. Arch.; cat. printing.	20,000		Mod. or by payt	LEINCOLN					
Family of Frezee (L. branch)	1817	Gen. Law, books lect.	16,801		Mod. or by payt	LEINCOLN					
Free Coll. Lib.		Theol., N. T. crit., Tis-chendorff's Lib.	24,000		Mem. and Stud	LEINCOLN					
Mitchell Library	1874	Printed, uncat. Mitchell's bag, foot, post, Glasgow col.	26,000		Few	LEINCOLN					
Mitchell Library	1874	Printed, uncat. Mitchell's bag, foot, post, Glasgow col.	26,000		Few	LEINCOLN					
Philosophic Inst.	1840		80,000		Sub	LEINCOLN					
Brit. Mus. Lib.	1793	Founded by Sir Isaac Newton	40,000		Mem	LEINCOLN					
Free Public Lib.	1793	Founded by Sir Isaac Newton	40,000		Mem	LEINCOLN					
University Library	1840	Also a Divin. Lib. and a Roman Law Lib.	115,000	280	Mem., Res. b. l.	LEINCOLN					
					By payt	LEINCOLN					
GLoucester Library						LEINCOLN					
Cathedral Library	1810		5,000		Open to the boys	LEINCOLN					
GOALINGH						LEINCOLN					
Cathedral Library	1810	Also 11 boarding-house libraries.	17,000		Open to the boys	LEINCOLN					
GLENNON						LEINCOLN					
GLENNON Library	1780	Gen., printed cat.	30,000		Sub	LEINCOLN					
Mechanics' Inst.	1819		4,000		Sub	LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON						LEINCOLN					
GLENNON											

[illegible]

[illegible]

III. GERMAN EMPIRE

ATC-LA-CHAPPEL State-Indebted	1586	Can. pr 1894	80,000	120	Strangers by gear
ALBERGUS Hermog Landes-B.	1086	Can. pr 1872	60,000		Open
AMBERG Oberlaus. Provin- zial-B.	1085	Formed from Monastic collections	\$1,000	200	Open.
ANDOLIN Friedr. Hof-Bnd.			30,000		By leave.
AUGSBURG St. Kreuz-B. Stadt-B	1487	Largely fr Monastic cells accretions almost entirely in history.	160,000	800	Students.
BAUMBERG Katholische B.	1411		135,000	2,300	Strangers by gear
BREILY Königliche B.	1601	Copy privileges K. Reichs-Adm. Geogr	850,000	14,000	Op. bks 1
BRUNNEN K. Oberlausitz. K. u. N. Genem. stabs-B.		Military; printed cat.	75,000 69,000		Staff and Offices
K. Städtisches Bureau Unterwelts-B.	1810	Can. printed, 2 vols. 4to. 1874-79	82,000	400	
	1841	Copy privilege.	200,000	383	Stud by gear.
BOSS Unterwelts-B.	1818	Printed cat. of MSS	520,000	674	Non-per- petuated by gear.
BREMEN Stadl-B.	1686	Gen. Local.	100,000		Ch. mem- bers by gear

[illegible]

VII BELGIUM.

Name	Formed	Special Character and Remarks	No of Vols.		To whom Accessible
			Print	MS	
ANTWERP B Public de la Ville	1606	Books lent, includes B Popular, 4443 vols	42,213		Open (over 10)
BRUXELS R. Pub. de la Ville	1798	Books lent	166,000	MISS	Open
BRUXELS B Royns	1847	MISS and Incunabula	320,000	30,000	Open
GERMAY B de l'Université	1779	Gen. Jurist., Phil., Phil. Aied., books lent, 1 branch	320,000	1,800	Open (over 18)
LISBON B de l'Université	1817	Gen. Idée, periodicals and publications of soc	105,740	1,544	Open (over 17)
LOUVAIN B de l'Université	1840	Theol., univ. course	208,000		Open
MAREMBERT B de la Ville	1846		18,000		Open
MOSCOW B Communale	1862		30,000	838	Open,
NANCY B de la Ville	1787		26,000	100	Open
TOURNAI B Public	1765		40,000	275	Open

VRIJ HOLLAND

AMSTERDAM	Univ. Bibliothek	1341	Gen., Med., Life of Dutch Geogr. and other Soc.	100,000	806	Open
HAARLEM	B. Communale	1696	Life and Hist., incunabula	25,000	169	Open
HAARUM (THEE)	De Koninklijke Bibliotheek	1768	Hist., Dutch, Lat., books	300,000	4,506	Open (Govt 14)
LEIDEN	Acad. Bibliothek	1678	Univ. course, books lent	160,000	4,860	Open
ROTTERDAM	Bibl. des Stad.	1870	Netherlands	40,000	950	Open
UTRECHT	Univ. Bibliothek	1683	Gen., incunabula	150,000	505	Open

IX. DENMARK

COFFENHAGEN					
Athenum			50,000		
Dato Sio Kenggel	1670	Gen. reference, Danish,	493,000	18,600	Mem. Open by
Bililochek	1708	national lib; bks lent			voucher
Kongene Heandib- Hirak	18--	Gen. Modern personal	40,000		King's perm
Uniretatsbililochek	1482	Gen. Nat. His, bks 1, Bib	250,000	4,000	Open
	1728	Congress, Scand MSS			

X ICELAND

REYKJAVIK			
College L	Hist, Phil	9,000	Mem
Stofubokasafn.	Sci, Iceland	30,000	Open

XI NORWAY

CHRISTIANA					
Leichmanns	1750	Gen. Pop.; founded by	15,300	800	By vouch
Bibliotek		C. Deichmann.			
Universitetsbiblio-	1811	Univ. course; Sel.; books	280,000	1,176	By vouch.
thek		lost, early Sound. It.			
THRONDSHEIM					
K. norske Vidensk.	1767	Science.	50,000	1,000	Residents.
skab. Selskab. B.					

XII. SWEDEN

LUND	Universitetsbibl	1688 Univ course, Sci, books lent, Delagardie MSS.	120,000	3,000	Mem (a b 1)
STOCKHOLM	Konungl. o. Rika B	1866 Gen., Swedlab, Nat Hist	250,000	8,000	Open
UPPSALA	Universitetsbibl	1820 Univ course, books lent	220,000	10,000	Open

XIII SPAT

BARRIONA					
Archives de la		50,000	MSS.	By leave.	
Corona de Aragón					
Museo y Biblioteca		50,000	MSS.	By leave.	
Provincial					
CADIZ					
B Provincial.		30,000		Open.	
HERNAN					
Herbaceous	1470	Gen., lucasabula; valMSS.	32,143	4,611	By leave.
MADRID					
B Nacional	1771	Gen., Spain.	400,000	10,000	Open.
B del Palacio Real.		Property of King	300,000		Open.
B de San Pedro.		Remitted by Jesuits.	65,000		Open.
B de la Universidad		Univ. courses.	30,000		Open.
SALAMANCA					
Universidad	1904	lucasabula	70,814	870	Open.

Name	Founded.	Special Character and Remarks	No of Vols		To whom Accessible.
			Print	MS	
SALVADOR B Facultes Univers- ty Provincial	1859	Gen. Theol, Spanish lit and books of civility	87,000	271	Open
SEVILLA. B. Columbian.	1860	Founder, Fernando, son of Columbus	18,000	MS.	Open
B. Universitat la TOLEDO	1767	Founded on health lib.	69,000		
R. de la Catedral	1898	Theology.	50,000	100	ly. inacc.
VALLADOLID B. del Arzobispado		Theology	10,000	MS	Open
B. Universitat	1768	Incun, destroyed in 1812	42,000		
VALLADOLID B. de la Catedral	1880	Gen., Theol., Law, In- cunades lit. of Santa Cruz (1480) and that of the University	27,180	908	Open

XIV. PORTUGAL

COLEÇÃO E da Universidade	1601	Gen., Univ dum dias	84,000		Mem (o b 1).
EVORA B Archiepiscopal Lisboa		Theology	50,000	MISS	By leave
B da Academia B Nacional.	1780 1786	Science Gen., Portug	60,000 200,000	MISS 9,415	Open Open
MATRA Bibliotheca	1789		80,000		By leave.
OPORTO E Pub Municipal	1829	General, books not lent.	160,000	1,300	Open

XY GREECE

ATHENS University Lib	1837 National Lit	160,000	000	Open
CORFU Public Library	1900 Univ course	40,000		Open

XVI RUSSIA

DORPAT University Lib Reserve Books University Lib	1801	Univ. course.	146,500	750	Man.
KAZAN University Lib	1829	Univ. course; Finland, esp. note Potemkin.	145,000		Reserve.
KHARKOFF University Lib	1804	Univ. course; lib of Prince Potemkin	86,000		Man.
KIEV University Lib	1804	Scholars.	56,000		Man.
MOSCOW Secretariat Museum Public Mus.	1826	Formerly at Wina.	116,000		Man.
U. of the Patriarch.	1865	Gen. lib., 2 editions	20,000	80	Open
L. of the Patriarch.	1865	Gen. lib., Hist. Russian, in- cludes Rumancev's lib	80,000	400	Open
ODESSA Public Library.	1850	Sec. lib. books have been removed	173,000		By leave.
St. PETERSBURG Academy of Sci.	1782	Univ. course, Hist.	40,000		By leave.
St. PETERSBURG Imperial Public Lib.	1782	Univ. course, Hist. 10,000 are in lib. of Asiatic Soc.	180,000	3138	By leave.
St. PETERSBURG Imperial Public Lib.	1800	Gen. Russian; copy por- tfolios.	1,000,000	20,000	Open
St. PETERSBURG Imperial Public Lib.	1800	Russian lib.	10,900	3788	Open
St. PETERSBURG Imperial Public Lib.	1824	Sect. Orient. Phil.	138,677		Man.

XVII. EGYPT

CAIRO Public Library	c 1890	Includes the Wakt of Cairo Mosques. See <i>Academy</i> 1870. xv n 53.	40,000	Incl.	Open
-------------------------	--------	---	--------	-------	------

XVIII INDIA, CHINA, AND JAPAN

BRINHAUS College Lib.	1894 Sanskrit Coll., 2,400 v 1836	10,000	3,600	Mem.
BOZRAV.	1894 Oriental; books lend.	40,000	300	Mem.
CALCUTTA Calcutta Public Lib.	1880 English; prop lib; books 1875; 1881; 1882; 1883; 1884; 1885; 1886; 1887; 1888; 1889; 1890; 1891; 1892; 1893; 1894; 1895; 1896; 1897; 1898; 1899; 1900; 1901; 1902; 1903; 1904; 1905; 1906; 1907; 1908; 1909; 1910; 1911; 1912; 1913; 1914; 1915; 1916; 1917; 1918; 1919; 1920; 1921; 1922; 1923; 1924; 1925; 1926; 1927; 1928; 1929; 1930; 1931; 1932; 1933; 1934; 1935; 1936; 1937; 1938; 1939; 1940; 1941; 1942; 1943; 1944; 1945; 1946; 1947; 1948; 1949; 1950; 1951; 1952; 1953; 1954; 1955; 1956; 1957; 1958; 1959; 1960; 1961; 1962; 1963; 1964; 1965; 1966; 1967; 1968; 1969; 1970; 1971; 1972; 1973; 1974; 1975; 1976; 1977; 1978; 1979; 1980; 1981; 1982; 1983; 1984; 1985; 1986; 1987; 1988; 1989; 1990; 1991; 1992; 1993; 1994; 1995; 1996; 1997; 1998; 1999; 2000; 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; 2010; 2011; 2012; 2013; 2014; 2015; 2016; 2017; 2018; 2019; 2020; 2021; 2022; 2023; 2024; 2025; 2026; 2027; 2028; 2029; 2030; 2031; 2032; 2033; 2034; 2035; 2036; 2037; 2038; 2039; 2040; 2041; 2042; 2043; 2044; 2045; 2046; 2047; 2048; 2049; 2050; 2051; 2052; 2053; 2054; 2055; 2056; 2057; 2058; 2059; 2060; 2061; 2062; 2063; 2064; 2065; 2066; 2067; 2068; 2069; 2070; 2071; 2072; 2073; 2074; 2075; 2076; 2077; 2078; 2079; 2080; 2081; 2082; 2083; 2084; 2085; 2086; 2087; 2088; 2089; 2090; 2091; 2092; 2093; 2094; 2095; 2096; 2097; 2098; 2099; 2100; 2101; 2102; 2103; 2104; 2105; 2106; 2107; 2108; 2109; 2110; 2111; 2112; 2113; 2114; 2115; 2116; 2117; 2118; 2119; 2120; 2121; 2122; 2123; 2124; 2125; 2126; 2127; 2128; 2129; 2130; 2131; 2132; 2133; 2134; 2135; 2136; 2137; 2138; 2139; 2140; 2141; 2142; 2143; 2144; 2145; 2146; 2147; 2148; 2149; 2150; 2151; 2152; 2153; 2154; 2155; 2156; 2157; 2158; 2159; 2160; 2161; 2162; 2163; 2164; 2165; 2166; 2167; 2168; 2169; 2170; 2171; 2172; 2173; 2174; 2175; 2176; 2177; 2178; 2179; 2180; 2181; 2182; 2183; 2184; 2185; 2186; 2187; 2188; 2189; 2190; 2191; 2192; 2193; 2194; 2195; 2196; 2197; 2198; 2199; 2200; 2201; 2202; 2203; 2204; 2205; 2206; 2207; 2208; 2209; 2210; 2211; 2212; 2213; 2214; 2215; 2216; 2217; 2218; 2219; 2220; 2221; 2222; 2223; 2224; 2225; 2226; 2227; 2228; 2229; 2230; 2231; 2232; 2233; 2234; 2235; 2236; 2237; 2238; 2239; 2240; 2241; 2242; 2243; 2244; 2245; 2246; 2247; 2248; 2249; 2250; 2251; 2252; 2253; 2254; 2255; 2256; 2257; 2258; 2259; 2260; 2261; 2262; 2263; 2264; 2265; 2266; 2267; 2268; 2269; 2270; 2271; 2272; 2273; 2274; 2275; 2276; 2277; 2278; 2279; 2280; 2281; 2282; 2283; 2284; 2285; 2286; 2287; 2288; 2289; 2290; 2291; 2292; 2293; 2294; 2295; 2296; 2297; 2298; 2299; 2300; 2301; 2302; 2303; 2304; 2305; 2306; 2307; 2308; 2309; 2310; 2311; 2312; 2313; 2314; 2315; 2316; 2317; 2318; 2319; 2320; 2321; 2322; 2323; 2324; 2325; 2326; 2327; 2328; 2329; 2330; 2331; 2332; 2333; 2334; 2335; 2336; 2337; 2338; 2339; 2340; 2341; 2342; 2343; 2344; 2345; 2346; 2347; 2348; 2349; 2350; 2351; 2352; 2353; 2354; 2355; 2356; 2357; 2358; 2359; 2360; 2361; 2362; 2363; 2364; 2365; 2366; 2367; 2368; 2369; 2370; 2371; 2372; 2373; 2374; 2375; 2376; 2377; 2378; 2379; 2380; 2381; 2382; 2383; 2384; 2385; 2386; 2387; 2388; 2389; 2390; 2391; 2392; 2393; 2394; 2395; 2396; 2397; 2398; 2399; 2400; 2401; 2402; 2403; 2404; 2405; 2406; 2407; 2408; 2409; 2410; 2411; 2412; 2413; 2414; 2415; 2416; 2417; 2418; 2419; 2420; 2421; 2422; 2423; 2424; 2425; 2426; 2427; 2428; 2429; 2430; 2431; 2432; 2433; 2434; 2435; 2436; 2437; 2438; 2439; 2440; 2441; 2442; 2443; 2444; 2445; 2446; 2447; 2448; 2449; 2450; 2451; 2452; 2453; 2454; 2455; 2456; 2457; 2458; 2459; 2460; 2461; 2462; 2463; 2464; 2465; 2466; 2467; 2468; 2469; 2470; 2471; 2472; 2473; 2474; 2475; 2476; 2477; 2478; 2479; 2480; 2481; 2482; 2483; 2484; 2485; 2486; 2487; 2488; 2489; 2490; 2491; 2492; 2493; 2494; 2495; 2496; 2497; 2498; 2499; 2500; 2501; 2502; 2503; 2504; 2505; 2506; 2507; 2508; 2509; 2510; 2511; 2512; 2513; 2514; 2515; 2516; 2517; 2518; 2519; 2520; 2521; 2522; 2523; 2524; 2525; 2526; 2527; 2528; 2529; 2530; 2531; 2532			

Name	Founded	Special Character and Remarks	No of Vols		To whom Accessible
			Print	MSs.	
MADRAS Pres. Pub Lib Liter Soc	1857 1819	Sci. & Lit., sans attached Oriental, & of Eng. As Soc.	10,000 26,000		Open Mem and pub.
ROCKEF Thomson Coll.	1859	Engineering, mech. & indus- trial lib	14,000		Mem
TAMER Lib. of Rupa	1857 1870	Sanitary, prop. of rats, cat by Dr. Barnard	18,000		By leave
SHANGHAI N. China Br. of R. As Soc Baffles Lib	1862 1841	Or., 1160 Chinese bks., cat by	2,500 11,000	1,100	Mem Open
HAWAII Hawaii Genosia	1841	Dutch Settlements, Indian Asiatic	20,000	1,700	Open
YOKO Lib. of Tokio Pu.	1879	China and Japan, 6000 Europ.	64,000		Part Open

XIX BRITISH COLONIES

Australia.					
Free Pub Lib	1850	Gen. Australia Books	51,140		Open
Parliamentary Lib	1844	Legislation, Documents.	27,000		Open 120
Free Public Lib					Mem
ADELPHI					
S. Asia Institute	1870	Gen. Australia, 100	20,000		Open
country list collated	1870				lens lent
MELBOURNE:					
Pub Lib of Vt.	1870	Gen., Australia.	111,641	10	Open
					(over 14)
British Guiana.					
Genosia	1844	Gen., British Guiana.	25,000		Mem
R. Agr. and Com. Society Lib	1864				
Canada.					
OTTAWA:					
Lib. of Parliament	1810	Canada, books lent.	109,000	20	Mem
Library	1897	Law, Canada, books	20,000		Mem
Library	1897	Law, Canada, books	20,000		Mem
Mechanics Inst	1859	Reference by small fee.	26,467		Mem
University Lib	1859	Unit. course, reading- room open	24,960	2	Mem
Jamaica					
Free Pub Lib	1874	Books lent, in conn with Inst. of Jamaica			Open
					(over 15)
Mauritius.					
Free Public Lib	1811	Gen. French, Lit., Med., and Music, bks. not lent	10,000		Open
New Zealand.					
Univ. Lib			10,000		Mem.
Wellington	1849		10,000		Mem
Athenaeum			10,000		Mem
South Africa.					
CAPE TOWN	1818	Gen. Africa, Australia, &c. Dorsetian and Grey bks	38,875	125	Open
GRAHAMSTOWN:	1839	Books lent on payment	7,800		Open
Free Public Lib			10,000		Open
Free Public Lib	1848	Books lent on payment	12,000		Open
Tasmania.					
HOBART TOWN	1870	Gen. local	8,000		Open
Tasmanian Lib	1869		8,000		Open

XX UNITED STATES

ALBANY (N. Y.):					
N. Y. State Lib.	1818	Gen. ref., Law, law lib	116,000	240	Open
		of 29,500 vols			(over 16)
AMHERST (Mass.):					
Ambrose College Lib	1827	Gen. ref., coll. lib; includes 2 sec. lib, 6410 vols	42,180		Mem
					(o b l)
ANDOVER (Mass.):					
Theology Sem.	1807	Theology	38,800	Few	Mem.
ANN ARBOR (Mich.):					
Univ. of Michigan	1841	Gen. ref., books lent only to professors.	40,000		Open.
ANNEAPOLIS (Md.):					
Maryland State Lib	1897	Law chiefly	40,000		Open.
AUGUSTA (Ga.):					
Maine State Lib.	1889	Gen. ref., Law.	26,000		Mem. of govt.

Name	Founded.	Special Character and Remarks	No of Vols		To whom Accessible
			Print	MS	
BALTIMORE (Md.):					
Johns Hopkins Un.	1876	Sci. & Lit.	12,000		Mem
Maryland Hist. Soc.	1844	History	17,000		Open
Milwaukee L. Assoc.	1819	Gen., Popul., 12,000 pamph- lets, 1000 bks.	36,000		Sub (85).
Postoffice Lib.	1870	Gen. ref.	72,000		Open
BOSTON (Mass.):					
Boston Athenaeum	1807	Gen. ref., Hist.; printed dictionary &c.	122,000		Prop. bks ref. (85)
Congregational Lib.	1820	Theol., Hist., 115,000 pam- phlets, 1000 bks.	26,135	225	Open
Mass. Hist. Soc.	1791	Hist., 1000 local hist. and war	50,000	1,000	Mem
New Eng. Hist. Soc.	1846	Hist., 1000 local hist. and war	17,000		Open
Public Lib. (S. Mass.)	1820	Books lent.	318,478		Open
State Lib. of Mass.	1820	Ref., Law, and Hist., best collect. of U. S. statistics and reports	20,000	Few	Open
BROOKLYN (N. Y.):					
Brooklyn Lib	1817	Books lent	61,108		Mem
Long Island Hist. Soc.	1849	Ref., Hist., Fine Arts	50,000		Mem
BRUNSWICK (N. Y.):					
Brunswick Coll. Lib	1857	Gen. ref.; incl. soc. lib.	37,000		Mem
BUFFALO (N. Y.):					
Young Men's Lib	1854	Books lent.	40,000		Sub (85).
Cambridge Mass. Harvard Univ.	1870	100,000 pamphlets; ballads, contraband coll. and 1744 maps, law, div., and ecology	200,000		Open for ref. (85)
CHARLOTTESVILLE (Va.):					
Univ. of Virginia	1819	Coll. course, mem. bor.	87,000		Open
Public Lib	1870	Books lent.	70,120		Open
CHICAGO (Ill.):					
Public Lib	1820	Gen. ref., Mod., Theol.; Read 1887; bor. free, others pay \$5	122,000		Open
Young Men's Mer- cantile Lib	1840	Books lent to residents.	45,000		Sub (85).
CLEVELAND (Ohio):					
Pub. School Lib	1817	Books lent.	28,093		Open
Public Lib	1817	Gen. ref., Law	47,800		Open.
COLUMBIA (Mo.):					
Public Lib	1867	Books lent.	48,000		Open
EVANSTON (Ill.):					
Northwestern Univ.	1857	Gen., Clas., Phil	31,000		Mem
University Lib	1821	Gen. ref., Law.	23,000		Open
GEORGETOWN (D. C.):					
Georgetown Coll.	1781	Theol. and Coll. course Observatory Lib. 800 vols	20,000	Few.	Mem and visitors.
HANOVER (N. H.):					
Dartmouth Coll. Lib	1789	Gen. ref., Books lent.	31,000		Mem (86)
HARRISBURG (Pa.):					
Ref. Lib	1877	Gen. ref., Law, 1000 manuscript list of State	44,000		Open
HARTFORD (Conn.):					
Connecticut Hist. Soc.	1834	History	20,000	Many	Open, by perm. lib.
Hartford L. Assoc.	1849	Books lent	31,000		Sub. (86)
Wetherspoon Lib. of Hist.	1869	Gen. ref.; connected with Conn. Hist. Soc. Lib.	34,800		Open
HAYWARD (Calif.):					
Public Lib	1870	Books lent.	34,912		Open
INDIANAPOLIS (Ind.):					
Public Lib	1870	Books lent.	31,027		Open
ITHACA (N. Y.):					
Cornell University	1868	Ref., Univ. Lib.; contains lib. of G. B. Smith, J. Bopp, and C. Anthon.	30,000		Mem
LANCASTER (Pa.):					
Univ. of Pennsylvania	1828	Gen. ref., Law; off. bor.	54,000		Open
LOUISVILLE (Ky.):					
Pub. Lib. of Kentucky	1871		60,800		Open
MADISON (Wis.):					
Wis. State Hist. Soc.	1849	Gen., Amer. Hist.	44,000		Mem (82).
MILWAUKEE (Wis.):					
Wisconsin Univ.	1848	Coll. course, Amer. Hist. daily Wisconsin Hist.	31,000		Mem
NEW BEDFORD (Mass.):					
Free Public Lib	1843	Books lent.	41,000		Open
NEW HAVEN (Conn.):					
Yale Coll. (and lib.)	1700	Gen. ref., 100,000 and of depts. of law, med. and divinity	126,000	200	Mem.
NEW YORK:					
Apprentices' Lib	1820	Gen., Trades and Useful Art, occupations and working women bor. bks. others \$5.	60,000		Open to apprentices.
Assur Lib	1840	Gen. ref., 1000 local and war	102,447		Open
Columbia College	1754	Gen. ref., books lent includes Phoenix Lib.	45,000		Open
Lenox Lib.	1870	Rare books; founded by James Lenox.	28,000	1,000	By card (on appn.).

Name	Founded	Special Character and Remarks	No. of Vols		To whom Accessible
			Print	MSS	
NEW YORK—contd					
Morgan's Lib Assoc	1829	Books lent	153,000		Sub Mem
N. Y. Hist Soc	1848	History	60,000		Mem (a b i).
N. Y. Society Lib.	1700	Gen. Art. Novels pubd 1754-1770-1820; books lent	80,000		Prop
Union Theol Sem	1840	Theology, H. B. Smith Memorial Theol. Lib.; bks lent, 50,000 pamph	40,000	181	Mem (a b p)
PHILADELPHIA					
Acad. of Nat. Sci.	1812	Nat. Hist. books not lent, 40,000 pamphlets.	35,000		Mem (a b p)
Brooklyn Lib	1861	1861	20,000		Sub.
Lib. Company of Phila (A branch)	1781	Logan's lib. held in trust	115,000	74	Sub. ref
Logan's Lib	1760		11,000		Sub. ref
Mercantile Lib Co	1821	Books lent	141,000	200	Sub. (94)
PRINCETON (N. J.)					
College of New Jersey Lib	1749	Gen. ref., includes society lib.	72,000		Mem
Presbyterian Theol Sem Lib	1819	Ref., Theol., books lent, endowment, \$60,000.	40,000		Mem
PROVIDENCE (R. I.)					
Brown University	1760	Col. course, rich in hist. clas. and part in endowment, \$60,000.	54,000		Mem (a b p)
Providence Atheneum	1826	Books lent, 987 shares, holders (\$14)	20,000		Sub (\$94)
BALTIMORE (N. C.)					
N. O. State Lib	1831	Gen. ref., Law	42,000		Open
REYNOLDS (Va.)	1829	Gen. ref., Law.	44,000		Open
SACRAMENTO (Cal.)	1860	Gen. ref., Law.	53,000		Open
ST. LOUIS (Mo.)					
Public School Lib	1866	Books lent for 61 years.	50,000		Sub
St. Louis Mercantile Library	1840	Gen., Amer. Hist., bks l., propert 84, clerks 34	80,000		
BALTIMORE (Md.)					
Essex Institute	1848	Ref., Hist.; special coll. rul. to Essex co	84,800	1,200	Mem (400)
STANFORD (Cal.)					
Fin. Public Lib	1870	Books lent	20,000		Open
Mercantile Lib Assoc	1848	Books lent	40,779		Sub (\$12)
SPRINGFIELD (Mass.)					
City Lib Assoc	1864	Books lent for 61 years.	46,457		Open
WASHINGTON					
Bureau of Education	1868	Education and libraries.	12,000		Use of Dept.
Department of State	1789	Ref., Law, Hist., orig. doc. of founders of U. S.	80,000		Use of Dept.
House of Representatives	1790	Pub. doc.	181,000		Mem
Library of Congress	1800	Education, sonators and type bot. copy priv.	395,000	1,000	Open (over 15)
Patent Office	1859	Technical, Patents, officers also borrow	34,000		Open
Surgeon-General's Office	1868	Med., Sci.; journals and treat; 87,800 pamph	82,000		Open
U. S. Senate Lib	1823	Pub. doc.	80,000		Senators

Name	Founded	Special Character and Remarks	No. of Vols		To whom Accessible
			Print	MSS	
WATERBURY (Conn.)	1870	Gen. Fine and Indus. Arts. books lent, endow	28,200		Open.
WEST POINT (N. Y.)	1812	Military and scientific books lent	28,268	10	Mem
WILLIAMSTOWN (Mass.)	1794	Gen. ref., includes society libraries	30,000		Mem.
WOMEN'S College Lib	1812	Ref., Amer. Hist., newspapers from 1704 to 1861, 5000 vols.	75,000		Open.
Free Public Lib.	1850	Books lent to residents	49,624		Open (over 15)
ALL SOUTH AMERICA, Etc					
Argent. Conf. Buenos Aires	1810	Gen. S. Am.	40,000		Open
B. Nacional			25,000		Open.
B. Provincial B. Universidad.		Unl course	20,000		
Brazil					
Rio Janeiro	1807	Brazil	100,000	1,000	Open.
Chili					
Santiago		Br at Astronomers for env and milita	66,000	MSS	Open.
Mexico					
Guadalajara	1807	Gen. Theol., sup conv 1874 pr cat 1875-76	24,000	100	Open
B. Publica					
Mexico					
B. de la Catedral		Theology	80,000	300	By leave.
B. Nacional	1857	Gen. Mexico	100,000	MSS	Open
B. Universidad	1760	Unl course.	25,000	600	By leave
Puerto Rico			28,211	Few	Open.
Paraguay					
Managua	1881	S. America.	15,000		Up
Paru					
Lima	1821	Hold to have been taken by Chileans to Santiago	15,000	MSS	Open.
Uruguay					
Montevideo	1818	National Hist., S. Am ro 1868	17,000	1000	Open
Venezuela					
Caracas	1875	Gen. Theol., Med., pr cat	29,000		Open.
S. de la Univers					

(H. R. T.—H. G. T.)

LIBURNIANS were a people who at different times were prominent on the Adriatic coasts. They were originally, one cannot doubt, one of the homogeneous Illyrian tribes (see **ILLYRIA**). Living in a barren rocky country along the north-eastern coast of the Adriatic, they devoted themselves to the sea, and were the chief navigators of the Adriatic in the early period. They settled on the coast of Picenum, where the town of Truentum was always counted Liburnian, and the Greek colonists found them at Corcyra and other places. They were pressed on all sides by other races, but were still a powerful people in the time of Scylax (Scyl., p. 7). The islands that lay along the coast were peopled by them and called by their name. They were a race of pirates, who used swift boats with a large sail. These Liburnian ships became famous when the Romans adopted them in several of their naval wars. The heavy and lofty ships that had been developed by the later Greek states proved unequal to the light and swift Liburnian boats. The country was incorporated by the Romans in the province of Dalmatia.

LIBYA was a geographical name by which the Greeks usually designated Africa, with the exception of Egypt, although sometimes the continent was thought to be divided between Libya and Ethiopia. Libya enters into the sphere of ancient history only in so far as it came into contact with the civilized races of antiquity, and the present article will

touch this point only; the natural features and the ethnology will be found under other headings (see **AFRICA**). The native tribes came several times into collision with the kings of ancient Egypt. In the reign of Rameses the Great and his successor they invaded the Delta, and various expeditions were made by the Pharaohs into the outlying country, on the south particularly (see **EGYPT**). Herodotus mentions one important expedition sent out by Pharaoh Necho (610-594 a.c.), which started from the Red Sea, circumnavigated the continent, and reached the mouth of the Nile after three years' absence. The truth of the tale has often been doubted, but one circumstance in which Herodotus himself expresses his disbelief, viz. that as they sailed west they had the sun on their right hand, has in modern times been generally accepted as proving that the voyage was actually made.

The Phœnician colonies on the north coast, Utica, Carthage, &c., beginning between 1000 and 800 a.c., established a powerful and civilized empire in a hitherto unknown part of Libya. Their trading expeditions gave them a wide acquaintance with the geography of the country, even with the Atlantic coast as far almost as the equator; but the contempt with which the Roman conquerors treated the literature of the Carthaginians allowed much valuable material to disappear. The historian Sallust, when praetor of Numidia, was still able to use the Punic records which

he got interpreters to translate for him (Sall. *Jug.*, 17); and fortunately one record of an exploring voyage along the west coast, preserved in a temple in Carthage, was translated by some Greek traveller and is still available (see HANNO). For all that is known of the Carthaginian rule in Libya see CARTHAGE.

Greek mariners must have visited Libya at a very early period, for the edible lotus of the northern coast is mentioned in the *Odyssey*.

In the latter part of the 7th century B.C. the Greeks began to colonize the north coast. Between the Cuthaginian territory and the borders of Egypt they planted a number of cities, and the Pentapolis of which Cyrene was the chief was among the richest and most flourishing of all the Greek states (see CYRENE). When the Persians invaded Egypt they made some attempt to extend their empire over Libya, but the expedition of Cambyses (about 525 B.C.) was too unfortunate to encourage them to further efforts. The camel was introduced into Egypt under the Persian rule, and from this time it became easier to make long journeys over the Libyan deserts. Herodotus shows much knowledge of the Sahara, and it is clear that his account must be founded on the reports of traders and caravan guides well acquainted with the desert route. Under the Macedonian kings knowledge of Libya was much extended; they sent exploring expeditions for scientific purposes into Abyssinia, while growing wealth and luxury caused a continually increasing demand for the ivory, spices, and other produce of Libya. In the period 500-200 B.C. it seems certain that commerce was maintained with the countries beyond the Sahara in at least two ways—by the Carthaginian ships trading along the Atlantic coast, and by the overland route across the desert to the Nile. The Roman conquest of Carthage closed the former route. Polybius indeed was commissioned by Scipio to explore the country, and sailed a long way down the west coast; but the Romans themselves had not the maritime enterprise required for such voyages. The record which Polybius wrote for his friend Scipio is quoted by Pliny and Stephanus. Sallust also collected information about the country, and under the emperor Nero an exploring expedition was sent into Abyssinia. The Romans added more to the knowledge of Libya in other ways,—by a better organization of the province and increased facilities of travel and trade, by the frontier wars against surrounding tribes, and finally by the expeditions sent directly into the heart of the country to procure wild animals for the amphitheatre. The passion of the Roman populace for seeing strange animals slaughtered in the public games was gratified by the emperors and magistrates. Enormous numbers of Libyan wild beasts were exhibited in the amphitheatre; even hippopotami and alligators are mentioned. One Roman officer, Maternus, penetrated at least as far as Lake Chad. The *Periplus* of Arrian preserves a record of the trade along the east coast of Libya in the 1st century. In these ways a fairly accurate knowledge of northern Libya was obtained, and Ptolemy could, in the 2d century, construct a good map of Africa as far south as 11° N., though his idea of the shape of the continent further to the south is less accurate than that of Herodotus.

See Ritter, *Erde und Volk*, 1; Haeren, *Historical Researches*, or in the *German Ideen*, vol. II; and the geographical works of Forbiger, Kiepert, Bunbury, &c.

LICATA. See ALICATA, vol. I p. 874.

LICHENS (*Lichenes*) may briefly be defined as cellular perennial plants, furnished with a vegetative system containing gonidia, and with a reproductive system consisting of female thecosporous fruits and male spermatogenous organs. They constitute a distinct class of cellular cryptogams, intermediate between algae and fungi, to

both of which in some respects they present certain affinities. By the earlier authors they were regarded as being *Aeropycnæ* or terrestrial algae, while of recent years they have been viewed by some writers as being *Ascomycetous* fungi. From both of these, however, they are sufficiently distinguished and separated by the special structure of their thallus, by the presence of certain immediate principles proper to their tissues, and by their mode of life and nutrition. Their relations to these neighbouring classes, and their true systematic place, will be best elucidated on considering their structure and its bearings upon some recent speculations.

Structure of Lichens.

A complete lichen consists of a nutritive and vegetative system termed the thallus, and of reproductive bodies borne upon it in the form of *apothecia* and *spermatogones*. Occasionally, however, there is no thallus present (e.g., *Sphaerium*, various *Leclides*, *Endococcus*), in which case the fructification is parasitical on the thalli of other lichens.

1. *Vegetative System*.—The thallus is very variable in external form and colour, as also in internal structure.

1. In external form it presents the following modifications. (a) The *filicæous* thallus, which may be either peltate, i.e., rounded and entire, as in *Umbilicaria*, &c., or variously lobed and lacinated, as in *Sticta*, *Parmelia*, &c. This is the highest type of its development, and is sometimes very considerably expanded. (b) The *fruticulose* thallus, which sometimes is filamentous, as in *Ephebe*, and may be either erect, becoming pendulous, as in *Umea*, *Ramatina*, &c., or prostrate, as in *Alectoria jubata*, var. *chalybeiformis*. It is usually divided into branches and branchlets, bearing some resemblance to a miniature shrub amongst the *Phanerogama*. An erect cylindrical thallus terminated by the fruit is termed a *podetium*, as in *Cladonia*. (c) The *crustaceous* thallus, which is the most common of all, forms a mere crust on the substratum, varying in thickness, and may be squamose (in *Squamaria*), radiate (in *Placodium*), areolate, granulose, or pulverulent (in various *Lecanora* and *Leclides*). In its pulverulent state it is either the rudimentary or the abortive condition of many species. (d) The *hypophloeal* thallus is often concealed beneath the bark of trees (as in some *Verrucaria* and *Arthonia*), or enters into the fibres of wood (as in *Xylographa* and *Aggyrium*), being indicated externally only by a very thin film or maula. To this may also be referred the evanescent thallus which is denoted solely by gonidia sparingly scattered on the stone or wood (as in some *Caliciei* and *Leclides*). This is the simplest form under which lichenous vegetation occurs. These two latter forms of thalli may be either *determinate*, i.e., of a definite shape with a distinct margin or boundary, or *effuse*, i.e., spreading extensively over the substratum with no visible limits. The differences in these forms are no doubt connected with differences in the chemical composition of the thallus. In colour also the thallus externally is very variable. In the dry and more typically state it is most frequently white or whitish, and almost as often greyish or greyish glaucous. Less commonly it is of different shades of brown, red, yellow, and black. These various colours do not originate from any colouring matters contained in the cells themselves, but, according to investigations made by Nylander (see *Flora*, 1879, p. 658) they depend upon such as are deposited in the granulations and cellular walls, whence they appear on the epithallus. In the moist state of the thallus these colours are much less apparent, as the textures then become more or less translucent, and the epithallus usually presents the greenish colour of the gonidia (e.g., *Parmelia Borreri*, *Peltidea apotheca*, *Umbilicaria pustulata*, and pulverulent *Leclides*).

2. The internal structure of the thallus presents two principal modifications, viz., the *stratified* thallus, having its different elements (hyphae and gonidia) arranged in layers, and the *unstratified* thallus, in which these different elements are confused in a homogeneous tissue.

A. *The stratified thallus*.—On making a vertical section this is seen in a foliaceous lichen to consist of three layers, constituting a *cortical*, a *gonidial*, and a *medullary* system, to which in the case of many crustaceous lichens is to be added a fourth, viz., a *hypothalline* stratum.

(a) *The cortical stratum* occupies the whole of the external surface of filamentose and foliaceous lichens, both the upper and under surfaces of some foliaceous and squamulose species, while it is found only on the upper surface of crustaceous lichens. It usually consists of a colourless cellular tissue, in which the cells are closely compacted and form a pseudo-parenchyma. Its most superficial portion, termed by Nylander the *epithallus*, a sort of cuticle, is amorphous, often more indurated and coloured. In some lichens (e.g., *Collema*) it is the only portion of the cortex present, while in pulvulent crustaceous thalli it is entirely wanting. (b) *The gonidial stratum* is situated immediately beneath the cortical stratum, and consists usually of greenish spherical cells, or of granules destitute of a cellular membrane. It is not always continuous, but is often interrupted, the gonidia occurring in disconnected masses. Sometimes it is situated on the upper part of the medullary stratum, in which case the gonidia are arranged either between or amongst its exterior elements. In general its limits may readily be distinguished from the others by its peculiar colour. Various important matters relating to the gonidia will more appropriately be afterwards discussed at length. (c) *The medullary stratum* is more variable in its constituent elements, but, being always colourless, is easily recognized. It presents the three following principal modifications. (a) *The woody medulla* consists of simple or branched filaments, which in foliaceous species are loosely interwoven and entangled, and in crustaceous species are more or less confluent, assuming a longitudinal direction, and constituting, as in *Ulex*, a kind of solid axis for the support of the thallus. (b) *The areolate medulla* occurs only in crustaceous lichens, and is generally characterized by its latticose appearance. It is more compact than the preceding, and consists for the most part of molecular granulations often intermixed with octahedral crystals of lime, and presenting but few traces of filamentous elements. (c) *The cellular medulla* consists of a tissue of angular, rounded, or oblong cells containing gonidia in their interior or in their interstices (e.g., *Pannaria*, *Endocarpon*). In some species (e.g., *Pannaria fuscula*) the cells have a tendency to reemit into filaments and then to separate again into rows of cells. (d) *The hypothalline stratum* is the inferior one of the thallus and that upon which the other strata are developed, though it is not always visible, and is sometimes entirely wanting. It usually presents itself under a twofold aspect, viz., the *hypothallus* and *rhizoma*. (a) *The hypothallus* proper, which is immediately developed upon the prothallus (i.e., the filaments of the gametangial sporae), is a horizontal stratum consisting of interlacing filaments of elongated, short, or round cells, and is sometimes of a white or whitish colour, but usually dark or blackish. In many crustaceous lichens it is represented only by a black or dark-colored border limiting the thallus (e.g., *Leucidea geophila*, &c.). (b) *The rhizoma* consist of vertical branched filaments, usually branching and tapered at their extremities, blackish or greyish in colour, rarely white, which occur on the lower surface of foliaceous lichens. They consist of several filamentous elements which are most frequently articulated and agglutinated (e.g., *Pannaria*, *Physcia*), or sometimes simple and then always articulated (e.g., *Stictis*). It is to be observed that the hypothallus and the rhizoma are merely as bases of attachment for the lichens to the substratum, and do not in any way aid in its nutrition.

B. *The unstratified thallus*.—This occurs amongst the *Lichenes* (which, however, are most frequently stratified as above), and in

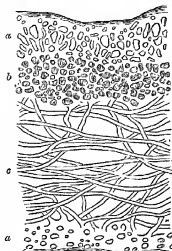


FIG. 1.—Section of Stratified Thallus of *Rosellea baccata*. a, cortical stratum; b, gonidial stratum; c, medullary stratum.

various species belonging to the inferior genera, which have a pulvulent or hypophloeal thallus. In these the cortical elements are more or less mixed together, though the gonidial stratum generally remains distinct, and is often visible when the others are absent. It is, however, the families of the *Physcia* and *Collema* that are more especially characterized by an unstratified thallus. Here the cortical stratum is chiefly represented by a gonophore (in *Collema*), rarely brown (in *Synalassa*, &c.), non-cellular epithallus, or in others (*Lepogium*) by a thin stratum of angular cells distinct from the other elements of the thallus. The gonidial granules are also disposed in a different manner to those of the *Lichenes* in the majority of the

Collema species they are strung together moniliformly, and distributed in a thread into a gelatinous pellucid substance, while sometimes they are agglomerated into small groups, and situated for the most part next to the epithallus. In *Ephraea* they are not moniliformly strung, but are tuncated or involved in a gelatinous cellular stratum. The rest of the thallus consists of the medullary system (except in *Ephraea*, in which there is no medulla), and is composed of tubular or hollow filaments, with rounded cavities containing the gonidial granules, and imbedded in the gelatinous substance, which very readily imbibes water. There are a few lichens in which there is no trace whatever of stratification, as the genus *Cacoecoporus*, in which the entire thallus is composed of filamentous membranous elements, and the peculiar family of the *Myurocladia* (formerly, however, referable to lichens), in which it is equally cellulose throughout.

In addition to the hyphal and gonidial anatomical elements which thus enter into the structure of the thallus, there is another to be noticed, which, however, is to be regarded rather as an immediate principle. This is the *molecular granulations*, which are extremely small and (in form) irregular corpuscles, 0.001–0.002 millim in diameter, and visible only when very highly magnified (300–400 diameters). They occur in all parts of the thallus, especially in the younger cells, from the epithallus to the hypothallus, being especially abundant in the medulla of crustaceous species. In the epithallus they are variously coloured according to the colour which it presents, but in all other parts they are colourless. They occur also in the apothecia, in the epithecium, in the spores, and constitute the famous “*microgonidia*” of Dr. Munk. By the application of sulphuric acid many of them are transformed into small acicular crystals, and in the spores they are frequently agitated by a Brownian movement.

We may here also, in connexion with the vegetable system of lichens, refer to certain peculiar *excrecences* which are sometimes presented by the upper or under surface of the thallus. Of these the principal are the following: (1) *Soredia* are pulvulent eruptions on the cortical stratum, varying in form, being rounded or diffuse, and either are scattered upon the upper surface of the thallus or border its margins. They are of a lighter colour than the thallus, and consist of a mass of gonidia and of molecular granulations intermingled with filamentous elements. They occur in many foliaceous, foliaceous, and crustaceous lichens, and their protrusion through the cortical stratum is owing most probably to an excessive development of the gonidial element. Occasionally also they appear on the disk of apothecia (in *Pezizomora*), which they render lobulate, and in this case constitute the pseudo-genus *Varicaria* of older authors. When detached from the thallus they are capable under certain favourable circumstances of giving rise to new plants, and thus act the part of bacilli in the *Phaeogameta*. It is denied by their means that many species which are never found in a fertile state (e.g., *Thamnochrysa verruculosa*) are propagated. (2) *Cyphellae* are small, ureolate, pale excrecences which occur abundantly on the under surface of many species of *Stictis*. They are generally naked, but are often also pulvulent or sorediferous.

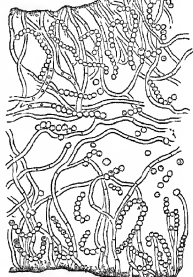


FIG. 2.—Section of Unstratified Thallus of *Collema conopseastrum*, with Moniliform Gonidia scattered amongst the Epithallic Filaments.

in which latter case they are called *pseudo apothecia*. That physiological function is not definitely known, but they are most likely connected with the nutrition of the plants. (3) *Isidia* constitute an evanescent condition of some foliaceous and crustaceous thalli. They consist of peltate, conical, stipitate excrescences, which are sometimes branched, and which are always of the same colour and texture as the thallus itself. This rudimental condition in crustaceous thalli is the basis of the old pseudogenus *Isidium*, which is merely an anomalous state of some species of *Peltularia*. *Isidia* have the same functions as the soredia, and serve as propagula. (4) *Cyphella* are orbicular and flattened or globose tubercles of a peculiar texture which occur on the thallus of many species belonging to different genera. They are usually gregarious, as in *Stereocaulon*, *Ulex*, *Lecanora gelata*, *Lecanora pinnatifida*, &c. In a few species, however, they are hygienous, as in *Peltularia canos* and *Pseudocyphella*, while in various *Ulex*, *Sphaerium capitatum*, &c., they are endogenous, bearing prominent protuberances on the lower surface. Recently Nylander has detected both endogenous and hygienous cyphella on *Parmelia asperum* and *Lecanora obtusata*. They are of a pulvinate colour than the rest of the thallus, from which they differ also in structure, being completely collimate, and containing gonidial granules. According to Th. M. Fries (*Flora*, 1896, p. 26) they are also normal excrescences caused by algae intruding themselves under the cortex, but this is at once refuted by the fact of their forming constant characters of so many different species occurring in various situations. In which they evidently constitute normal organs, the use of which, however, is unknown.

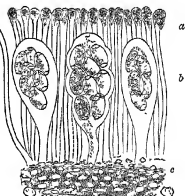
II. *Reproductive System*.—This consists of *apothecia* or the female organs, of *spermatogones* or the presumed male organs, and probably also of *gonodes* or a secondary kind of fructification.

1. The apothecia, like the thallus, are very variable in external form and colour, as also in their internal structure. In external form they present three principal modifications, viz. (1) *disciform* (or gymnocarpous), in which the shape is that of a disc (as in all the higher genera), (2) *nucleiform* (or angiocarpous), in which the shape is that of a rounded tubercle with an apical ostiole (as in *Entoloma*, *Pezizacanthus*), and (3) *peridioform*, similar in shape to the preceding, but closed, with no ostiole (as in *Thelecia*, *Entolomaceae*). The last two are but little variable in figure, and consequently do not in this respect admit of different designations. The disciform apothecia, however, present various shapes, of which the following are the principal:—(a) *peltate*, which are large, rounded, without any distinct thalline margin (e.g., *Ulex*, *Peltigera*), (b) *lecanorine*, or scutelliform, which are orbicular and surrounded by a distinct, more or less prominent thalline margin (e.g., *Parmelia*, *Lecanora*), having sometimes also in addition a proper one (e.g., *Thelotrema*, *Ureolaria*); (c) *lecidine*, or patelliform, which are typically orbicular, with only a proper margin (e.g., *Lecanora*), sometimes obsolete, and which are occasionally irregular in shape, angular or flexuose (e.g., *Lecanora jurana*, *L. myrmecina*), or complicated and gyrose (e.g., *Gyrophora*), and even stipitate (e.g., *Boxomyces*); (d) *irregular*, which are of very irregular figure, elongated, branched or flexuose, with only a proper margin (e.g., *Xylographa*, *Graphis*, &c.) or none (e.g., some *A. thecia*), and are often very variable even in the same species. It may be here observed that young disciform apothecia are more or less nucleiform. In colour the apothecia are extremely variable, and it is but rarely that they are concolorous or subconcolorous with the thallus (e.g., *Ulex*, *Rinodina*). Usually they are discolorous, and may be black, brown, yellowish, or also less frequently rose-coloured, rusty-red, orange-reddish, saffron, or of various intermediate shades. Occasionally in the same species their colour is very variable (e.g., *Lecanora metaboldes*, *Lecanora decolorans*), while sometimes they are white or glaucous, rarely greenish, pruinose. Lecidine apothecia, which are not black, but otherwise variously coloured, are termed *isotoma*.

The two principal parts of which an apothecium consists are the *hypothecium* and the *thecium*.

(1) The *hypothecium*, which corresponds to the hypothallus, is the conceptacle of the apothecia. It is composed of cellular tissue, generally very dense, and often presenting an indistinct stratification. This tissue may in general be distinguished from that of the neighbouring parts of the thallus by its cells being smaller, more compact, and differently coloured, though in some instances (as in certain *Parmelia*) the limits are not determinable. In the apothecia of such genera as *Collema*, *Boxomyces*, &c., the hypothecium is composed of hollow cemented filaments arranged longitudinally and constituted into a stipe for the support of the fruit. The hypothecium in disciform apothecia is usually termed the *excipulum* proper, while in nucleiform apothecia it is termed the *pyrenium*, and in peridioform apothecia the *peridium*. When the pyrenium quite covers the nucleus it is said to be *calcareo*, *dissimulate* when it covers only the upper portion. The hypothecium is either colourless or dark, or reddish or yellowish, according as its cells are tinged.

(2) The *thecium*, or as it is more frequently termed the *apothecium*, is that part of the apothecium which contains the organs of the fruit, viz. the *thalamium* and the *theceae*, which are placed perpendicularly to the hypothecium. It is penetrated by an amyloid substance, colourless and very sticky of water, termed the *hypocaulic gelatin*, formed of the gelatin, which becomes bluish or wine-reddish when tinged with colour. The thecium itself corresponds to the gonidial-membranous stroma, while its superficial portion, termed the *epithecia*, corresponds to the epithallus. (a) The thalamium generally consists of paraphyses which are erect colourless filaments arising from the hypothecium, and whose function is to aid in the expulsion of the spores by the pressure which they exert upon the thecae. They are of nearly equal height, closely placed together, usually very slender, though slightly variable in thickness, frequently attenuated, and rarely branched or anastomosing. Internally they are hollow and filled with prothallium, which sometimes is separated into little globules. Their spores are generally coloured, in most instances dilated, sometimes clavate, and are cemented together by gelatin. They are frequently confused together, occasionally they are but little evolute, while in many of the *Pyrenopezizae* they are entirely wanting, though in these the ostiole filaments of the hypothecium leave sometimes been mistaken for them. (b) The thecae are large, oblong, cylindrical or ovoid cells or vesicles containing the spores, and are usually more or less attenuated towards the base. In size and shape they vary considerably in the different genera and species according to the size, number, form, and arrangement of their spores. They differ also in the same species, within certain limits, according to age, the young thecae being more slender than those which are older. In some genera which have very large spores (e.g., *Parmelia*, *Pezizacanthus*) the thecae are distended in proportion, and generally present a sacrate or subglobose-vesiculate form. The theca itself is a thin membranous cellule, the walls of Pro 3.—Vertical Section of Apothecium of which are at first of *Physcia patens* a, paraphyses, b, an equal thickness throughout, but in process of development they become gradually thinner, except at the summit, where they retain their original thickness. In some species the wall is remarkably thick at the apex (e.g., *A. thoma*), and in others it is invested throughout with a kind of external crust (e.g., *Pezizacanthus*). The thecae are resorbed after the expulsion of the spores, though where their walls are extremely thin (as in *Collema*) they are ruptured and disappear at a very early stage. The spores are the special reproductive organs of lichens, and are produced in the thecae by free cell-division, i.e., by the separation and subsequent condensation of the protoplasm of the fully developed sporangia around central points in its interior, corresponding in number to that of the spores to be formed. After the formation of the external spore-wall has taken place, the spores have a definite outline, and may consist of only one cellule or loculus (simple spores), or may be divided by one or more transverse peritremes (septate spores). Sometimes the loculi are restricted to the two ends or poles of the spore (one in each) and are said to be *polari-locular*, the two loculi being occasionally united by a longitudinal tube. At other times the transverse partitions are further divided by several longitudinal partitions, in which case the spore is said to be *murally-divided*, from the resemblance it then bears to the stones in a wall. The contents of the spores are



Pro 3.—Vertical Section of Apothecium of which are at first of *Physcia patens* a, paraphyses, b, an equal thickness throughout, but in process of development they become gradually thinner, except at the summit, where they retain their original thickness. In some species the wall is remarkably thick at the apex (e.g., *A. thoma*), and in others it is invested throughout with a kind of external crust (e.g., *Pezizacanthus*). The thecae are resorbed after the expulsion of the spores, though where their walls are extremely thin (as in *Collema*) they are ruptured and disappear at a very early stage. The spores are the special reproductive organs of lichens, and are produced in the thecae by free cell-division, i.e., by the separation and subsequent condensation of the protoplasm of the fully developed sporangia around central points in its interior, corresponding in number to that of the spores to be formed. After the formation of the external spore-wall has taken place, the spores have a definite outline, and may consist of only one cellule or loculus (simple spores), or may be divided by one or more transverse peritremes (septate spores). Sometimes the loculi are restricted to the two ends or poles of the spore (one in each) and are said to be *polari-locular*, the two loculi being occasionally united by a longitudinal tube. At other times the transverse partitions are further divided by several longitudinal partitions, in which case the spore is said to be *murally-divided*, from the resemblance it then bears to the stones in a wall. The contents of the spores are

a homogeneous protoplasm, molecular granulations (often abundant), and a pale-yellow oily substance, which in the fully developed spore often becomes concentrated into one or more globules, visible generally near its ends or in the middle. The number of the spores in each thallus varies very much in different species, being in most lichens 8, occasionally 6, 4 or 2, or rarely only 1. In some species, however, they are 20-100, when the thallus is said to be *polysporous*. In form they are also very variable, the principal shapes assumed by them in order of frequency being *ellipsoid*, *fusiform*, *oblongo-cylindrical*, *spherical*, and *acicular*, with several intermediate forms. They are still more variable as to size, being smallest in polysporous (e.g., *Leucospora funaria*, etc.), and largest in monosporous species (e.g., *Peltigera consimilis*, Ra.). The largest spores of all are found in *Pezizella in amica ostrea*, where they are 0.225-0.030 millimetre long, and 0.035-0.115 millim thick. As to colour, they are either *colourless* (white, nearly hyaline or pale yellow under the microscope), or *coloured* (brownish, or brown, or blackish), while in *Sphaerophorus* there is also a blue-black superficial pigment. The spore-wall varies in thickness, and is typically composed of two strata, the outer of which is termed the *exospore* and is coloured, while the inner is termed the *endospore* and is colourless, gelatinous, and generally less distinct. Notwithstanding that in these respects the spores are so variable in different species, they are when mature remarkably constant in the same species, so that their characters afford valuable specific diagnoses. Apparently it is only those lichens which germinate from spores that occur in a futile condition.

2. The *spermatogones*, which are the presumed male organs of reproduction, at once differ in appearance from the apothecia in being very minute corpuscles. In many cases their outline is invisible to the naked eye, unless the thallus has been previously moistened, when they appear as minute points or papillae. When magnified they externally bear a resemblance to the apothecia of the *Pyrenopezices*, but internally, on microscopic examination, they are seen to differ essentially from these. In form they are nucleiform, round, or oblong, and are either sessile on the surface of the thallus, or more or less immersed in its substance, or sometimes enclosed in prominent thalline verrucae. Usually they are simple, though occasionally two or several become confluent or aggregated into little groups. They almost always occur on the same thallus as the apothecia, or rarely on different thalli (e.g., *Ephebe pubescens*), so that lichens are consequently monocious or dioecious. In colour the spermatogones are black or brown, or concolorous with the thallus itself. They are composed of two parts, viz., a shell or *conceptacle* and a *nucleus*.

(1) The *conceptacle*, which is analogous to the hypothecium of the apothecium, is composed of a tissue formed of very small cells, which are cemented together and have thick walls. The orifice at its summit is generally similar to that of nucleiform apothecia, and in the case of entirely immersed spermatogones is the only portion visible.

(2) The *nucleus* consists of the *stergmata* and *spermatia*, and of a mucilaginous substance (the spermatine gelatin) in the cavity between them, which very greatly imbibes water and aids in the expulsion of the spermatia. Sometimes also there are present in the nucleus a few elongated, articulated, and occasionally branching filaments intermixed with the stergmata which are comparable with the paraphyses of the apothecia (e.g., *Ramalina*). (c) The *stergmata* are elongated cells filled with a colourless fluid, and are attached to the interior face of the conceptacle growing from it convergently towards the centre, and often nearly filling its entire cavity. They present two important modifications, viz., *simple stergmata* and *articulated stergmata* or *arthrostergmata*, both of which may become somewhat branched. When arrived at maturity they possess the faculty of producing from their apices or also from the articuli the spermatia, one at a time, though many in succession, as may be inferred from the immense number of them lying in the cavity of the nucleus. (d) The spermatia are very small, slender, colourless corpuscles, which at first appear as minute pectinuous on the apices of the stergmata cells. They subsequently become gradually elongated, and, on reaching maturity, detach themselves from the stergmata and lie free in the cavity of the nucleus, till in wet weather they are expelled through the ostiole of the spermatogone. In form they present two principal modifications, viz., *acicular* and *ellipsoid*, of which the former, the more frequent, is rather variable. They may be slightly unisiformly-increase at one apex (e.g., *Usnea*), or at both apices (e.g., *Paraselia*), or they may be cylindrical and straight, the most common shape, or cylindrical and arched (e.g., *Roccella*). The spermatia of arthrostergmata are cylindrical and straight, but slightly thickened and obtuse at the

apices. In size they also vary, though more in length than in thickness, the aciculate spermatia being sometimes very long (0.040 millimetric). These differences in form and size are often very useful in the discrimination of species, just as the two types of the stergmata are sometimes of great service in the distinction of genera. The spore-

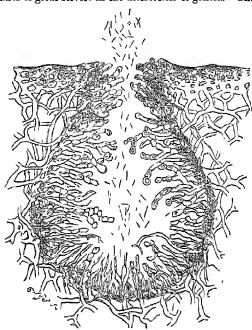


Fig. 4.—Vertical Section of a Spermatogone of *Pezizella physodes*, showing the Stergmata and Spermatia.

ma frequently exhibit a Brownian movement, but they possess no faculty of germination, their functions as generally acknowledged, being the fertilization or fecundation of the spores. That the spermatogones are rightly presumed to be the male organs of reproduction may legitimately be inferred alike from their relation to and their antagonism with the apothecia. In the former respect their position on the thallus relatively to the apothecia is similar to that of the sexual organs in other classes of plants, while in the latter respect spermatogones are plentiful on thalli destitute of apothecia, and on those with apothecia are much more sparingly present. The manner, however, in which the spermatia impregnate the spores has not yet been definitely ascertained. Most probably, as suggested by Nylander (in *Syn.*, p. 40, note 1), the spermatia do not exercise any direct influence on the female organ in the hymenium, but their fecundating influence is rather exercised on the prothalline elements of the growing thallus. M. Stahl indeed has recorded and illustrated (*Beitr. zur Entwick. der Flechten*, 1877) the results of certain researches on *Collema atro-ophyllum*, in which he supposed that he had detected sexual organs in the shape of an *ascogonium* and a *stichogonium*, regarded by him as a kind of *crotopogonium*. These observations, however, have not been confirmed by subsequent researches on the same or any other species of *Collema*, while his attributing to the hyphae a faculty of "concoction" or equally cooking themselves, which from their nature they do not and cannot possess, is calculated to invalidate all that he otherwise observed and depicted.

3. The *pycnodes* are minute, dark-coloured pyrenoidous conceptacles which occur on the thallus of various lichens, especially such as are crustaceous. In external appearance they resemble to some extent the spermatogones, from which, however, they at once differ in their internal organization. They consist of simple filaments composed of narrow (often short) cells, termed *bandae*, bearing on their apices bodies called *tylospores*, which are colourless, usually oblong, but variable in form and size, and filled with organic matter (in part at least only) similar to thespores. Each basidium produces only a single tylospore, which, unlike the spermatia, has a germinative property. Their occurrence in lichens was first pointed out by Tulane, who showed their affinity to certain analogous fruits (*Diplodia*, *Phoma*, *Sporium*, &c.) in various thecaepored fungi, and regarded them as supplementary or secondary sponiferous reproductive organs. Considering the number of parasitic *fungilli*

which frequently occur on lichens, it might be supposed that the pyrenides in reality belonged to the same category. From their constant occurrence, however, on the same

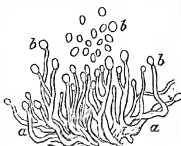


FIG 5.—Fronds of *Peltigera rufescens* a, basal; b, stylous.

states of *Peltigera rufescens* and *P. rufescens*, where they have often been mistaken for spermatophytes, which in this genus have not yet been detected. Pyrenides occur also in *Leccaria rufescens*, and abundantly in *L. tinctella*, in *Urocladus*, in several species of *Stictis*, in *Sporopodium reverens*, and will probably be yet observed in other lichens.

The Gonidia of Lichens.

In view of the important place occupied by the gonidia in the structure of lichens, and of the discussions that have recently taken place concerning them, they require to be considered somewhat in detail in order that their real nature and relation to the hyphae, or the thalline filaments, may become apparent. The gonidia are spheroidal, ellipsoidal, or variously rounded cells, with thin, colourless walls composed of cellulose, containing chlorophyll (or a submineral colouring matter), homogeneous or granular, with generally a solid nucleus in the centre. As to the origin of the chlorophyll, it may be observed in passing that this is the same in lichens as in other cryptogamic plants, e.g. mosses and *Hepatica*, in which it occurs, the only visible difference being that gonidia often occur as discrete cells. The gonidia increase by binary (very rarely by ternary or quaternary) division, the nucleus also dividing into two portions, each of which forms the centre of a secondary gonidial cell. In this gonidial stratum, where they are arranged between the radicles of the hyphae, their division necessarily proceeds only slowly, but in ecoriated thalli, hepatic and others, in which they are free, they are readily multiplied by repeated division. In gonidia isolated from the thallus of some species belonging to *Cladonia*, *Evernia*, and *Physcia*, zoospores have been detected by M. Faminitzin and M. Boranetzky (see *Ann. Sc. Nat.*, 1868, p. 137), and, although Nylander failed to perceive such in subsequent experiments (*Flora*, 1877, No. 23), he adds that it is possible they may be generated in free gonidia (i.e., in unstratified thalli), which could not be the case in gonidia closely surrounded by thalline filaments. The subject will well repay further investigation. Other matters relating to the character and relations of the gonidia will be best elucidated by considering the forms which they present, and their origin in the thallus.

1. *The Forms of the Gonidia*.—These have been fully treated by Nylander in the *Flora*, *loc. cit.*, where also the first scientific description and classification of them have been given. According to the views there propounded, gonidia in their wider acceptance include three very distinct types.—(1) *Ergonidia* (or gonidia proper), which are involved in a distinct cellular membrane, and are usually bright green, (2) *Gonatae* (or the gonidial granules already mentioned), which are naked, pale greenish, glaucous greenish or bluish, and (3) *Gonidia* (or *Leptogonidia*), which are intermediate between the two preceding, smaller, and of an oblong form. Of these the distinction between *ergonidia* and *gonatae* is fundamental, and of "so great weight that lichens seem to present a twofold parallel series" according to the presence of the one or the other in their texture.

These two distinct anatomical elements, as observed by Nylander, have a certain biological analogy with the blood globules in animals, and similarly afford absolute characters. The principal forms presented by these three kinds of gonidia are the following: 1. *Ergonidia* consist of—(a) *Hypogonidia*, the most frequent, simple, of a protracted form, or sometimes globose (as in *Sciaropsis leprosa* Thall.), (b) *Phragmogonia*, being depressed and variously prominently ornamented gonidia (*Synagoga*), as in some foliose species (e.g. *Peltigera* *phylosum*), (c) *Chlorogonidia* (or *Chlorogonidia*), containing chlorophyll and orange granules (endotheca) in the same cells, more or less similar to *chloridia* (as in *Chloridia chloridia*, *Arthonia prunella*, *Platyphaga pilosa*, *Vericaria* *insularis*, and the genus *Tholera*), (d) *Confertogonidia*, somewhat resembling *Confertia*, and forming the chief element of the thallus of *Crotophaga*. 2. *Gonatae* are smaller than gonidia proper, with the wall of the cell less distinct. They occur in *Peltigera*, *Sclerophora*, and *Arthonia crystallina*. To these belong also *lyngbyoid gonidia*, which are often very minute, and are present in the thallus (not in the perithecia) of various *Pyrenopeziza* (e.g. *Pyrenopeziza pallida*, *P. umbellata*, and *P. lyngbyoides*), rarely of *Arthonia* as in *Arthonia* *chrysoidea*. 3. *Gonidia* (including the gonidia of *Chloropoda*) consist of—(a) *Hypogonidia*, which are somewhat large (very large in *Phyllopora*), and either simple, or two or several aggregated, (b) *Synagoga*, which are spheroidal or spheroidal gonidia, distinguished by the gonium being truncated, and are characteristic of the family *Ethecaria*, (c) *Horogonidia*, the most common form, smaller, moniliformly arranged, and contained in synagoga, especially characteristic of the family *Collema*, whence *Collema* (or *Nostoc*) itself, according to Nylander, is to be considered but as a single synagoma, (d) *Sperogonidia*, which are similar to the preceding, but are not moniliform, with the synagoma subglobose, smaller and more scattered, as in *Gompholoma* and *Synagoga*. It will be perceived from the above that many of these forms are more or less similar to "gonidia" as *algae*, though, as we shall presently see, they are not identical with these.

II. *The Origin of the Gonidia*.—By pre-microscopic authors this was a subject necessarily ignored, and indeed it is only within the last thirty years that it has been investigated, by its help as the easiest thing as to this origin was that put forward by Bory de Saint-Vincent (*Revue sub d. Lichens*, and *deux* *Revue*, 1851), confirmed by observations of Sphaerocarpus (*Bot. Zeit.*, 1858, &c.), and supported by Schweinichen (*Unterz. sub d. Flechtengonien*, 1868). This was to the effect that the gonidia derived their origin from the hyphae (i.e., the thalline filaments), in the way commonly described by M. Fries (*in Staat*, 1871, p. 7, where it is fully enclosed). "The hyphae," he says, "are not only elongated into filaments, but also put forth short branched, the terminal cell of which is gradually dilated, becomes subglobose, and is at length filled with chlorophyll (or a submineral matter), in the way commonly described by M. Fries into a gonidium, and then by varied division generates other gonidia." For several years this theory was accepted as second-hand by most authors who referred to the subject, though a different origin of the gonidia, presently to be noticed, was indicated by the celebrated Tulasne so early as 1852, in his "Mémoire sur les lichens" (*Ann. Sc. Nat.*). The erroneous nature of this theory was well pointed out by Schweinichen, who (*Die Agenten d. Flechtengonien*, 1868) very correctly affirmed that the actual development of a gonidium from the terminal cell of a hypha had not been observed, though, strange to say, he had previously himself observed this phenomenon. Not being able otherwise to account for the origin of the gonidia, and following up one of the alternatives put forward by De Bary (*Morpholog. und Physiol. der Pilze, Flechten*, &c., 1865, p. 201), he promulgated the hypothesis now familiarly known as Schweinichenism. The conclusion to which De Bary came on noticing the resemblance between the gonidia of *Collema* and certain algae was as follows: "The origin of the lichens in question," he says, "are the perfectly developed states of plants, whose imperfect forms have hitherto stood amongst the algae, as *Nostoc* and *Chroococcoides*, on these latter are typical algae which assume the forms of *Collema*, *Ethecaria*, &c., through certain parasitic *Ascomycetes* penetrating into them, spreading their mycelium into the continuously growing thallus, and finally attaching to their phycochrome-bearing cells." Taking this latter suggestion as his starting point, and assuming the identity of certain algal types with the gonidia of lichens, and the identity of the mycelium of fungi with their hyphae, Schweinichen extends the said alternative to various other groups of lichens than the *Collema*, and comes to the conclusion that a lichen is composed of a parasitic fungus (the hyphae) and a number of low algae (*Chlorophytales* and *Phycococcaceae*), the former of which produces the reproductive bodies and is nourished by the latter. This theory was subsequently expanded and illustrated at length by Bornet (*Recherches sur les Gonidies des Lichens*, 1879), and has since been the subject of numerous investigations, "that the connection of the hyphae with the gonidia is of such a nature as to exclude all possibility of the one organ being produced by the other," and that the theory of parasitism can alone explain it satisfactorily. To give any detailed

account of the investigations of these authors, and the arguments by which they endeavor to support the hypothesis, would exceed the limits of the present article, even were all other matters relating to lichens to be excluded. Suffice it to state briefly that, according to Schwendenerism, a lichen is not an individual plant, but rather a community made up of two different kinds of individuals belonging to two distinct classes of organisms, viz., a master-fungus and colonies of algal slaves, which it has sought out, caught hold of, and retains in perpetual captivity in order to provide it with nourishment. To such a singular theory, which from its plausibility has met with considerable support in certain quarters, various *a priori* objections of great validity may be taken. Amongst others which have been adduced it may especially be noticed, having reference to the nature of this alleged parasitism, and the situations in which lichens are found. (1) The parasitism described is of a kind unknown in the vegetable kingdom, inasmuch as the host (the *Algae*), instead of suffering any injury, only flourishes the more vigorously. Moreover, the algal slaves being entirely enclosed in the master-fungus, can evidently supply no nourishment to it whatever, while direct observation shows that it is through the surface of the thallus of the lichen that nourishment is conveyed to the gonidial statum, where the active life chiefly has its seat. (2) As is well known, lichens attain such habitats as are most frequented by algae and fungi, and occur in situations where neither of these are seen. Where then are the algal colonies which, according to the hypothesis, the fungus goes forth in quest of, and "picks into its service"? Each of these arguments is sufficient to throw more than doubt upon Schwendenerism. At the same time, as will be perceived, the origin of the gonidia in the thallus remains to be accounted for, in order that the hypothesis may be utterly subverted. It might at first sight be supposed that this was a matter of no very great difficulty, since by cultivating lichens from the spores it would readily become apparent. All attempts, however, in this direction (and many such have recently been made) have, owing to the peculiar character and conditions of lichen-growth, confessedly proved futile, and the experiments instituted have been productive of no definite results. This is not altogether to be regretted, since in nature itself, when lichens occur on certain substrata, we have in various instances the whole process of the evolution of their vegetative system placed before our eyes, from the first germinations of the spores to the formation of the perfect thallus. It is to Nylander, whose services here are elsewhere in lichenological science—statistical, physiological, and systematic—are so valuable, that we owe the first clear enumeration as to the origin of the gonidia in the lichen-thallus. This, though previously indicated by him, as we shall presently see, was at greater length and still more doubtfully stated in several important papers in the *Floa*, viz., "De gonidiis et eorum formis animaliversionibus" (1877, No. 23), "Citra lichenes vitulosus natum" (1878, No. 10), and "De hypothallo natum" (1879, No. 36). In these he incontrovertibly demonstrates that the gonidia originate, not from the filaments themselves, but in the cellules of the first cortical gromesules which are produced upon the young hypothallus. This may very easily be studied in the earlier stages of development of crustaceous lichens growing on pure quartz rocks (e.g., *Leccaria vagophylla*), on the smooth bark of young trees (e.g., *Leccaria subulæ*), and more especially on the surface of old glass (e.g., *Leccaria galactina* and *Leccaria albobata*). In the case of the young thalli of *Leccaria anversa* this was sufficiently well demonstrated by the celebrated Tulane in 1863, the year subsequent to the promulgation of the Bayrholferian theory, in his elaborate "Mémoire sur les Lichens," pl. III. f. 8. Afterwards, as the evolu-

tion of the cortical statum advances, its lower portion is resolved, and the gonidia there become free, giving rise to the gonidial statum, to the hyphae in which they are not *obscure*, as has been represented, but only adherent by means of the gelatin which penetrates all the elements of the lichen. Often also growing gonidia, young and adult, may be observed in the pseudo-parachymatous cortical cellules in lichens which in this respect are best adapted for examination, such as *Umbilicaria* (vide Nylander in *Floa*, 1875, p. 303), *Physcia putrescens*, *Pannaria hypogyna*, &c. Similarly, with respect to the origin of the gonidia, Nylander observes (*Floa*, 1868, p. 353) that the nuclei in the *Collenchyma* (more especially in *Collenchyma*) "show very clearly under the microscope the entire history of the evolution of the thallus from its first origin from a cellule containing a single gonium to a minute true nodule, and ultimately to the perfect texture of a *Collenchyma*." With these facts before us, to which various others might be added, such as the entire absence of any algal on pure substrata, where lichen growth presents itself in all its stages, we are compelled to come to the conclusion that the gonidia constitute a true gonial system in lichens, and in nature are nowhere seen outside the thallus. Consequently these free algal forms, such as *Protococcus*, &c., regarded as the free gonidia of lichens, are true algae, these being indeed a parallelism between them but no identity. On the other hand, as the alleged identity of the lichen-hypha with a fungus-mycelium, it is to be observed that the two are totally different in their nature. The hyphae of lichens (*mycelophyses* of Nylander) are rigid, elastic, containing lichenine, not becoming putrid by maceration, with no facility of penetrating or involving, while the hyphae of fungi are colourless, soft, flexible, with thin walls, &c. Hence, as there is no algal in the lichen, so neither is there any fungus, though there is a parallelism between the fructification of lichens and the asciferous section of fungi (Columbs in *Pap. St. Bot.* 1874).

Nutrition and Life of Lichens

As already intimated, lichens derive their nourishment directly from the atmosphere, in the shape of rain (or dew) with the materials contained in it. Here, as elsewhere, water is the condition of life, and through its medium is conveyed to them the nutrient substances requisite for their existence and growth, from the clouds, from rivers, and, in the case of maritime species, even from the sea. Where, however, the atmosphere is impregnated with smoke, soot, or other deleterious ingredients, lichens will not grow nor flourish. Hence in our larger cities, or even in smaller manufacturing towns, scarcely any lichen vegetation, or none whatever, is seen. Even in their more immediate suburban districts they occur only in a gonidial or rudimentary state, constituting the pseudo-genus *Lepraria* of the older botanists, and increasing through long periods by bisection, but never developing into perfect plants. Indeed it is now a well-known fact that their fully developed condition is a sure indication of the purity of the air and the salubrity of the districts in which they occur. It has sometimes been stated that they draw some portion at least of their nutriment from the substratum to which they are affixed. For this, however, their structure is by no means well adapted, and such inorganic substances as iron and lime, which enter into their composition, are only as if mechanically derived in solution from the substratum. This in very many instances, e.g., bare quartzose rocks, dead splashed wood, and pure naked glass, can evidently supply no nutriment whatever. Moreover, in the case of crustaceous species, such as *Leccaria tartarea*, &c., and also of terricole fruticose species, such as *Cetraria islandica*, &c., the portion of the thallus next to the substratum is dead, so that no nutrient substances can be conveyed through it to the upper layers of the thallus. A very simple, but at the same time convincing, illustration of this is adduced by Nylander. "By immersing," he says, "any fruticose thallus, such as *Ulex*, by the base in water, it remains entirely dry (with the exception of the part submerged), but if water be poured over the other portions, it quickly absorbs it, softens, and revives." The same thing may be seen in nature itself, in the case of such species as *Cladonia rangiferina*, *Alectoria ochroleuca*, *Platyisma rivale*, &c., growing on temporarily wet substrata,



FIG. 6.—Hypothalline condition of *Leccaria anversa*, showing the origin of the first Cortical Gonidigenous Cellules (After Tulane) 36. In these he incontrovertibly demonstrates that the gonidia originate, not from the filaments themselves, but in the cellules of the first cortical gromesules which are produced upon the young hypothallus. This may very easily be studied in the earlier stages of development of crustaceous lichens growing on pure quartz rocks (e.g., *Leccaria vagophylla*), on the smooth bark of young trees (e.g., *Leccaria subulæ*), and more especially on the surface of old glass (e.g., *Leccaria galactina* and *Leccaria albobata*). In the case of the young thalli of *Leccaria anversa* this was sufficiently well demonstrated by the celebrated Tulane in 1863, the year subsequent to the promulgation of the Bayrholferian theory, in his elaborate "Mémoire sur les Lichens," pl. III. f. 8. Afterwards, as the evolu-

when the base of their thalli is soft and moist, and all the rest dry and rigid. It cannot therefore be doubted that the nutritive elements contained in the rain or other water are conveyed to the lichen through the surface of the thallus. It is in the superficial parts also, as Nylander has well observed (in *Flora*, 1874, No. 4), that "the active life has its seat, chiefly around the gonidia, manifesting itself in the putting forth of young parts (lobes, lacinae, branches, isidia), and in the functions of the apothecia and the spermatogones, so that the nourishing humours necessary for all the actions of life are especially and directly poured upon these." The vital activities, however, in lichens thus nourished are, as might be expected from the nature of the source whence their nutriment is derived, very intermittent, and in dry weather cease to operate, and become entirely dormant. Hence their life, unlike that of all other plants, is twofold, viz., one *active*, in which when moistened all the vegetative and reproductive functions are at work, and the other *passive*, in which when dry these functions are completely in abeyance. For such a peculiar duplex existence, at one time vegetating, at another lethargic, their organization in all its parts, gonidial and otherwise, is admirably adapted. More especially is this the case with respect to the lichens found in their textures, which, being readily dried and as readily moistened, enables them to resist with impunity the greatest extremes of temperature, alternate periods of drought and wet, the scorching heat of the sun, the vehemence of stormy winds, and the nipping frosts of winter.

In this fitful and abnormal life of lichens we have the explanation in a great measure of their almost indefinite duration of existence. It is well known that they are perennial plants in the widest sense of the term, and that, though in the earlier stages of their existence their growth is comparatively rapid, yet this becomes extremely slow when they arrive at a certain age. The time required for the development of even the most rapidly growing species may be calculated by the appearance of such of these as are met with on gravestones, mortar of houses, stone walls, wooden palings, and such like, the date of whose erection is known. Amongst other instances which have come under the present writer's own observation may be adduced the case of *Physcia purietina*, growing in fair quantity on the stones of a granite wall built in 1836 in a maritime district where the plant is extremely abundant, and where atmospheric and other conditions are well suited for its growth. In a recent visit to the spot it was found that, although the thallus is now well developed, no fructification whatever is visible, though traces of spermatogones are beginning to appear, so that in the space of forty-five years this plant has not yet attained full maturity. But slow as is the growth of lichens after a certain stage of their development, their tenacity of life is very remarkable, as might *a priori* be inferred from their capacity of enduring without injury the greatest extremes of temperature and of hygrometrical conditions. It is on record that, after the lapse of nearly half a century, the same specimen on the same spot of the same tree has been observed without any change in its condition. On this point also E. Fries (in *L. B.*, p. xlv.) notices that certain species such as *Physcia ciliata*, kept in houses for upwards of a year, revive when again exposed to the influences of the atmosphere,—an observation which in the case of *Cladonia rangiferina* similarly kept for a still longer period the present writer can fully corroborate. Endowed then with this singular intermittent vitality, we can easily understand how many individuals which occur on hard mountainous rocks or on the trunks of aged trees in ancient forests are in all probability many hundreds of years old. Nor does age seem in any way to weaken their fecundity, even when the

thallus has apparently ceased to grow. This, as observed by Nylander (in *Syn.*, p. 5), is shown from the circumstance that were it otherwise "the already old fruits would be destitute of spores, which is never the case," unless in plants of some lower tribes, e.g., *Graptolidea* and *Tremacaria*, in which the thallus is but sparingly gonidiose, and the life consequently is shorter. In other instances the central portion of the thallus sometimes normally perishes in old plants, as in *Pterygium centrifugum*, *Colema melanum*, *Parmelia centrifuga*, and *P. saxatilis*, leaving only peripheral circles, in which, however, the life of the individual still continues for ages. In fact, "the life of lichens bears in itself no cause of death, and is only to be ended by external injuries" (E. Fries, *L. B.*, loc. cit.), or by the alteration of climatic and atmospheric conditions. Hence the assumption is not unwarrantable that individuals of such confessedly long-lived species as *Leccidea geographicus*, growing on rocks upon the summits of lofty mountains, date from more than "fabulous epochs," and probably outlive in longevity the ages assigned to the oldest trees on the surface of the globe.

Chemistry of Lichens, and Chemical Reactions.

Chemistry of Lichens.—This is still but little understood, notwithstanding that the subject has been more or less investigated by authors. Their examinations, however, have been too limited and desultory to enable us to give any detailed account of the different principles which enter into the composition of the lichen tissues. Moreover, with respect to those species which have been more particularly analysed, they have sometimes employed not only the same terms in different senses, but also different terms to denote the same substance. There can, however, be no doubt that the chemical composition of lichens not only produces great modifications in their form, but also considerable diversities in their properties.

The principal substance which occurs in lichens, especially in such as are foliaceous and fruticulous, is *lichenin*—a special kind of gelatin peculiar to them. It is intermediate in character between dextrin and starch, and very cogely imbibes water; though if boiled in water it is dissolved and lost. Starch also very rarely occurs in large lichenular grains scattered in the tissues. In crustaceous lichens *oxalate of lime* predominates, and forms a large proportion of the thallus, e.g., 65 per cent. in *Leccidea esculenta* according to Gebel. *Chlorophyll* and its modification *phycochroms* are found in lichens only in relatively small quantities, as is also the case with most of the other principles they present. These are enumerated by Nylander (in *Syn.*, p. 61) according to the affinities they bear, as follows:—(1) phosphate of lime, sea-salt, manganese, iron, (2) picroleucine, varicoline, creosote, cotinine, fauline, erythrine, roselline, picroerythrine; (3) glyphoric acid, paralic acid, umac acid, oxalic acid, erythric acid; (4) sugar not crystallisable, oil, waxy matter, resinous matter. Several others, especially phosphates and acids, have been enumerated by authors, which in some instances have not been corroborated, and in others are doubtfully distinct. In illustration of the manner in which several of these principles enter into the composition of lichens, we may adduce the analyses given in one or two species which have been more fully subjected to experiment. In *Cetraria islandica* there have been detected *emch*, including lichenine and umaline, to the extent of 80 per cent.; gummy and waxy matters; a bitter principle, *cetrarin* acid; a fatty principle, *ichthostearic acid*; *fumaric acid*, which exists also in *Dumortiera officinalis*; *gallic acid*, the astringent principle of galls, uncrystallisable sugar; various salts, such as *bisulphate of potash*, and *carbonate and phosphate of lime*. Again, in *Physcia porietina* there have been found several alimentary principles, as *glutidine*, *starch*, *sugar*, *gum*; several medicinal substances, as *resin*, *bitter matter*, *gallic acid*, and a peculiar etheric oil; a yellow colouring matter called *erythrophoric acid*; also *resin*, *stearine*, and some salts, as *carbonate of lime*. The ash of lichens is said to constitute from 8 to 10 per cent. of their bulk, and consists of various earthy bases, such as potash, soda, lime, magnesia, alumina, silica, manganese, and peroxide of iron, in combination with various acids, such as carbonic, phosphoric, sulphuric, and hydrochloric. The whole subject, however, of the chemistry of lichens requires to be investigated in a more extensive and methodical manner than has hitherto been done either by chemists or

Chemical Reactions in Lichens.—These have reference to the thallus and the apothecia, and in both respects afford valuable assistance in the systematic study of lichens. (a) *Thallus* reactions depend upon the presence in the thallus of certain colourable materials in the form of acids, and are manifested on the application of hydrate of potash and the hypochlorite of lime either on the cortical stratum or the medulla. Of these reagents, hydrate of potash (K), composed of equal weights of caustic potash and water, and hypochlorite of lime (CaCl), composed of chloride of lime and water of any strength, may give certain reactions or none, according to the presence or absence of particular acids in the thallus. If no reaction takes place, this is denoted by K-, CaCl-, and similarly if there is reaction by K+, CaCl+. A very convenient mode of symbolizing the positive and negative reactions of the cortical layer and the medulla of the same species is to place the reaction of the former above the latter, e.g., K⁺, CaCl⁺, denoting that with K the cortical stratum shows reaction and the medulla none, while with CaCl the cortical stratum gives none, but the medulla a distinct reaction. Again, there is often no reaction produced by K alone, but if CaCl be added to it while still moist, a decided reaction appears, for which K(CaCl) is the symbol; or, on the other hand, the reaction given by K may be neutralized by the immediate application of CaCl, in which case it is expressed by K+(CaCl)-. The positive reactions are due to the presence of particular acids in the thallus, such as *erythrone* acid giving a crimson reaction with CaCl, *chrysophanic* acid giving a purple reaction with K, *glauconic* acid giving a yellow reaction with CaCl, and *lecanoric* acid giving a crimson reaction with K. In most cases where the natural colour of the thallus (often also of the medulla) is yellow or orange, chrysophanic acid is present, and with K gives a purple reaction (e.g., *Phycia lychnis*), but in others externally similar in colour and general appearance, where only *leucophanic* acid is present (e.g., *Lecanora leucophaea*), K gives no reaction whatever. Sometimes K produces at first a yellow colour which immediately changes into a red or purple, as in *Lecanora cinerea*, which at once enables us to distinguish it from the closely allied species *L. gibbosa* and *L. calceola*. A solution of iodine (I) is also in certain cases useful as a test on the medulla, and in the discrimination of some species of *Gyrodia*. The value of these chemical tests in lichens was first pointed out by Nylander in *Flora*, 1868, pp. 223, 224, was subsequently illustrated by him in *Flora*, 1869, *passim*, in the case of species belonging to various genera, and has since been generally acknowledged by lichenists and employed by them in all species diagnoses. The reactions are of great importance, not only in the discrimination of many difficult and closely allied species, but also in enabling us to refer with certainty varieties to the species to which they properly belong. Nay, even a small fragment of the thallus, whether sterile or fertile, may by their aid be readily determined. The reactions of most of the quite undecomposable or doubtful. Generally they may be obtained on any portion of the thallus, but they are frequently more vivid, as might be expected, in the growing or circumferential portions. It is, however, only immediate reactions which depend on the colouring matter contained in the cortical stratum and the medulla that are to be attended to, and not secondary or tardy reactions which may otherwise originate, e.g., from the dissolution of the chlorophyll in the gonidia. At the same time it is to be observed, in order to prevent a misconception which has occasionally been entertained, that they do not *per se* constitute a special specific character, but only an additional or corroboratory specific character. As such, their value is clearly apparent in cases where the external characters are similar or approximate, and doubt necessarily exists as to their specific value. (b) *Apothecial* reactions for the most part take place either externally on the epithemum or internally on the hymenial gelatin. The reactions of the epithemum are generally produced by K on species which have yellow or orange apothecia (e.g., *Lecanora aurantiaca*, *Lecidea leucocanthos*), while others with concolorous apothecia (e.g., *Lecanora epomora*, *Lecidea lucida*) give no reaction whatever, owing to the presence or absence of chrysophanic acid. In certain cases also the reaction with CaCl is very useful in enabling us to separate closely allied species with similar apothecia, e.g., *Lecanora subcaneana* (epithemum CaCl-) from *L. glauconia* (epithemum CaCl+yellow). Again, with respect to the reaction of the hymenial gelatin, this, as already observed, depends on the application of a solution of iodine. The formula by which the solution is to be prepared is—iodine, gr. i; volatile of potash, gr. ii; distilled water, a ounce. In most lichens, where the spores are mature, this solution will tinge the hymenial gelatin in some cases only blue, in others at first blue and then wine-red, and in others wine-red or tawny wine-coloured only, without any preceding blue tinge. In such instances the reaction obtained is often very useful as a confirmatory specific character. Sometimes, however, the blue reaction takes place only on the thallus (e.g., *Peridermium*, *Cladonia*, &c.), and at other times only on the epispore (e.g., *Graphis*, *Thelotrema*, &c.). In the case of some species belonging to the inferior genera the reaction with I is especially valuable for the assistance it lends in distinguishing them from certain pyrenomy-

cetous fungi, to which otherwise they might be supposed to belong. True, in some fungi (e.g., *Fusca*) we obtain a reaction with I, and in some lichens we have no reaction visible; but otherwise in such exceptional instances their respective anatomical characters readily show to which class they belong.

Economic Uses of Lichens.

These are intimately connected with their chemical constituents, and are in some respects very important. In the arts, as food and as medicine, many of them have been highly esteemed, though others are not now employed for the same purposes as formerly.

1. *Lichens Used in the Arts*.—Of these the most important are such as yield, by maceration in ammonia, the valuable dyes known in commerce as archil, cudbear, and litmus. These, however, may with propriety be regarded as but different names for the same pigimentary substance, the variations in the character of which are attributable to the different modes in which the pigments are manufactured. Archil proper is derived from several species of *Rocella* (e.g., *R. Montagnei*, *R. tinctoria*), which yield a rich purple dye and fetch a high price in the market. Of considerable value is the "perilla" prepared from *Lecanora parella*, and much used in the preparation of a red or crimson dye. Inferior to this is "cudbear," derived from *Lecanora tartarea*, which was formerly very extensively employed by the peasantry of north Europe for giving a scarlet or purple colour to woollen cloths. By adding certain alkalis to the other ingredients used in the preparation of these pigments, the colour becomes indigo-blue, in which case it is the litmus of the Dutch manufacturers. Amongst other lichens affording red, purple, or brown dyes may be mentioned *Ramalina scopulorum*, *Parmelia saxatilis* and *P. omphalodes*, *Umilicaria pustulata* and several species of *Gyrophora*, *Urcularia cerporea*, all of which are more or less employed as domestic dyes. Yellow dyes, again, are derived from *Cladonia vulpina*, *Platysma juniperinum*, *Parmelia asperata* and *P. conspersa*, *Phycia flavicans*, *Ph. parietina*, and *Ph. lychnis*, though like the preceding they do not form articles of commerce, being merely used locally by the natives of the regions in which they occur most plentifully. In addition to these, many exotic lichens, belonging especially to *Parmelia* and *Sticta* (e.g., *Parmelia tinctorum*, *Sticta argyraea*), are rich in colorific matter, and, if obtained in sufficient quantity, would yield a dye in every way equal to archil. These pigments primarily depend upon special acids contained in the thalli of lichens, and their presence may readily be detected by means of the reagents already noticed. In the process of manufacture, however, they undergo various changes, of which the chemistry is still but little understood. At one time also some species were used in the arts for supplying a gum as a substitute for gum-arabic. These were chiefly *Ramalina fraxinea*, *Evernia prunastri*, and *Parmelia physodes*, all of which contain a considerable proportion of gummy matter (of a much inferior quality, however, to gum-arabic), and were employed in the process of calico-printing and in the making of parchment and cardboard. In the 17th century some filamentous and fruticulous lichens, viz., species of *Ulex* and *Ramalina*, also *Evernia furfuracea* and *Cladonia rangiferina*, were used in the art of perfumery. From their supposed aptitude to imbibe and retain odours, their powder was the basis of various perfumes, such as the celebrated "Poudre de Cypre" of the hairdressers, but their employment in this respect has long since been abandoned.

2. *Nutritive Lichens*.—Of still greater importance is the capacity of many species for supplying food for man and beast. This results from their containing amylaceous substances, and in some cases a small quantity of saccharine

matter of the nature of mannite. One of the most useful nutritious species is *Cetraria islandica*, "Iceland moss," which, after being deprived of its bitterness by boiling in water, is reduced to a powder and made into cakes, or is boiled and eaten with milk by the poor Icelandic, whose sole food it often constitutes. Similarly *Cladonia rangiferina* and *Cl. sylvatica*, the familiar "reindeer moss," are frequently eaten by man in times of scarcity, after being powdered and mixed with flour. Their chief importance, however, is that in Lapland and other northern countries they supply the winter food of the reindeer and other animals, who scrape away the snow and eagerly feed upon them. Another nutritious lichen is the "Tripe de Roche" of the Arctic regions, consisting of several species of the *Gyrophoraceae*, which when boiled is often eaten by the Canadian hunters and Red Indians when pressed by hunger. But the most singular esculent lichen of all is the "mannia lichen," which in times of drought and famine has served as food for large numbers of men and cattle in the arid steppes of various countries stretching from Algiers to Tartary. This is derived chiefly from *Leconora esculenta*, which grows unattached on the ground in layers from 3 to 6 inches thick over large tracts of country in the form of small irregular lumps of a greyish or white colour. Speaking of the distribution of these nutritive lichens, whose qualities depend on the presence of amylaceous matter, Dr. Lindsay (in *Pop. Hist. Brit. Lich.*, p. 82) very appropriately remarks that, "by a beautiful provision of nature, they occur precisely under the circumstances where they are most wanted—in northern or arctic countries, or on arid steppes, where grain stuffs are unknown, and food of a better kind is often scarce or deficient." In connexion with their use as food we may observe that of recent years in Scandinavia and Russia an alcoholic spirit has been distilled from *Cladonia rangiferina* and extensively consumed, especially in seasons when potatoes were scarce and dear. Formerly also *Stictia pulmonaria* was much employed in brewing instead of hops, and it is said that a Siberian monastery was much celebrated for its beer which was flavoured with the bitter principle of this species.

3. *Medicinal Lichens*.—During the Middle Ages, and even in some quarters to a much later period, lichens were extensively used in medicine in various European countries. Many species had a great repute as demulcents, febrifuges, astringents, tonics, purgatives, and anthelmintics. The chief of those employed for one or other, and in some cases for several, of these purposes were *Cladonia pyxidata*, *Ulex barbata*, *Ramalina farinacea*, *Evernia prunastri*, *Cetraria islandica*, *Stictia pulmonaria*, *Parmelia saxatilis*, *Physcia parietina*, and *Pertusaria amara*. Others again were believed to be endowed with specific virtues, e.g., *Peltigera canina*, which formed the basis of the celebrated "pulvis antilyssus" of Dr. Mead, long regarded as a sovereign cure for hydrophobia; *Platyma juniperinum*, lauded as a specific in jaundice, no doubt on the *antilia emulibus* principle from a resemblance between its yellow colour and that of the jaundiced skin; *Peltidea aphthosa*, which on the same principle was regarded by the Swedes, when boiled in milk, as an effectual remedy for the *aphthae* or rash on their children. Almost all of these virtues, general or specific, were imaginary; and at the present day, except perhaps in some remote districts of northern Europe, only one of them is employed as a remedial agent. This is the "Iceland moss" of the druggists' shops, which is undoubtedly an excellent demulcent in various dyspeptic and chest complaints. Probably also *Pertusaria amara*, from the intensely bitter principle which it contains, might still with propriety be employed as a febrifuge. No lichen is known to be possessed of any poisonous properties, although *Chlorea pulvinata* is believed by the Swedes to be

destructive to wolves when powdered and "mixed with pounded glass." Nor are lichens, as has sometimes been alleged, injurious to the trees upon which they grow, except to a very limited extent. Not being parasites properly so called, the only injury they can inflict upon them is by slightly interfering with the functions of respiration, or, when growing very crowdedly upon the branches of orchard trees, by checking the development of buds.

Classification of Lichens.

From the time of Acharius, the father of lichenological science, different authors have proposed different classifications of lichens, according to the degree of importance attached by them to one or other of their vegetative and reproductive organs. Most of these classifications, however, whether proposed by microscopical or pre-microscopical lichenists, have been too artificial and arbitrary, and indeed less natural in various ways than that originally propounded by Acharius. Of recent years they have been entirely superseded by other two systems, viz., that of the Massalongo-Koerberian and that of the Nylanderian school. With respect to the former of these, its characteristic feature is the prominence which it assigns to the form and structure of the spores not only in the differentiation of species but also in the foundation of genera. Though it has been adopted, with various modifications, by many Continental lichenists, yet essentially it also proceeds on an artificial principle, and necessitates the adoption of far too many genera, distinguished from each other merely by slight differences in the spores. The other system—that of Nylander, which was first proposed by him in his *Essai d'une Nouvelle Classification des Lichens* (1854-55),—has since then commended itself more and more to the acceptance of lichenists, so that even the disciples of the opposite school (the sporologists) have in many respects gradually approximated towards it in their most recent writings. Not only is it the only complete system of classification yet wrought out; it is also the most natural and philosophical of any hitherto propounded. In its main outline it proceeds upon the principle of showing the near relation of certain lichens to some genera of algae on the one hand, and of certain other lichens to some genera of fungi on the other hand, and connects these three great classes of cryptogams together by a sort of twofold chain, commencing with those genera of lichens nearest allied to the algae, working up to those genera best developed (*Stictia*), and thence retrograding and terminating with those nearest allied to the fungi. His genera also are principally founded, not upon a single special character, but upon the combined anatomical characters presented by the thallus, the apothecia, and the spores. It may here be further observed that we are indebted to the same accomplished lichenist for the succinct but comprehensive diagnoses, generic and specific, of the different parts of a lichen, which have tended so much to facilitate their systematic study. The following is a synopsis of the Nylanderian classification of lichens, with the leading characters of the different families and tribes, and an enumeration of all the principal genera of which these are composed.

Family I.—*Sphaerocetæ*, Nyl.

Thallus but little turgid when moist, gonidial stratum consisting of gonimia which are tumidate; medullary filaments none.

Tribe 1. *Sphaerophenæ*, Nyl.—Thallus filamentoso-fruticulosus, gonimia vacuolately connate. Apothecia basiform or lecidiform. Spores gonimata or sphaerostigmata.

Genera: *Sphaerophora*, Ktze.; *Goniomeria*, Nyl.; *Sphaeromeria*, Born. Tribe 2. *Pyrenopezizæ*, Nyl.—Thallus thinly granulose, rubraceous within, gonimia simple or connate. Apothecia lecanioid or pyrenopezizoid. *Sphaeromeria* with striatulate apothecia.

Genera *Eusporia*, Nyl.; *Pyrenopeziza*, Nyl.

Tribe 3 *Homonidacea*, Nyl.—Thallus either fruticose with the gonimia sessile, or squamuliform or granulose with the gonimia subulterior. Apothecia pyrenopezizoid with or without paraphyses. Sporegonia with simple sterigmata.

Genera *Epiclita*, Fr.; *Epiclita*, Nyl.; *Phyllostictum*, Nyl.; *Collemopodium*, Nyl.

Tribe 4 *Magnopora*, Nyl.—Thallus pyrenopezizoid, containing syngonimia, the gonimia arranged without order. Apothecia petiolate.

Genera *Magnopora*, Nyl.

Family II — *Collema*, Nyl

Thallus tergal when moist, gonidial stratum consisting of gonimia uniformly arranged, medulla not discrete.

Tribe 1 *Lichina*, Nyl.—Thallus fruticose or radially lacinated, gonimia elongato-sessile moniliform, subconnate. Apothecia lecanorine or lecanine. Sporegonia with sterigmata or arthrosterigmata.

Genera *Lichina*, Ag.; *Pterygium*, Nyl.; *Leptogium*, Nyl.; *Lichinidium*, Nyl.

Tribe 2 *Collema*, Nyl.—Thallus membranaceous, lobate, rarely fruticose, granulose or subequamuliform, gonimia moniliformly arranged, cortical stratum none or distinct. Apothecia lecanorine or rarely pyrenopezizoid. Sporegonia with simple sterigmata or arthrosterigmata.

Genera *Leptophyllum*, Fr. fil.; *Synalasia*, DR.; *Omphalium*, DR.; *Aeneia*, Nyl.; *Paulia*, Fée.; *Schizoma*, Nyl.; *Collema*, Ach.; *Leptogium*, Ach.; *Zamacladonia*, Nyl.; *Lichinella*, Nyl.; *Ampodium*, Nyl.; *Collema*, Nyl.; *Egyrotrichum*, Russ.

Tribe 3 *Epyridicta*, Nyl.—Thallus fibrillose, gonimia moniliformly coherent, cortical stratum distinct. Apothecia pyrenopezizoid.

Genera *Epyridicta*, Nyl.

Family III — *Lichenaria*, Nyl.

Thallus not gelatinous, with a gonidial, rarely gonimic stratum, medullary stratum more or less distinct.

Series I — *Eponidicta*, Nyl

Apothecia with the apices usually naked and pulverulent on the surface of the fructification.

Tribe 1 *Calicia*, Nyl.—Thallus horizontally expanded, sometimes none. Apothecia stipitate, capsuliform or sessile. Sporegonia with simple sterigmata.

Genera *Sphinctrina*, Fr.; *Calicia*, Pers.; *Stenocleia*, Nyl.; *Conocarpus*, Ach.; *Epyridicta*, Nyl.; *Trachylia*, Fr.; *Pyrulium*, Nyl.

Tribe 2 *Tylophora*, Nyl.—Thallus thinly crustaceous. Apothecia at first pyrenopezizoid and then lecanorine with sporal mass. Sporegonia with somewhat branched sterigmata.

Genera *Tylophora*, Nyl.

Tribe 3 *Sphaerophora*, Nyl.—Thallus fruticose, branched. Apothecia at first nucleiform, becoming variously dehiscence, with sporal mass. Sporegonia with simple sterigmata or arthrosterigmata.

Genera *Sphaerophora*, Pers.; *Acrocephalus*, Lev.; *Tholurus*, Norm.

Series II. — *Cladodes*, Nyl

Apothecia terminal on podetia, rarely sessile, batorine or rarely lecanorine.

Tribe 4 *Bromyelidicta*, Nyl.—Thallus horizontally expanded. Apothecia substipitate. Sporegonia with sterigmata or arthrosterigmata.

Genera *Gomphallium*, Nyl.; *Bromyces*, Pers.; *Glossidium*, Nyl.; *Thylenachium*, Berk.; *Stereocaulium*, Nyl.

Tribe 5 *Pidalia*, Nyl.—Thallus granulose, cephalodiferous, with rigid podetia. Apothecia cephalodine on the podetia, with the paraphyses prolonged into the hypothecium. Sporegonia with simple sterigmata.

Genera *Pidalia*, Nyl.

Tribe 6 *Stereocaulium*, Nyl.—Thallus cespitose, podetiform, solid. Apothecia terminal or lateral, lecanine or rarely lecanorine. Sporegonia with simple sterigmata.

Genera *Stereocaulium*, Schreb.; *Stereocaulium*, Nyl.; *Aigopsis*, Fr. fil.; *Ovalidium*, Mnt.

Tribe 7 *Cladonia*, Nyl.—Thallus folioseous or fruticose, with fissure podetia. Apothecia biatorine on the podetia, rarely sessile on the leaflets. Sporegonia with simple sterigmata.

Genera *Heterodermis*, Nyl.; *Pycnothelia*, Ach.; *Cladonia*, Hoffm.; *Cladonia*, Nyl.; *Cladonia*, Nyl.; *Ramalina*, Nyl.

Series III. — *Ramalina*, Nyl

Thallus folioseous, fruticose, or filamentous. Apothecia generally lecanorine.

Tribe 8 *Rocella*, Nyl.—Thallus simple or branched, internally with filamentous medulla. Apothecia irregular (normally lecanorine), adnate, terminal, or lateral. Sporegonia with simple sterigmata.

Genera *Rocella*, DN.; *Rocella*, DC.

Tribe 9 *Siphuleti*, Nyl.—Thallus podetiform, simple or fruticose, internally with filamentous or stictic medulla. Apothecia unknown. Sporegonia (where seen) with arthrosterigmata.

Genera *Siphuleti*, Fr.; *Endoclea*, Cromb.; *Thamnochrysa*, Ach.

Tribe 10 *Ramalina*, Nyl.—Thallus fruticose-folioseous, rounded or compressed, with woody medulla. Apothecia lecanorine, scutellate. Sporegonia with arthrosterigmata.

Genera *Ramalina*, Ach.

Tribe 11 *Usoeri*, Nyl.—Thallus much branched, rounded, or compressed, with firm medullary axis. Apothecia peltoid, petiolate. Sporegonia with simple sterigmata.

Genera *Usoeri*, Hoffm.; *Neurospora*, N. and Fr.; *Chlorea*, Nyl.

Tribe 12 *Actocera*, Nyl.—Thallus branched, rounded, or compressed, with woody medulla. Apothecia peltoid, scutelliform. Sporegonia with simple sterigmata or arthrosterigmata.

Genera *Actocera*, Ach.; *Actocera*, Nyl.; *Dufourea*, Ach.

Tribe 13 *Cetraria*, Nyl.—Thallus fruticose or folioseous, with woody medulla. Apothecia peltoid, marginal, obliquely affixed. Sporegonia with simple sterigmata or arthrosterigmata.

Genera *Cetraria*, Ach.; *Platyura*, Hoffm.

Series IV. — *Phylloidea*, Nyl

Thallus folioseous, usually depressed, lobate. Apothecia generally peltiform or lecanorine.

Tribe 14 *Parmitia*, Nyl.—Thallus frondosely dilated, or lobate, or lacinated, with woody, rarely solid, medulla. Apothecia peltoid, scutelliform. Sporegonia with simple sterigmata or arthrosterigmata.

Genera *Parmitia*, Ach.; *Evernia*, Nyl.; *Parmitia*, Ach.; *Parmitia*, Nyl.

Tribe 15 *Stictis*, Nyl.—Thallus large, lobate, cyphellate, or cyphellate beneath, gonidial stratum composed either of nodulose gonimia or of true gonidia. Apothecia lecanorine, rarely perithecioid. Sporegonia with arthrosterigmata.

Genera *Stictis*, Nyl.; *Lecanaria*, Nyl.; *Stictis*, Ach.; *Lecanaria*, Nyl.; *Stictis*, DN.

Tribe 16 *Peltigera*, Nyl.—Thallus frondosely dilated, the cortical stratum often wanting beneath, gonidial stratum consisting either of gonidia or (usually) of gonimia, rarely of gonidia. Apothecia peltiform, adnate, or innate. Sporegonia (where seen) with arthrosterigmata.

Genera *Nephroma*, Ach.; *Nephroma*, Nyl.; *Peltigera*, Ach.; *Peltigera*, Hoffm.; *Solitaria*, Ach.

Tribe 17 *Physcia*, Nyl.—Thallus stellato-obovate, rarely fruticose, internally with woody medulla. Gonidial stratum consisting of true gonidia. Apothecia lecanorine. Sporegonia with arthrosterigmata.

Genera *Physcia*, Nyl.

Tribe 18 *Punctelia*, Nyl.—Thallus stellato-laciniate, with woody medulla and true gonidial stratum. Apothecia lecanorine. Sporegonia with arthrosterigmata.

Genera *Punctelia*, Fr.

Tribe 19 *Gyrophora*, Nyl.—Thallus umbilicately affixed, with woody medulla and true gonidial stratum. Apothecia lecanorine, or lecanine and gynoecious. Sporegonia with arthrosterigmata.

Genera *Umbilicaria*, Hoffm.; *Gyrophora*, Ach.

Series V. — *Placodi*, Nyl

Thallus variously crustaceous, sometimes evanescent, rarely hypophloeoid, without any filamentous medullary stratum. Apothecia lecanorine, or lecanine, or imbricate.

Tribe 20 *Lecanora*, Nyl.—Thallus crustaceous, rarely evanescent or obsolete. Gonidial stratum consisting of gonidia, rarely of gonimia. Apothecia lecanorine, rarely subulterior or typically biatorine. Sporegonia with simple sterigmata or arthrosterigmata.

Genera *Pannaria*, Del.; *Gynodermis*, Nyl.; *Brodiaea*, Fée.; *Hippia*, Neg.; *Amphileta*, Fr.; *Pannaria*, Fr.; *Lecanora*, Ach.; *Ophiodermis*, Nyl.; *Peltula*, Nyl.; *Dermatium*, Nyl.; *Dermis*, Fr.

Tribe 21 *Pertusaria*, Nyl.—Thallus crustaceous, continuous, gonidial stratum consisting of true gonidia. Apothecia endocarpioid or lecanorine. Sporegonia with simple sterigmata.

Genera *Pertusaria*, DC.; *Pertusaria*, Nyl.

Tribe 22 *Thelotrema*, Nyl.—Thallus crustaceous, or pulverulent, or areolate, with true gonidial stratum. Apothecia urceolot-impregnated with double margin. Sporegonia with simple or somewhat branched sterigmata.

Genera *Thelotrema*, Wallr.; *Tremotium*, Nyl.; *Thelotrema*, Ach.; *Thelotrema*, Ach.; *Thelotrema*, Fr.; *Thelotrema*, Nyl.; *Acidulum*, Fée.; *Gynodermis*, Nyl.

Tribe 23 *Lecidea*, Nyl.—Thallus variously crustaceous, pulverulent, evanescent or none proper, with the gonidial stratum consisting of gonidia (rarely obryogonidia), rarely gonimia. Apothecia lecanine (or basiconic). Sporegonia with simple or simple sterigmata.

Genera *Canthopeltis*, Ehrh.; *Byssoecium*, Mnt.; *Pannaria*, Nyl.; *Conocarpus*, Pers.; *Lecidea*, Ach.; *Gyrodactylum*, Nyl.; *Epithemia*, Nyl.

Tribe 24. *Graphidea*, Nyl.—Thallus thinly crustaceous, or hypophloeoid, or rarely none proper; gonial stratum consisting of gonimia (rarely diacygonimia). Apothecia hirsute or reticulate. Spermogones with simple sterigmata.

Genera. *Xylographa*, Fr., *Aggraria*, Fr.; *Lithographa*, Nyl.; *Graphis*, Ach.; *Thelographis*, Nyl.; *Melminthocarpa*, Fée; *Lecanographa*, Nyl.; *Opographis*, Ach.; *Platygrapha*, Nyl.; *Stigmatidaceae*, Mey.; *Albidaria*, Ach.; *Melanogonia*, Nyl.; *Lecanactis*, Eschsch.; *Schizoglyphis*, Nyl.; *Glyptis*, Ach.; *Chiodacton*, Ach.

Series VI.—*Pyrenoclii*, Nyl.

Thallus peltoide, or crustaceous, or hypophloeoid, or evanescent. Apothecia imbriciform, with an apical umbel.

Tribe 25. *Pyrenocarpi*, Nyl.—Thallus various, often macular or olivolete, gonial system consisting of gonimia (rarely diacygonimia), sometimes of gonimia. Apothecia pyrenoidiform, often without paraphyses. Spermogones with simple sterigmata or atrostostigmata.

Genera. *Cora*, Fr.; *Endocarpus*, N. ab Es.; *Von-mundia*, Nyl.; *Endocarpus*, Helw.; *Pyrenocarpus*, Nyl.; *Verrucaria*, Pers.; *Thelocelia*, Nyl.; *Thelopsis*, Nyl.; *Orizans*, Wallr.; *Strigula*, Fr.; *Parathecium*, Nyl.; *Melanotheca*, Fée; *Tryptothelium*, Ach.; *Astrothelium*, Eschsch.

Series VII.—*Psilidioides*, Nyl.

Thallus thin, often wanting. Apothecia peridiciform, without any ostiole.

Tribe 26. *Psilidi*, Nyl.—Thallus thin, macular, or none proper. Apothecia consisting of a peridium. Spermogones (where seen) with simple sterigmata.

Genera. *Thelocarpus*, Nyl.; *Spelocarpus*, Nyl.; *Endocarpus*, Nyl.; *Myocarpus*, Flot.

Family IV.—*Mysrangaceae*, Nyl.

Thallus unstratified, entirely and equally cellulosic. Fructification not discrete.

Tribe 1. *Mysrangia*, Nyl.—Thallus noduloso-pulvinat. Apothecia subconiciform. Spermogones unknown.

Genus. *Mysrangium*, Mnt and Berk.

In the *Mysrangium* arrangement, most of these tribes and genera are again divided into subtribes and subgenera, the latter being further subdivided into sections according to the affinities of the different species.

Habits and Distribution of Lichens.

These two subjects are intimately related and present many interesting features which here we can only very generally notice without entering into details.

1. *Habits of Lichens*.—These are extremely varied, and comprehend a great number of very different substrata. Chiefly, however, they are the bark of trees, rocks, the ground, mosses, and, rarely, perennial leaves. (a) With respect to corticole lichens, some prefer the rugged bark of old trees (e.g., *Ramalina*, *Parmelia*, *Stictis*), and others the smooth bark of young trees and shrubs (e.g., *Graphidea* and some *Lecidea*). Many are found principally in large forests (e.g., *Usnea*, *Alectoria jubata*); while a few occur more especially on trees by roadsides (e.g., *Physcia parietalis* and *Ph. pulverulenta*). In connexion with corticole lichens may be mentioned those lignicole species which grow on decayed or decaying wood of trees and on old pales (e.g., *Calicidia*, various *Lecidea*, *Xylographa*). (b) As to saxicole lichens, which occur on rocks and stones, they may be divided into two sections, viz., calcicole and calcifugus. To the former belong such as are found on calcareous and cretaceous rocks, and the mortar of walls (e.g., *Lecanora calcarea*, *Lecidea calcivora*, and several *Verrucaria*), while all other saxicole lichens may be regarded as belonging to the latter, whatever may be the mineralogical character of the substratum. It is here worthy of notice that the apothecia of several calcicole lichens (e.g., *Lecanora Prevostii*, *Lecidea calcivora*) have the power (through the carbonic acid received from the atmosphere) of forming minute favelli in the rock, in which they are partially buried. (c) With respect to terricole species, some prefer peaty soil (e.g., *Cladonia*, *Lecidea decolorata*), others calcareous soil (e.g., *Lecanora crassa*, *Lecidea decipiens*), others argillaceous soil or hardened mud (e.g., *Colema limosum*, *Peltidea venosa*); while many may be found growing on all kinds of soil,

from the sands of the sea-shore to the granitic detritus of lofty mountains, with the exception of course of cultivated ground, there being no agrarian lichens. (d) *Muscolae* lichens again are such as are most frequently met with on decayed mosses and jungermannias, whether on the ground, trees, or rocks (e.g., *Lepidogium muscicola*, *Gomphillus calcivivida*). (e) The epiphyllous species are very peculiar as occurring upon perennial leaves of certain trees and shrubs, whose vitality is not at all affected by their presence as it is by that of fungi. In so far, however, as is known, they are very limited in number (e.g., *Lecidea Bouteilleri*, *Strigula*). With the exceptions of these last, it is to be observed that all the rest may, under different conditions of locality and climate, be found growing for the most part indiscriminately on the substrata mentioned, a normally saxicole species becoming corticole, a terricole one becoming muscicola, and vice versa. Amongst other instances of this that might be adduced, the case of *Lecidea geographica*, a peculiarly saxicole species, growing on the stems of *Rhododendron* in the Tyrolean Alps, and that of *Lecidea rivulosa*, a like peculiarly saxicole species, growing on the bark of trees in Germany, are especially striking. Sometimes also various lichens occur abnormally in such unexpected habitats as dried dung of sheep, bleached bones of reindeer and whales, old leather, iron, and glass, in districts where the species are abundant. Consequently it is apparent that in many cases lichens are quite indifferent to the substrata on which they occur, whence we infer that the preference of several for certain substrata depends upon the temperature of the locality or that of the special habitat. Thus in the case of saxicole lichens the mineralogical character of the rock has of itself little or no influence upon lichen growth, which is influenced more especially and directly by their physical properties, such as their aptitude for imbibing and retaining heat and moisture. As a rule lichens have a propensity for open exposed habitats, though some are found only or chiefly in shady situations; while, as already observed, scarcely any occur where the atmosphere is impregnated with smoke. Many species also prefer growing in moist places by streams, lakes, and the sea, though very few are normally, and probably none entirely, aquatic, being always at certain seasons exposed for a longer or shorter period to the atmosphere (e.g., *Lichina*, *Leptogium rivulare*, *Endocarpus fumatilis*, *Verrucaria maura*). Some species are entirely parasitical on other lichens (e.g., various *Lecidea* and *Pyrenocarpi*), and may be peculiar to one (e.g., *Lecidea niellinaria*) or common to several species (e.g., *Habrothallus parietinarum*). A few, generally known as *erratic* species, have been met with growing unattached to any substratum (e.g., *Parmelia revoluta*, var. *concentrica*, *Lecanora esculenta*); but it seems somewhat doubtful if these are really free *ab initio* (vide Crombie in *Journ. Bot.*, 1873, p. 306). It is to the different characters of the stations they occupy with respect to exposure, moisture, &c., that the variability observed in many types of lichens is to be attributed. The fact also that in numerous instances they are so indifferent to the nature of their habitats clearly shows that they do not at all depend upon the substratum for their nourishment.

2. *Distribution of Lichens*.—From what has now been said it will readily be inferred that the distribution of lichens over the surface of the globe is regulated, not only by the presence of suitable substrata, but also and more especially by atmospheric and climatal conditions. At the same time it may safely be affirmed that their geographical range is more extended than that of any other class of plants, occurring as they do in the coldest and warmest regions—on the dreary shores of the paleocretic sea and in the torrid valleys of tropical climes, as well as on

the greatest mountain elevations yet attained by man, on projecting rocks even far above the snow-line (e.g., *Lecidea geographica*), where, as in many other situations, fungus-mycelium and gonoid algal are unknown. Our knowledge of the distribution of lichens in various countries, like that of other plants, is derived from general and local floras, from special works on lichenology, from the observations of scientific travellers and the collections made by them in distant parts of the world. Most of these, however, of an earlier date, are to be used with great caution, as the species recorded were, in the absence of microscopical examination, not sufficiently discriminated, and in many cases are *prima facie* entirely erroneous. Amongst botanical travellers whose contributions are most trustworthy may be mentioned pre-eminently Sir Joseph D. Hooker, whose remarks on this subject in his *Flora Antarctica* and in various papers in *Trans. Linn. Soc.*, vol. xiv, &c., are most valuable and suggestive. Again, in purely lichenological works, the general principles regulating lichen distribution (with statistical tables) are admirably expounded by Nylander in the introduction to his *Synopsis Methodica Lichenum*, while the only complete record of the distribution of species is that given by the same author in his *Énumération générale des Lichens*. Since the date of this latter work (1858) our knowledge of the range of lichens, both European and exotic, has been greatly extended, apart from the discovery of numerous species previously unknown. No special treatise, however, on the subject has been published, though there is now ample material, very much scattered no doubt, available for the purpose. It may, however, be observed that of the four thousand species (exclusive of numerous varieties and forms) which have been described, the geographical distribution is known almost as well as that of phanerogams and filices, as well, if not more so than that of mosses and hepatics, far better than that of algae and fungi. In arctic regions lichens form by far the largest portion of the vegetation, occurring everywhere on the ground and on rocks, and fruiting freely; while teriolic species of *Cladonia* and *Stereocaulon* are seen in the greatest luxuriance and abundance spreading over extensive tracts almost to the entire exclusion of other vegetation. The lichen flora of temperate regions again is essentially distinguished from the preceding by the frequency of corticose species belonging to *Lecanora*, *Lecidea*, and *Graphidæ*. In inter-tropical regions lichens attain their maximum development (and beauty) in the foliaceous *Stictis* and *Parmelites*, while they are especially characterized by epiphyllous species, as *Strigula*, and by many peculiar corticose *Thelotrema*, *Graphidæ*, and *Pyrenopeziza*. Some lichens, especially saxicolous ones, seem to be cosmopolitan (e.g., *Lecanora subfusa*, *Cladonia pyxidata*); and others, not strictly cosmopolitan, have been observed in regions widely apart. A considerable number of species, European and exotic, seem to be endemic, but further research will no doubt show that most of them occur in other climatal regions similar to those in which they have hitherto alone been detected. To give any detailed account, however, of the distribution of the different genera (not to speak of that of individual species) of lichens would necessarily far exceed the limits at our disposal. Suffice it to say that both in horizontal and vertical range, they sufficiently correspond with the distribution of phanerogams in the several regions of vegetation into which the surface of the globe has been divided. The proportion of lichens to phanerogams in different regions increases in a regular ratio from the equator to the poles, and from the base to the summit of lofty mountains, till at length in more arctic and alpine tracts lichens constitute almost and sometimes entirely the sole vegetation. (x. m. c.)

LICHFIELD, a city and municipal and parliamentary borough of Staffordshire, England, is situated in a pleasant and fertile valley, on a small tributary of the Trent, and on the South Staffordshire Railway, 16 miles north from Birmingham. The town is well built, and contains many handsome houses. Of the old Norman cathedral there are now no remains. The present building is supposed to belong to the end of the 12th or beginning of the 13th century. Its style is Early English approaching to Decorated, and it possesses an imposing central tower 385 feet in height, with two western spires 183 feet. The transepts, which contain some portions of Norman architecture, are richly ornamented, and adorned with windows of beautiful tracery. The total length of the building from east to west is 403 feet. The damage which it suffered during the civil wars was repaired by Bishop Hackett in 1671, and at present (1882) it is undergoing extensive restorations. A new building for the King Edward's grammar school was erected in 1860. In the market-place is a statue of Dr Johnson, facing the house where he was born. A guild-hall, a market-hall, a corn exchange, and a public library and museum are the principal buildings of a secular character. There are several charitable institutions. The industries of the town include brewing and coach-building; and in the neighbourhood there are large nurseries and market gardens. The municipal and parliamentary boroughs have the same area (3116 acres); the population in 1871 was 7347, and in 1881 8380.

Lichfield is spelt by Bede Liefeld, the word being supposed to mean "Field of the Dead," from a massacre which took place near it of a large number of Christians. It was made an episcopal see in 692, St Chad being its first bishop. In the reign of Offa it was promoted to be an archbishopric, but in 803 the primacy was restored to Canterbury. In 1075 the see of Lichfield was transferred to Chester, and thence, a few years afterwards, to Coventry, but it was restored in 1148. The town has returned members to parliament since 1805, at which time it also received a charter of incorporation. Since 1667 it has returned only one member. It was made a city by Edward VI. in 1649.

See the histories of Lichfield by Jackson (1805) and Harwood (1806), and histories of the cathedral by Britton (1820) and Stone (1870).

LICHTENBERG, formerly a small German principality on the west bank of the Rhine, enclosed by the Nahe, the Blies, and the Glan, now forms the circle of St Wendel in the government district of Treves, Rhenish Prussia. The principality was constructed of parts of the old electorate of Treves, Pfalz-Zweibrücken, and Salm, and lay between Rhenish Bavaria and the old Prussian province of the Rhine. Originally called the lordship of Baumholder, it owed the name of Lichtenberg and its elevation to a principality to Ernest, duke of Saxe-Coburg, to whom it was presented by Prussia in 1815 in accordance with terms agreed upon at the congress of Vienna. The duke, however, restored it to Prussia in 1834, in return for an annual pension of £26,000 sterling. The area is 210 square miles, and the population 45,000.

LICHTENBERG, GEORG CHRISTOPH (1744-1799), physicist and satirical writer, was born at Oberamstadt, near Darmstadt, July 1, 1744. In 1763 he entered Göttingen university, where in 1770, after spending several years in England, he became extraordinary professor of physics, and five years later ordinary professor. This post he continued to hold till his death, February 24, 1799. As a physicist he is best known for his investigations in electricity, more especially as to the so-called Lichtenberg figures (see vol. viii. p. 66), which are fully described in two memoirs *De nova methodo naturam ac motum fluidi electrici investigandi* (Göttingen, 1778-79). He sent many excellent contributions to the *Göttingen Taschenrechner* from 1778 onwards, and to the *Göttingische Magazin der Literatur und Wissenschaft*, which he edited for three years (1780-82) along with J. G. A. Forster.

His various scientific writings occupy the latter part of his *Vermaelte Schriften*, edited by Kriess (9 vols., Göttingen, 1800–5, new edition, 6 vols., Götting, 1841–46). The earlier volumes of these collected writings contain his satirical and humorous productions. His keen satire involved him in many a literary controversy with well-known contemporaries, such as Lavater, whose science of physiognomy he wittily ridiculed, and Voss, whose views on Greek pronunciation called forth a powerful satire *Ueber die Pronunciation der Schöpfung des alten Griechenlandes* (1782). Notes of his lectures on natural philosophy, astronomy, and physical geography were published by Gamauf (Vienna, 1809–12, 1813, 1819); and more recently some of his brilliant sayings have been collected by Gisebach in one volume, *Lichtenberg's Gedanken und Aeußeren Licht-Strahlen aus seinen Werken* (Leipzig, 1871).

LICINIUS. Publius Flavius Galerius Valerius Licinianus Licinius, Roman emperor, of Dacian peasant origin, was born probably about 250 A.D., and was elevated after the death of Severus to the rank of Augustus by Galerius, his former friend and companion in arms, on November 11, 307, receiving as his immediate command the provinces of Illyrium. On the death of Galerius in May 311, he shared the entire empire with Maximin, the Hellaspont and the Thracian Bosphorus being their mutual boundary. In March 313 he entered into alliance with Constantine at Milan, and in the following month inflicted a decisive defeat on Maximin at Heraclea, with the result of establishing himself as master of the East, while Constantine (now his brother-in-law) was supreme in the West. In the following year his jealousy led him to encourage a treasonable enterprise on the part of Bassianus against Constantine. When his perfidy became known a civil war ensued, in which he was twice severely defeated—first near Cibalis in Pannonia (October 8, 314), and next in the plain of Marica in Thracia, the outward reconciliation, which was effected in the following December, left Licinius in possession of Thracia, Asia Minor, Syria, and Egypt, but added numerous provinces to the Western empire. In 323 Constantine, tempted by the “advanced age and unpopular vices” of his colleague, anew declared war against him, and, having defeated his army at Adrianople (July 3, 323), succeeded in shutting him up within the walls of Byzantium. The defeat of the superior fleet of Licinius by Crispus, Constantine's eldest son, compelled his withdrawal to Bithynia, where a last stand was made, the battle of Chrysopolis (September 18) finally issued in his submission and death.

LIEBER, FRANCIS (1800–1872), a distinguished publicist and writer on political science, was by birth a German, by adoption a citizen of the United States. He was the son of Frederick Wilhelm Lieber, and was born at Berlin, March 18, 1800. Upon the return of Napoleon Bonaparte from Elba, young Lieber, then only fifteen years of age, volunteered as a soldier, and served with his two brothers under Marshal Blücher in the campaign of 1815. He fought at Ligny, Waterloo, and Namur. In the last-named battle he was twice severely and dangerously wounded. At the close of the war he returned to his studies, and joined the Berlin gymnasium under Dr. Jahn. Shortly afterwards he was arrested and thrown into prison for his political sentiments, the chief evidence against him being several songs of liberty which he had written. After several months' confinement he was discharged without a trial, but informed that he would not be permitted to pursue his studies at the Prussian universities. He accordingly went to Jena, where he took his degrees in 1820, subsequently continuing his studies at Halle and Dresden. When the Greek revolution broke out, young Lieber instantly resolved to take part in the struggle for

Grecian independence. He made his way with great difficulty to Marseilles, travelling much of the way on foot, and thence embarked for Greece. His experiences there are recorded in his *Journal in Greece*, published at Leipsic in 1823, and at Amsterdam in the same year under the title of *The German Anachorist*. Returning from Greece after the failure of the struggle, he landed at Ancona, and proceeded to Rome. There he made the acquaintance of Niebuhr, then Prussian ambassador to Rome, who took great interest in him and employed him as tutor to his son. He lived a year in the family of the historian, a period of his history which he afterwards embalmed in his *Reminiscences of Niebuhr*, first published in America, and afterwards in England. Returning from Rome to Berlin in 1823, he was soon again arrested by the Prussian authorities on the old charges of enmity to the Government and advocating republican opinions, and was imprisoned in the bastille of Koepnick, but was released after some months' confinement through the influence of Niebuhr. In 1825 he abandoned his country, and after spending a year in London went to the United States (1827), and as soon as possible was naturalized as a citizen of that country. Lieber took up his residence at Boston, and was occupied for five years in his laborious work *The Encyclopedia Americana* (13 vols.). In 1829 he removed to New York, where he published a translation of De Beaumont and De Tocqueville's work on the penitentiary system, with many notes. In 1833 he went to Philadelphia to prepare a plan of education for Girard College, then newly founded. While there he published *Letters to a Gentleman in Germany* and a supplement to his *Encyclopedia*. In 1835 he was appointed professor of history and political economy in South Carolina College at Columbia, S.C., where he remained more than twenty years, and during this period wrote and published the three great works upon which his fame as a writer chiefly rests—the *Manual of Political Ethics* (1838), *Legal and Political Hermeneutics* (1839), and *Civil Liberty and Self Government* (1853).¹

In 1856 Lieber resigned the professorship in South Carolina College, and was immediately elected to a similar professorship in Columbia College, New York, and to the chair of political science in the law school of the same institution. He continued in the discharge of the duties of these positions until his death, which occurred October 2, 1872. During the great war for the preservation of the Union from 1861 to 1865, Lieber rendered services of great value to the Government of his adopted country, and was frequently consulted by the secretary of war. He was one of the first to point out by his pen the madness of secession, and was ever active in supporting the Government and upholding the Union. He prepared, upon the requisition of the president, the *Code of War for the Government of the Armies of the United States in the Field*, which was adopted and promulgated by the Government in General Orders No. 100 of the war department. This code has been characterized by many European publicists as a masterpiece, and it suggested to Bluntchli his codification of the law of nations, as may be seen in the preface to his *Droit International Codifié*. During this period also Lieber wrote his *Guerrilla Parties with Reference to the Laws and Usages of War*, a valuable contribution to the law of war. At the time of his death he was by appointment of the Government of the United States the umpire of the commission for the adjudication of Mexican claims. The political writings of Francis Lieber are held in great estimation by all publicists. Sir Edward S.

¹ New editions of these works and of his miscellaneous writings have been published recently at Philadelphia.

Cressy, in his *First Platform of International Law*, alluding to his death, has justly said of him, "America and the civilized world in general have lately had to deplore in his death the loss of one whom the French jurist M. Laboulayes truly styled 'une des figures les plus originales parmi les urgenssables de notre temps'."

Beside the works already mentioned, Liebig published at various times many smaller works and pamphlets on different subjects, all of which attracted public attention, such as *The Origin and Development of the First Constituents of Civilization*, *Great Events Described by Great Histories*, *Essays on Property and Labour*, *The Laws of Property*, *Penal Laws and the Penitentiary System*, *Prison Discipline*, *The Relation between Education and Crime*, *The Fading Power*, *The Character of the Gentleman*, *International Copyright*, *Law a Bredman's Vocal Sounds*, *On Anglican and Gallican Liberty*, *The Post Office and Postal Reform*, *Independence of the Judiciary*, *Nationalism*, *Rise of the Constitution* (an unfinished work), and many minor tracts and publications. These works are all written with as much ease and purity of idiom as if English had been his native tongue, a fact not more remarkable than that he, a German, should have become the great American teacher of the philosophy of Anglian political science. (M. R. T.)

LIEBIG, JUSTUS (1803-1837), was born at Darmstadt in 1803. His father earned on business as a dyersalter and dealer in dye-stuffs, and made various experiments with a view to improved methods of preparing and purifying his wares. These led the son to take an interest in chemistry, and to seek for knowledge in the chemical books and periodicals in the grand-ducal library, which is rich in scientific works. At home he employed his time in repeating, as far as the means at his command admitted, the experiments he found described in books, and thus while still a boy attained a theoretical and practical knowledge of chemistry comparable with that of many full-grown professors of the science. He determined to be a chemist, to devote his life to the pursuit of science. The only kind of chemist available for teaching purposes was the chemist and druggist, and accordingly Liebig, at the age of fifteen, entered the shop of an apothecary at Heppenheim near Darmstadt to study chemistry. He soon found out how great is the difference between practical pharmacy and scientific chemistry, and returned to Darmstadt, after ten months, to look for another and more likely way of attaining his object. After some months spent in study at home he entered the university of Bonn, which he soon left for Erlangen. There he attended the lectures of Kastner on chemistry, and, beside the study of allied sciences, devoted some time to make up for the almost total neglect of school work caused by his early love of chemistry. He was much influenced by the metaphysical speculations of Schelling, and in after life referred to this influence as injurious to him as a scientific investigator. In those days there were no laboratories accessible to ordinary students, and Liebig had to content himself with what the university could give him in the lecture-room and in the library. Both at Bonn and at Erlangen he formed a students' chemical and physical society for the discussion of new discoveries and speculations as these appeared in scientific books or periodicals. In 1822 he left Erlangen with the degree of Ph.D. By means of the liberality of Louis I., grand-duke of Hesse-Darmstadt, Liebig was enabled to continue his chemical studies in Paris. There he made the acquaintance of Runge, Mitscherlich, and Gustav Rose. He attended the lectures of Gay-Lussac, Thénard, and Dulong, and, while carrying on the investigation into the composition and properties of the fulminates which he had already partly published, he attempted, as at Erlangen, to work up his neglected school studies. The results of his work on the fulminates were communicated to the Academy of Sciences, and attracted the favourable attention of Humboldt, who was at that time in Paris. Humboldt introduced Liebig to Gay-Lussac, who admitted him into his private laboratory as a pupil. Here he had opportunities of learning all the mysteries of the art from

one of the most skilful and ingenious of experimenters. It was on the advice of Humboldt that Liebig determined to become a teacher of chemistry, but difficulties stood in his way. As a native of Hesse-Darmstadt, he ought, according to the academical rules of the time, to have studied and graduated at the university of Giessen, and Humboldt had to use his influence to induce the authorities to forgive his having attended the foreign university of Erlangen. After examination his Erlangen degree was recognized, and in 1824, in his twenty-first year, he was appointed extraordinary professor of chemistry in the university of Giessen. Two years later he was promoted to the post of ordinary professor, which he held for twenty-five years, notwithstanding the most tempting offers from other universities. It was here, in the small town and small university of Giessen, that by far the most of Liebig's work was done. He began by remedying the evil which as a student he had himself felt. He induced the Darmstadt Government to build a chemical laboratory in which any student of the university might obtain a thorough practical training. It is difficult for us, who live in a time when nearly every university and many schools possess well-arranged and often well-endowed laboratories, to understand how great a revolution was made in the practical teaching of physical science by the foundation of the Giessen laboratory. We can form some idea of it by reading Liebig's articles on the condition of chemistry in Austria and Prussia, in which he goes over in detail the means of teaching afforded in the various universities of those great countries. He tells us that in 1838 two young Prussians came to Giessen to study chemistry, unable to obtain entrance to a laboratory in their own country, but were ordered back again by the Prussian Government. Fortunately other Governments were less strict, or other students were less obedient, and crowds of young men anxious to study chemistry came to Giessen, and carried home the light there acquired. Partly by Liebig's urgent appeals to the interests and to the shame of the great German states, partly by the influence of his pupils, a great reform was effected, and German universities now vie with one another in offering opportunities of practical instruction in chemistry and the other physical sciences.

The amount and the importance of the laboratory work done by Liebig in Giessen were very great. Without considering here the work done by his students under his direction, of which no doubt a very large part was conceived by him, and in the execution of which he constantly contributed his assistance and advice, we shall look only at what appears under his own name. During the twenty-six years he spent at Giessen as ordinary professor, he contributed to scientific journals more than two hundred papers, about twenty of which were records of joint work, chiefly with Wohler. During the same time he published his works on organic analysis, organic chemistry, chemistry applied to physiology and agriculture, his *Chemical Letters*, and many smaller treatises. From 1832 he was joint editor of the *Annalen der Pharmacie*, from 1837 of the *Handwörterbuch der reinen und angewandten Chemie*, and from 1847 to 1856 of the *Jahresbericht der Chemie*. These statements give some idea of the amount of his work; of its importance and of its effect on the history of science we shall speak later.

In 1845 he was raised to the hereditary rank of baron under the title of Freiherr von Liebig. In 1852 he accepted the invitation of the Bavarian Government to the ordinary professorship of chemistry in the university of Munich. This office he held till his death in 1873.

In private life Liebig was hospitable, courteous, and kindly. Honoured by all the great scientific societies of the world, and regarded by almost every one as the great authority in chemistry, he assumed no airs of superiority,

and lived the simple and quiet life of a German professor. Liebig's influence on the history of chemistry may be considered under five heads—(1) the effect of the opening of the Giessen laboratory, and of Liebig's constant efforts to induce other universities to follow this example; (2) the improvements introduced by him in methods of investigation and in apparatus; (3) the discovery of new facts; (4) the development of theory; and (5) the application of chemistry to physiology, agriculture, and the arts.

We have already spoken of the first. Under the second head by far the most important change introduced by Liebig was his method of organic analysis. Organic substances were analysed, and analysed with accuracy, before 1830, but such analyses could then be carried out only by highly-skilled chemists, and involved great labour and the use of cumbersome apparatus. Liebig's method of organic analysis, which was published in all its details in 1831, and which (with important but secondary improvements) is that still used, made it easy for any advanced student to make a fairly accurate and very useful analysis of an organic substance. Analysis as to the chemical and astronomical methods for determining longitudes and latitudes are to the geographical explorer. Without it many interesting and useful discoveries may be made, but it is only when complete and accurate analyses are made of all the new substances produced in the course of a research that the research becomes fully valuable to other explorers. If Liebig had cultivated nothing in organic chemistry but his method of analysis, he would still have been in a precisely true sense the founder of modern organic chemistry. Many other improvements of apparatus are due to him, we need only mention the simple form of condenser called by his name, and constantly used by every chemist, and the easy and accurate method for determining the quantity of urea in a solution, which was the first step towards introducing precise chemical methods into practical medicine. This is also the proper place to refer to his analyses of the natural alkaloids, and his discovery of the means of determining their equivalents by the analysis of their chlorhydrates. In the third place we have to consider the new facts discovered by Liebig. The very great addition to our knowledge of organic chemistry made by Liebig naturally throws into the shade his contributions to inorganic chemistry, but we ought to remember his famous analyses of mineral waters and his constant interest in the difficult question of the accurate separation of cobalt and nickel. It is, however, in organic chemistry that Liebig's great discoveries were made. These discoveries are so intimately connected with his chemical theories that we may most conveniently consider them along with the fourth head, his contribution to chemical theory.

The notion of compound radicals is to be found in chemistry as far back at least as the time of Lavoisier. Lavoisier says, "Some experiments of my own and some made by M. Hassenfratz have convinced me that in general nearly all the vegetable acids such as tartaric, oxalic, citric, malic, acetic, pyrotartaric, pyromucic acids, have for their radical hydrogen and carbon, but united we so to form a single base, that all these acids differ from one another by the difference in proportion of these two substances and the degrees of oxidation." Berzelius adopted this view and expressed it thus,—
"We find the differences between organic and inorganic bodies to be that, while in inorganic nature all the oxidized substances have a simple radical, all the organic substances have compound radicals. Just as ammonia is an alkali with a compound radical, but possessing nevertheless the greatest analogies with the mineral alkalis which have simple radicals, so we find the greatest analogy between the mineral and the organic acids, so that the relations of potash and soda to nitric, oxalic, nitric acids are the same as their relations to sulphuric, nitric, phosphoric acids." These views were published by Berzelius in 1817. In 1816 Gay-Lussac had discovered cyanogen, and shown that this compound of carbon and nitrogen is the radical of prussic acid and the salts in the same sense as chlorine is the radical of hydrochloric acid and the chlorides. Ampère had indicated a theory of the constitution of the ammonia salts, which Berzelius worked out in detail, according to which these salts contain a compound radical, ammonium, playing in them the part of potassium in the potash salts. Finally, Davy suggested in 1815 that the hydrated acids which correspond in function to hydrochloric acid should be regarded as the true acids, and proposed to represent them as compounds of hydrogen with a radical.

Such were the knowledge and the theoretical position of chemists on this question when Liebig became professor, the dates to which we have referred correspond to the time when as a schoolboy he was devouring the contents of chemical journals at Darmstadt, and no doubt he then became acquainted at first hand with the discoveries and speculations of Ampère, Davy, Gay-Lussac, and Berzelius.

We have seen that his first investigation referred to the fulminates. He continued his researches upon the compounds of cyanogen and the substances connected with them formal frequent

analyses of his researches during his whole life. In this region of organic chemistry he made many important discoveries, of which the limits of this article do not allow a detailed account; we can only mention melonic, melanic, ammeline, ammeline, and melamine, as substances discovered and investigated by him. In the course of these investigations he discovered the fusible nature of the chemical changes which occur in the manufacture of bromide of potash. In 1831 he examined the action of chlorine upon alcohol, among other substances discovered chloral, and commenced the series of investigations into the derivatives of alcohol and ether to which we shall refer immediately. In 1839 Wöhler and Liebig published the results of their joint research on the oil of bitter almonds and its derivatives. This research may be said to stand at the head of modern organic chemistry. For elegance of method and for clearness of insight it is unrivalled, and will always remain a model of what such an investigation should be. They showed in the clearest manner that the compound C_6H_5O (here and elsewhere in this article we use the symbols now in common use, instead of those employed by the authors), to which they gave the name of benzoyl, is the constant part, or radical, of a great series of compounds. The importance of this investigation was generally recognized. Berzelius hailed it as the advent of real daylight on the subject of organic chemistry, and even suggested the names pin or ethrin (from *pin* and *ethers*) for the newly discovered radical.

We now come to the long controversy as to the constitution of alcohol and ether, which engaged so much of Liebig's time and energy. Gay-Lussac had shown in 1816 that alcohol and ether might, for as their composition is concerned, be represented as compounds of olefiant gas and water, and further, that, if we represent the quantities by volume of gas or vapour, ether contains one volume of olefiant gas and half a volume of water vapour, while alcohol contains equal volumes of the two. In 1838 Dumas and Boullay published an elaborate memoir on the preparation and properties of the ethers, in which they further developed the ideas suggested by Gay-Lussac. They regarded olefiant gas as the radical of all the etheral compounds, as ammonia is of the ammoniacal salts, and formulated them thus—

	Base	Acid	Water
Sulphuretted	NH_4	HCl	
Muriatic ether	C_2H_4	HCl	
Nitric of ammonia	NH_4	HNO_3	H_2O
Nitrous ether	NH_4	HNO_2	H_2O
Ether	C_2H_4	H_2O	H_2O
Alcohol	C_2H_4	H_2O	H_2O
Alumina solution	NH_4	H_2O	H_2O

We have given only a sample of their tables, leaving out among others some substances in reference to the composition of which they had not made quite a sure case, since Liebig's theory was used as an argument, valid enough then no doubt, but of little interest now.

In 1833 Liebig proposed a quite different theory, one which stands to Dumas and Boullay's in the same relation which the ammonium theory holds to the ammoniac theory of the constitution of the ammoniacal salts. Just as Ampère and Berzelius regarded ammonium, not as NH_4 , HCl , but as NH_4Cl , so Liebig proposed for muriatic ether the formula C_2H_5Cl instead of C_2H_4HCl . The really cogent argument which he brought forward, the argument which we can now best appreciate, is that, while alcohol contains combined water, ether does not. According to Dumas and Boullay alcohol and ether are both hydrated, but in Liebig's view ether is $(C_2H_5)_2O$ and alcohol $(C_2H_5)_2O.H_2O$. If we wish to understand this argument we must recollect that to the chemicals of that time oxidized hydrogen was water, and Liebig's arguments are as sound now as they were then, for the most recent views represent alcohol as C_2H_5O and ether as $C_2H_5OC_2H_5$, and thus contain combined hydrogen, or, as we may say, half a molecule of water, and Liebig's tests do not distinguish preformed water, but hydrogen and oxygen combined as they are in water. Much debate and investigation followed, in the course of which the relations of all the substances derived from alcohol were thoroughly and practically studied in a fuller and more careful manner than would have been possible had there not been a theoretical point to defend and to attack. The enormous number of facts discovered by Liebig put him in a very favourable position as the advocate of his theory. Chemists could not do without a knowledge of these facts, and they could only get this knowledge through Liebig's papers, in which the facts were expressed in the language of his theory.

In 1835 Regnault began a series of most important researches into the compounds derived from olefiant gas. He showed that many of these substances might be classified and their relations explained by the assumption of a radical C_2H_4 , to which he gave the name of ethyl. Liebig gave the name of *etheral* to the C_2H_5 part of the meaning of the word radical, as "the unchanging constituent in a series of compounds," the same radical may be assumed in alcohol and in acetic acid, and in 1839, in a note published in the *Annalen*, he puts the matter in a very clear light. He says, "Ether and ammonia have in their compounds a certain resemblance which was

first introduced by Dumas and Berzelius, and the view of the constitution of the ammonia salt; which is generally held in France was the reason why ether was considered the first hydrate of elefant gas, alcohol as the second hydrate, &c., in Germany and other countries the water necessary for the constitution of the salts of ammonia with oxygen bases was considered as an integral part of the base. It was assumed that thus water forms with the ammonia salts of ammonium (NH_4O), and this view in a certain sense smoothed the way for another, according to which the existence of organic oxides, capable of neutralizing acids, appeared very probable, as a necessary complement to the organic acids which chemists had long been inclined to regard as species of organic radicals. Ether was in these countries regarded as an organic radical, and this difference of view excited a ten years' strife, as an immediate result of which we may regard the discovery of a great number of compounds which carried science with innumerable important observations. No region of organic chemistry has been so thoroughly and so completely studied as the compounds connected with ether, and now, when the existence of organic oxides is no longer denied, the support of the opposite opinion has come to an end, although it cannot be said that the question itself has been experimentally decided. If we compare in the light of our present knowledge the ammonia compounds with the ether compounds, we at once see that the opposing views were fundamentally the same in the two cases. The dispute took place because we were not at one as to the interpretation of the phenomena. The ether and ammonia compounds assume in fact the same form if ammonium is regarded as the unchanged radical of the ammonia compounds, and acetyl (Regnault's aldehydyl) as the stating point of the ether compounds. The two sets of compounds differ only in so far as we must ascribe to acetyl the power of forming acids, a power which ammonium does not possess.

He then gives a table containing in two columns the ammonia and the ether compounds, in which C_2H_5 corresponds to NH_3 , C_2H_5 to NH_2 , and C_2H_5 to NH , and acids. "These formulae require no explanation, they have been developed in order to show the extraordinary resemblance of the ammonia and the ether compounds, and to show why it was that many chemists regarded elefant gas as the first member of the series of ether compounds. Both of the formerly antagonistic theories have, as may be easily seen, from this point of view the same foundation, and all further questions as to the truth of the one or other view is thus of course at rest."

It was during the course of the controversy which then closed that Liebig had discovered aldehyde, chloral, and simultaneously with Soubeiran, chloroform, besides numerous other substances of less general interest, and developed the theory now generally received of the formation of ether by the action of sulphuric acid on alcohol. In the very first number of the series of ether compounds, as to the constitution of ether, we mentioned that Liebig's ethyl theory was to some extent borrowed from Berzelius. Berzelius had suggested that ether was the oxide of a radical (Liebig's ethyl), but he was at first inclined to regard alcohol, not as the hydrate oxide of the same radical, but rather as the oxide of another one, which with our symbols would be written C_2H_5 . But there was a deeper difference than this between the radical theories of Berzelius and Liebig. This essential difference first clearly showed itself in the notes which Liebig added to two letters from Berzelius to Wohler, published in the *Annalen* in 1859. In these letters Berzelius gives his views of the constitution of oxyhalides, with which he classes such bodies as trichloroacetic acid. All those bodies he represents as compounds of oxides and chlorides, in harmony with the dualistic system.

Thus, instead of SO_2Cl_2 , $\text{C}_2\text{H}_5\text{ClO}_2$, &c., he writes $\text{SO}_2 + 2\text{SO}_2$, $\text{C}_2\text{H}_5 + \text{C}_2\text{H}_5\text{O}_2$ (as taking the anhydrous acid). In his second letter on Liebig's chlorides, where he naturally arrives at formulae of extreme complexity. In his notes Liebig states that he does not agree with Berzelius, and that the analogy first pointed out by Berzelius between inorganic and organic compounds and his theory of organic radicals had been a guiding star in a labyrinth in which previously no one could find the way. "But, while there are points of resemblance, there are very many points of difference; we should follow a theory as long as it gives us light and explains facts; up to a certain point the principles of inorganic chemistry help us in organic chemistry, beyond if they leave us, and produce instead of removing complications; beyond this point we require new principles."

These new principles were supplied by Liebig's radical theory. As Liebig showed, abstract discussions as to the truth of a theory are out of place in an experimental science; the question is not as to their essential truth but as to their practical fruitfulness. Do they help us to understand old and to discover new facts? If they do, the morrow may take thought for its own theories. These are not Liebig's words, but they seem to express his ideas.

Liebig early expressed his approval of Davy's views as to the constitution of acids, but he rarely used the language or the notation corresponding to his view. This divergence between his theory and his habitual language is interesting as showing that he held

that the same truth may be expressed in more than one way, and that where no immediate point is to be gained it is well to employ the language best understood by those whom we address. In this, as in his preference for what was called the equivalent system of notation over that of Berzelius, he showed his sound practical judgment and common sense. We now see that the notation of Berzelius was nearer to the truth, but its advantage could not be felt until chemistry had advanced further, and its retention would have led to complications of formulae and obscuring of relations. The resemblance indeed of our present notation to that of Berzelius is to a great extent accidental, and the advance was hastened rather than hindered by what now looks like a retrograde step.

There is one other point which we have to mention under the present head. Liebig at once saw the importance of Graham's researches on the phosphates. He applied Graham's idea of polybasicity to organic acids, and satisfactorily proved, notwithstanding the opposition of Berzelius, that tartaric acid is dibasic and citric acid tribasic.

We have hitherto said nothing as to the relation of Liebig's theories to those at present held by chemists. On this subject a word may suffice. The great revolt against the radical theory led by Laurent and Gerhardt produced a long and acrimonious controversy. In this controversy Liebig took his part, and many laws and some unfair things were said by him. The controversy itself was of course the means of producing a vast amount of thorough research, and was thus, like all such contests, of direct use, it also led to the revision of all theoretical opinions from a totally new point of view. From this point the radical theory has emerged, not very different in appearance, but it has undergone a profound change. Its foundations have been immensely strengthened, it has been to a great extent explained. Some chemists seem to think that this makes it an entirely new theory. We cannot share this view. Our reasons for believing in ethyl and benzyl differ from the reasons adduced by Wohler and Liebig only in this, that we have arguments which they had not, then arguments remain. We now know something of the reason why such radicals exist, we can, to a certain extent, deduce their properties from those of the elements which they contain, but explanation is something different from refutation. The radical theory has grown, but it has not been destroyed.

Liebig all his life showed a special predilection for the study of the immediate products of animal life. He investigated with untrusting zeal the substances contained in urine and in the juice of flesh. In these researches he discovered many new substances, and cleared up details and difficulties as to their relations to one another and to other bodies. Late in life he expressed the most lively interest in Volhard's synthesis of sacrosin and creatins, substances with the preparation of which he had long before been engaged. In this connection it is right that we should mention his elaborate investigation on urea acid and its derivatives. This line of study led him to interest himself in the chemistry of food, and the importance of his work in this direction can scarcely be overestimated. We do not refer alone to his methods of preparing the extract of meat and the food for infants, which have perhaps spread his fame more widely than his strictly scientific work could have done; we refer rather to the influence which his analyses and calculations have had on medical opinion and practice. And this leads us to our fifth head, Liebig's influence on the application of chemistry to physiology, agriculture, and the arts.

Before Liebig undertook his investigations into the chemistry of vegetables, the views (they are sometimes called theories) held as to the manner in which plants are nourished were vague in the extreme. The only point satisfactorily made out was that under the influence of light the green parts of plants are capable of decomposing carbonic acid, giving off oxygen and retaining the carbon. Some of the most careful experiments on the cultivation of plants, first noted by Priestley, is mainly due, believed that the nitrogen of the plant came from soluble organic substances absorbed by the roots, and expressly says that the main use of ammonia in manure is as a solvent of humus, which he supposed to be one source of the carbon in plants, and that although the case of the one plants had been analysed, the importance of the mineral constituents of vegetables was not at all recognized. Liebig undertook the investigation of this question in 1840. He showed that the plant derives its nourishment partly from the air, partly from the soil; the carbonic acid and water, and the carbonic acid, which he showed to be the source of the plant's nitrogen, comes from the atmosphere; while the potash, soda, lime, iron, magnesia, sulphuric acid, phosphoric acid, and silica come from the soil. No exhaustion can take place of the former, but the soil contains only a limited amount of the latter in a soluble state, and when this is used up the soil becomes barren. He showed that the soil contains any one of the necessary substances makes the soil barren. He showed how manure acts by restoring these deficient ingredients, and how, when the land is left fallow, atmospheric influences decompose the insoluble minerals and supply the soil with what has been removed. He further showed that plants can take their nourishment from the soil the articles of plant food in various proportions,

and thus explained the submergence of a rotten crop. The animal and human body he reproduced contained the essential animal substances, and a small quantity of mineral salts, because he held that while the animal supplies ammonia it does not always supply at first enough, particularly to the less fatty parts. He bought a bull not to test his experiments, and treated it with the artificial manure, but the result was disappointing. The manure was not inactive, but not nearly so active as it should have been. It was many years before he detected the cause. To prevent the manure wasting away the alkalies in the manure, he had taken great pains to render them insoluble. Way's experiments on the absorption of manure by the soil (1850) confirmed him in his suggestions. In 1857, I wished to improve his soil, and in my blindness believed that, in the marvellous chain of laws leading life on the earth's surface and keeping it always warm, a link had been forgotten which I, weak mortal, could not supply.

Now, just as he showed that plants require carbon—often small quantities of particular substances, for they will not grow at all, however great may be the quantities of other kinds of food supplied, so he showed that animals also require, not only a proper quantity of food, but also the right proportion of the different kinds of food, animal as well as mineral. In the classification of the kinds of organic food into hydrocarbon and alcohol, it was necessary to examine whether the (alcoholized, starch, sugar, &c.) should be placed alongside of fat. It was thus led to inquire into the power of the animal body to produce fat from starch or sugar, and came to the conclusion, contrary to the opinion of Dumas and Berzelius, that the fermentation does take place.

Liebig's investigations into the relations of organic chemistry to physiology led to the conviction that the only source of animal heat is the heat produced by the oxidation of the tissues, and, strange as it may appear, he had to defend this view against what he truly enough, though not quite justly, called the "phlogiston" of his medical opponents. He also succeeded in demonstrating, it is to be hoped finally, the ridiculous belief in the possibility of the spontaneous combustion of the human body.

Liebig's theory of FERMENTATION (*of r*) aimed at explaining the phenomena on purely chemical principles. He introduced the physiological theories, and looked upon the growth of fungi rather as inevitable of the fermentation, adding the fermentative changes of amygdaline and similar substances as cases of fermentation without life.

We have still to notice one of Liebig's chemical discoveries, of secondary interest chemically, but of great practical importance. This is his discovery of a method for depositing a uniform film of metallic silver on smooth clean surfaces. This method may render it possible to use reflectors for astronomical telescopes of a size unattainable with the old speculum metal.

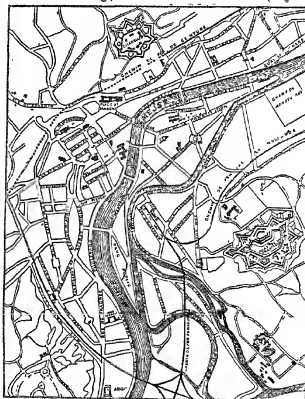
The most important of Liebig's works separately published are as follows:—*Lehrbuch der Analytischen organischen Chemie*, 1835, 41, 42, 1858. *Der Chemie in ihrer Anwendung auf Agrikultur und Physiologie*, 1840, 9th ed., 1875-76. *Die Theorie der Gärung und die Gärungschemie in ihrer Anwendung auf Fäulnis und Pathologie*, 1842, 3d ed., 1847. *Handbuch der Chemie und Technologie für Pharmazeuten*, 1841, vol. 1 of *Becker's Handbuch der Pharmazie*, new ed., Chemische Reihe 1844, 6th ed., 1859. *Chemie in ihren Anwendungen auf die Naturgeschichte und die Technik*, 1847. *Grundriss der Agrikultur-Chemie*, 1855. *Der Thee in Paris und der Ländliche Thee*, 1856. *Naturgeschichte der Luft* also the *chemische Landwirtschaft*, 1859. *Lehrbuch der Agrikultur-Chemie*, a p. volume collection of some of his addresses and shorter publications. Liebig's scientific papers were chiefly published in *Poggendorff's Annalen* (1839), and in *Liebig's chemische Annalen* (1840 and 1864, and also as a separate publication). (C. G. B.)

LIECHTENSTEIN, a sovereign and independent principality, the smallest in Germany, is bounded on the N E and E by the Austrian Vorarlberg, on the S, by the Swiss canton of Grisons, and on the W. by the Rhine, while on the north it tapers almost to a point. The state, consisting of the lordships of Vaduz and Schellenberg, is only 15 miles in length, hardly over 5 miles in its average breadth, and comprises an area of 68 square miles. Excepting in the immediate neighbourhood of the Rhine, the surface of the country is mountainous, being traversed from south to north by spurs of the Ebneth Alps, which at some points attain an altitude of about 7000 feet. The climate is mild, and the soil generally fertile and well watered. The chief products are corn, wine, flax, fruit, and timber. Agriculture and the tending of cattle form the chief employment of the inhabitants. A branch of the Vorarlberg railway from Feldkirch to Buchs passes through

the state. In 1876 the population amounted to 8664, of old German extraction, and Roman Catholics by confession. The capital is Vaduz or Liechtenstein, with 960 inhabitants.

Until 1862 Liechtenstein formed part of the German confederation, but from that date it has been constitutionally independent, although for the sake of convenience the postal system, customs, and currency are under the general Austrian administration, from which the principality receives annually some £1000 as its share in the customs dues. According to the charter of the 28th September 1862, Liechtenstein is a constitutional monarchy, the sovereign prince sharing the legislative power with a diet of fifteen members (elected biennially), of whom three are nominated by the prince, and twelve elected by popular suffrage. The chief control of the principality is vested on the prince by a court of honour, which also serves as the judicial court of appeal of first instance, the ultimate court of appeal being at Innsbruck. The immediate direction of the principality in administrative and judicial matters is at Vaduz. The inhabitants are free from military service and direct taxation. The annual revenue amounts to about £8000. Although the sovereignty of the prince is so small, his estates in Austria and elsewhere render him one of the wealthiest landed proprietors in Germany, his income from them amounting to nearly £240,000 sterling. The house of Liechtenstein, one of the oldest in Central Europe, was elevated to the princely dignity in the early part of the 17th century. Anthony Florian in 1715 obtained a vote and seat in the imperial diet, and after the union, in 1718, of the lordships of Vaduz and Schellenberg into one principality under the name of Liechtenstein, his privileges were, in 1723, confirmed to his successors. See Jacob von Falke, *Geschichte des fürstlichen Hauses Liechtenstein*, 2 vols. (Vienna, 1898-77).

LIEGE (Germ., *Lüttich*, Dutch, *Luik*, Walloon, *Lige*; usually Latinized as *Lecodum*), a city of Belgium, the chief town of the province of Liège, is situated in 50° 39' N lat. and 5° 31' E long, 56 miles east of Brussels (82½ by



Plan of Liège

rail), and 16 miles south-west of Maestricht. It occupies a remarkably fine position on the banks of the Meuse, which at this point is joined by the Ourthe. On the left-hand side stands the older city with the citadel and the more important historical buildings, on the right hand lies the lower and more modern portion, commanded by the fort of the Chartreuse. The river, there 460 feet across, is spanned by several bridges, of which the Pont des

Archés, rebuilt in 1860-63, dates originally from the 8th century, and plays a prominent part in the local annals. Place St Lambert is the historical centre of Liège. Here still stands the noble building—erected (1508-40) by Cardinal de la Marck in a late Gothic style—which down to the revolution was the palace of the prince-bishops, and is now with its modern extensions occupied by the public courts and other administrative offices. And here, till it was raised by the revolutionists in 1794, and completely removed in 1808, stood the old cathedral of St Lambert, originally founded in 712, and rebuilt after a great fire at the close of the 12th century. The rank of cathedral was in 1802 transferred to the abbey-church of St Paul, the foundation of which is assigned to 958, though the nave is no older than the 16th century, and the choir belongs to 1280. The stained glass and the wood carving of the pulpit by Ceefs deserve particular mention. Other churches of note are St Jacques, a fine Gothic building founded in 1016, with a Romanesque west tower and polygonal choir; St Barthélemy, a completely modernized basilica of the 13th century; St Martin, founded in 962 and rebuilt in the middle of the 16th century; and the Holy Cross, founded by Nolker in 973, with a west choir dating from the 12th century, and the east choir and nave from the 14th. The university of Liège, established in 1317, is a flourishing institution, with about 40 professors and 800 students, a library of 100,000 volumes, a botanic garden (1819, formerly the Jesuits' garden), a school of mines (1825), a school of arts and manufactures, a normal grammar school, and several other auxiliary foundations. There is no theological faculty, the theological seminary, with a large library of its own, being an independent institution. The city further possesses a blind asylum, a deaf and dumb institute, school of design, painting, and music, a zoological garden, a municipal museum, &c. The Place d'Artois is adorned by an equestrian statue of Charlemagne by Jéhotte, and in front of the theatre stands a bronze statue of Gretry, the composer, who was born at Liège.

Liège is the centre of a great mining district rich in coal, lead, zinc, and iron; the coal-mines extend under the city and the river. In 1879 358,100 tons of coal were raised in the province, 22,156 persons being employed in the pits. The iron, lead, and zinc foundries in the town and neighbourhood work up large quantities of ore in addition to the local supply. Steel, copper, and tin wares, steam-engines and general machinery, woollen goods, excellent saws and files, nails, needles, mirrors, clocks, leather, paper, and oil are among the products of the versatile industry of the place. Liège diamonds have long enjoyed a wide reputation. They give employment to about 30,000 workmen, who for the most part work in their own houses, though in 1873 a large factory was erected in the American style for making all parts of the weapon by machinery. In 1875 188,806 single-barrelled guns, 118,121 double-barrelled guns, 408,649 revolvers, 19,596 saddle pistols, and about 85,000 army weapons, &c., were passed by Liège through the Government testing office. The town is favoured by the fact that the town is an important junction on the Rhemish Belgian Railway, commands more than one navigable river, and has long been one of the leading cattle-markets in the country. The population was 115,956 in 1874.

About 720 the bishops of Tongres, after oscillating between Tongres and Maastricht, settled at Liège, though they did not take the title bishop of Liège for more than two centuries. Their church of St Lambert received large territorial endowments, and in the 14th century they became princes of the empire. For centuries the struggle was maintained between episcopal tyranny and civic independence; and feudal and imperial armies were called in to crush the insurrections. In this way Charles the Bold of Burgundy made himself master of the city in 1467, and again with much bloodshed and barbarity in 1468. Bishop Ferdinand in 1680 and Bishop Maximilian in 1884 were each imposed on the citizens by force of arms, and kept them down by means of a strong citadel and foreign soldiers. In 1691 Liège was bombarded for five days by Marshal de Boufflers; in 1702 Marlborough took the citadel by storm from a French garrison; and in 1792 the town was the scene of a great defeat of the Austrians by the French.

See *Reynard, Hist. de Liège*, *Reynard, Hist. de l'ancien pays de Liège*, and *Liège pittoresque*. *Polain and Baethem, Courumes du pays de Liège*; *Baron de Godefrid, Hist. de Liège* (2d ed., 1868); *Reynard, Biographie Liégeoise*.

LIEGNITZ, the capital of a district of the same name in the Prussian province of Silesia, is picturesquely situated on the Katzbach, just above its junction with the Schwarzwasser, and 40 miles west-north-west of Breslau. It consists of an old town, surrounded by pleasant, shady promenades, and several well-built suburbs. The most prominent building is the palace of the former dukes of Liegnitz, rebuilt after a fire in 1836, and now occupied by the administrative offices of the district. The Ritter Academie, founded by the emperor Joseph in 1708, for the education of the young Silesian nobles, was reconstructed as a gymnasium in 1810. The Roman Catholic church, with two fine towers, contains the burial vault of the dukes. The principal Lutheran church dates from the 14th century. There are also several other churches and schools, and a number of benevolent institutions. The theatre, the barracks, the military hospital, and the town-house are the most noteworthy of the remaining buildings. The manufactures of Liegnitz are considerable, the chief articles being cloth, wool, leather, tobacco, and pianos. Its trade in grain and its cattle-markets are likewise important. The large market gardens in the suburbs grow vegetables to the value of £20,000 per annum. Population in 1880 37,168, about one-fourth being Roman Catholics.

Liegnitz is first mentioned in an historical document in the year 1004. In 1164 it became the seat of the dukes of Liegnitz, who greatly improved and enlarged it, especially in 1170 and 1175. The dukes were members of the illustrious Piast family, which gave so many kings to Poland. At Wahlstatt, near Liegnitz, the tide of Mongol invasion was stemmed, in 1241, in a hard-fought battle between the Tartars and the Christian army under the duke of Silesia. The victory, indeed, remained with the invaders, but the obstinate resistance deterred them from any further attack on Germany. During the Thirty Years War Liegnitz was taken by the Swedes, but was soon recaptured by the Imperials. The Saxon army also defeated the imperial troops near Liegnitz in 1634. On the death of the last duke of Liegnitz in 1675, the duchy came into the possession of Austria, which retained it until the Prussian conquest of Silesia in 1740-45. In 1760 Frederick the Great gained a decisive victory near Liegnitz over the Austrians under Laudon, and in 1813 the last of important battles in the neighbourhood was completed by Blücher's defeat of the French at the battle of the Katzbach. During the present century Liegnitz has been uniformly prosperous, and its population has increased fivefold since 1800. See *Schuchard, Das Stadt Liegnitz* (Berlin, 1858); *Semmler and Krafft, Chronik von Liegnitz* (Liegnitz, 1861-78).

LIEN, in English and American law, properly means a right of detaining goods of another in your possession until a debt due to you from the owner of the goods is paid. To the original or common law conception of a lien it would appear to be necessary that the goods over which lien is claimed should be actually in the possession of the creditor, and further that the debt should have been incurred with reference to the goods which are detained. Such is the lien of the workman to whom articles are delivered for the purpose of being operated upon by him in the way of his trade. He is entitled to keep the article he has worked at until remuneration for his labour has been made to him. Of precisely the same character is the lien of the carrier over the goods conveyed by him, for the fare; or of the farrier over the horse which he has cured, for his fee; or of blacksmiths, shipwrights, and other artificers for the wages they have earned by working at or on the thing detained. Thus, the true lien of the English law, is denominated a particular lien in contradistinction to a right of detainer exercisable over the property of another, for a debt not incurred in relation to the thing detained. The latter is a general lien. The former is said to be favourably, the latter strictly, construed by the law. The former arises by implication of law from the relation of the parties; the latter requires a special contract either expressed in terms or to be inferred from the usage of trade. Again, as possession is the foundation of lien in common law, a parting with the possession would in general operate as a waiver

or forfeiture of the lien. The same effect would follow of course from any agreement by the lien holder to give up his right while retaining possession of the property. Again as a general rule lien men have only a right of detention, not a power of sale,—a fact which distinguishes it from a pledge of property in security for a loan. But in special cases power of sale have by statute or judicial decision been added to liens. Thus innkeepers now have, in addition to their ordinary right of lien, power to sell goods and chattels left with them after six weeks (41 & 42 Vict. c. 38). In the United States the principle of the particular lien has been developed in a notable manner in protecting the rights of workmen employed in building. At common law, the building belongs absolutely to the owner of the soil, and accordingly, when a house is erected by contract, the contractor may receive payment from his employer and may fail to pay the labourers he has employed, who are consequently left without redress. The "mechanics' liens," created by statute in several of the American States, give labourers a lien over the building which they have erected for their unpaid wages. Notice having been filed in the prescribed manner, they acquire a right to have their wages paid out of the property, with it may if necessary be sold for that purpose. A similar preferential charge, not depending on possession, is recognized by the law in various cases, and goes by the name of lien. Thus in equity an unpaid vendor has a charge for the amount of the purchase money, or the balance thereof, over the estate, although it may no longer be in his possession. Charges of this kind are sometimes denominated equitable liens. Of the same nature is the charge acquired over a ship by a person who has supplied her with necessaries for the voyage under a lawful contract with the master (maritime lien).

LIERRE, or LIÈGE, a town of Belgium, in the province of Antwerp, 9½ miles south-east of Antwerp (on the railway to Malines), at the junction of the Great and Little Noëthe. It is a busy place of 15,659 inhabitants (1874), and manufactures silk, lace, and shoes, beetroot sugar, and a peculiar kind of white beer known as *caveuse*. The church of St Gommaire (in plan a Latin cross with a lofty tower in front) is one of the most notable buildings of its class in Belgium. It was commenced in 1425, but not completed for more than a century. Of the fine stained glass windows three were presented by the emperor Maximilian.

LIÈGE, which dates from the 9th century, owed much to the favour of the dukes of Brabant, to whose territory it belonged. The more important facts in its annals are the celebration of the marriage of Philip the Fair with Joanna of Castile (1496), the residence in the town of Christian II. of Denmark during his exile, and the contests between the Dutch and Belgian forces in 1830. Joseph II. ordered the fortifications to be razed in 1784.

LIFE ASSURANCE. SEE INSURANCE.

LIFEBOAT. It will be convenient to consider here, not the lifeboat simply, but also other means of saving life at sea. When it is borne in mind that the vast commerce of such a country as Great Britain extends to every part of the world, that the arrivals and departures from the ports of the country in one year average six hundred thousand vessels, that these are manned by more than two hundred thousand men and boys, and carry goods to the estimated value of six hundred millions sterling, with unknown thousands of passengers, that its seaboard is nearly 5000 miles in extent, many parts of it being exceedingly dangerous to shipping, that about two thousand wrecks occur every year on its shores, and above seven hundred lives are lost, the necessity that exists for a well-organized system of life-saving apparatus becomes very apparent. It is satisfactory to be able to add that this well-organized system is most efficiently provided by the Royal National Lifeboat Institution, with its splendid fleet

of two hundred and seventy-one lifeboats, and by the Rocket Service. The number of lives saved annually, either by the lifeboats or by special excursions for which the institution has granted rewards, averages in round numbers nine hundred, and by far the greater proportion of these (four-fifths) are saved by lifeboats. These lifeboats, too, are the means of saving every year from twenty to thirty vessels which, owing to stress of weather, exhausted men, &c., would almost certainly have been lost but for the aid afforded by the fresh and experienced lifeboat crews.

The qualities of the lifeboat first deserve our attention. These are such that this boat is able to live in seas, and go into positions of danger, that would overwhelm ordinary boats or insure their destruction. Eight important qualities are possessed by it in a very high degree—(1) buoyancy, (2) great lateral stability, or resistance to upsetting, (3) the power to right itself if upset, (4) the power of immediate self-discharge when filled with water, (5) strength, (6) stowage room for a large number of passengers; (7) speed against a heavy sea, (8) facility in launching and taking the shore.

The buoyancy of the institution's lifeboat, or its inability to sink, be it ever so deeply laden, is secured chiefly by means of a watertight deck or floor, air-cases round the sides inboard, and two large air-chambers, one in the bow, the other in the stern. The "extra buoyancy" thus obtained cannot be too great so long as it does not interfere with the space necessary for working the boat and stowing shipwrecked persons. The air-cases round the sides serve also to confine any water shipped to the centre of the boat, a point of great importance. There is an airtight space between the boat's floor and its bottom, filled partly with air partly with cork-balling, which gives it additional buoyancy, but the air-chambers above the floor would float the boat even if she were stove in and this space filled with water. In a 33-feet boat the buoyancy obtained by all its chambers is equal to 11½ tons.

Stability is obtained chiefly by means of ballast. Immense difficulty was experienced in arriving at the present form of the institution's splendid boat, because qualities of differing value had to be sacrificed to each other in due proportion. Thus, while breadth of beam secured stability, it seriously interfered with the self-righting quality. Ballast, therefore, in the form of a heavy iron keel, instead of breadth, became necessary to give the requisite stability.

Fig. 1 represents, let us say, the 38-feet, double-barked, tanned, self-righting, and self-emptying lifeboat of the institution on its transposing carriage, ready for launching, figs. 2 and 3, respectively, a section and a bird's-eye view of the same. The

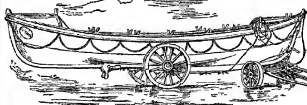


FIG. 1.—TEN-OWNED LIFEBOAT.

breadth is 8 feet, with stowage room for forty-three persons—thirty passengers and thirteen of a crew. The trestled lines (fig. 1) enable people in the water to clamber aboard, or, without assistance. The shaded parts of figs. 2 and 3 show the position of the air-cases. The white oblong space in fig. 3 shows the free space available for crew and passengers. In fig. 2 are seen the depth to which the air-cases descend, and the height to which the bow and stern air-chambers ascend above the gunwale, also the ballast space between the floor and the keel.

The self-righting power is due to the large elevated air-chambers in bow and stern, coupled with great sheer, or rise fore and aft, of gunwale, to the iron keel, which weighs

about 9 cwt in a 33-foot boat, and to the air-cases and ballast, which latter weighs from 7 to 8 cwt. When the boat is upset it cannot rest on its two elevated air-chambers, it necessarily rolls on one side, then the heavy iron keel and ballast come into play and drag it back to its right position.



FIG. 2—Lan.boat (Sheet Plan)



FIG. 3—Lifeboat (Deck Plan)

in a few seconds. This principle of self-lighting was discovered—at all events first exhibited—at the end of last century, by the Rev James Biemess of Orkney, but was not finally adopted till the middle of the present century.

The self-emptying quality depends chiefly on the well-known physical fact that water must find its level. The float of the lifeboat (fig. 2), the dotted double line extending from stem to stern, on which the men's feet rest when seated on the thwarts, is placed so as to be very slightly—2 or 3 inches—above the level of the sea when the boat is fully manned and loaded. In this floor there are six holes of 6 inches diameter, into which are fitted six metal tubes. These pass through the boat's bottom into the sea. The water of course enters them, but cannot rise above them into the boat, because it cannot rise above its own level. Valves at the upper ends of the tubes, opening downwards, prevent the annoyance of water spouting in, but allow it freely to run out. When, then, a billow overwhelms the boat, and fills it, the water rushes violently down the discharging tubes until it reaches the sea-level, by that time it has descended below the level of the floor and left the boat empty. So complete and swift is the process that a filled boat frees herself in about half a minute. This principle was first applied by the institution in 1851. Lifeboats devoid of the self-discharging quality become temporarily useless when filled by a sea, as they can be emptied only by the slow and laborious process of baling.

Strength, that will enable the lifeboat to suffer treatment which no ordinary boat could stand, is dependent on peculiarity of construction and material. The best Honduras mahogany is used, and the diagonal plan of construction adopted,—that is, the boat has two distinct "skins" of planking, both sets of planks being laid on in a position diagonal to the boat's keel and contrary to each other, besides passing round from gunwale to gunwale under the boat instead of from stem to stern as in ordinary boats. The skins have a layer of prepared canvas between them, and thus great strength and elasticity are combined.

The *carriage* of the lifeboat is an essential adjunct for the purpose of conveying it over any kind of road or beach to the place where it may be required. It can be run deep into a raging surf, and the boat, with its crew seated and oars ready out, can be launched at once, by blocks and tackle, so as to enable the men to dash forward and meet the incoming rollers with sufficient force to propel it through or over the seas, and thus avoid the risk of being hurled back on the beach. Each lifeboat is furnished with a set of spare oars, as these are frequently broken.

The institution's lifeboats are of various sizes—six, eight, ten, and twelve oared,—and they are placed at various

points of the coast according to the necessities of each station. Some are called out at long intervals, others, such as those near the Goodwin Sands, are constantly on duty in rough weather—that of Ramsgate having a steamer to attend on it, which lies in harbour, with its fires banked up, ready for instant action night and day. The average cost of a lifeboat station is £1000,—the boat and equipments, including belts and carriage, costing £550, and the boat-house £350. The average annual expense of maintaining a station is £70, which is expended in paying the crew for going off and saving or attempting to save life from shipwreck, for exercising the lifeboat once a quarter, paying coxswain's salary, replacing gear, and repairs.

The *lifebelt* of the institution is a part of the equipment of the lifeboat which merits special attention, because it is a very efficient contrivance, and has been the means of saving many lives in time past. Fig. 4 shows its appearance and the manner in which it is worn. It was designed in 1854 by Admiral J. R. Ward, the institution's Chief Inspector of Lifeboats. It is made of cork fastened on canvas, and contains great buoyancy with strength and flexibility. It not only floats a heavily-clad man head and shoulders above water, but enables him to support a comrade easily—the extra buoyancy being 25 lb. One of its distinctive features is its division at the waist, by which means great freedom of action is allowed. It serves also as a species of armour to protect the wearer's most vital parts from blows against rock or wreck, while it affords some degree of warmth. No man may serve in the lifeboats of the institution without it, and it would be well if every British ship were obliged to carry lifebelts of this kind.



FIG. 4

History.—The first lifeboat was conceived and designed by Lionel Lukin, a London coachbuilder, in 1785. Encouraged in his philanthropic plans by the prince of Wales (George IV.), Lukin fitted up a Norway yawl as a lifeboat, took out a patent for it, and wrote a pamphlet descriptive of his "Inamemorable Boat." Buoyancy was obtained by means of a projecting gunwale of oak and air-chambers inside—one of these being at the bow, another at the stern. Stability he secured by a false iron keel. The self-lighting and self-emptying principles he seems not to have thought of; at all events he did not compass them. Despite the patronage of the prince, Lukin went to his grave a neglected and disappointed man. But he was not altogether unsuccessful, for, at the request of the Rev. Dr Sharp, Lukin fitted up a coble as an "inamemorable" lifeboat, which was launched at Bamberough, saved several lives the first year, and afterwards saved many lives and much property.

Public anxiety in regard to shipwreck was at length swept away by the wreck of the "Adventure" of Newcastle in 1789. This vessel was stranded only 300 yards from the shore, and her crew dropped, one by one, into the raging breakers in presence of thousands of spectators, none of whom dared to put off in an ordinary boat to the rescue. An excited meeting among the people of South Shields followed; a committee was formed, and arrangements were entered for the best models of a lifeboat. This called forth many plans, of which those of William Wouldhave, a painter, and Henry Gienstead, a boatbuilder, of South Shields, were selected. The committee awarded the prize to the latter, and, adopting the good points of both models, gave the order for the construction of their boat to Greenhead. This boat was rendered buoyant by nearly 7 cwt of cork, and had very taking stem and stern-posts, with great curvature of keel. It did good service in after years, and Gienstead was well rewarded; nevertheless no other lifeboat was launched till 1798, when the duke of Northumberland ordered Greenhead to build him a lifeboat which he endowed. This boat also did good service, and its noble owner ordered another in 1800 for Oporto. In the same year Mr Cathcart Dempster ordered one for St Andrews, where, two years later, it saved twelve lives. Thus the value of lifeboats began to be recognized, and before the end of 1808 Greenhead had built no fewer than thirty-one boats—eighteen for England, five for Scotland, and eight for foreign lands. That these boats were lamentably insufficient to meet the necessities of England was shown year after year by the ever enlarging record of wreck and loss of life on her shores; nevertheless, public interest in lifeboats was not thoroughly aroused till 1828.

In that year Sir William Hillary, Bart., stood forth to champion the lifeboat cause. Sir William dwelt in the Isle of Man, had

assisted with his own hand in the saving of three hundred and five lives, and felt the horrors of shipwreck so keenly that he resolved to stir up public men and the nation generally to a sense of their duty in regard to this matter. Eventually, in conjunction with two members of parliament—Mr Thomas Wilson and Mr George Hibbert—he founded the "Royal National Institution for the Prevention of Life from Shipwreck." This, perhaps the grandest of England's charitable societies, and now named the "Royal National Lifeboat Institution," was founded on the 4th of March 1824. The king and many of the nobility and gentry patronized it. The archbishop of Canterbury presided as its patron; the next day the king—among them the Wilkes—pleaded the cause; the institution was launched under the most favourable auspices, and began its noble career with a sum of only £9826. In the first year twelve new lifeboats were built and placed at different stations, besides which thirty-nine lifeboats had been stationed on the British shores by benevolent individuals and by independent associations over which the institution exercised no control though it often assisted them. In its early years the institution placed the mortar apparatus of Captain Mauley at its many stations, and provided for the wants of sailors and other saved from shipwreck. The latter duty was soon efficiently discharged by the "Shipwrecked Fishermen and Mariners' Royal Benevolent Society." At the date of the institution's second report it had contributed to the saving of three hundred and forty-two lives, either by its own life-saving apparatus or by other means for which it had granted rewards. With fluctuating success, both regards means and results, the institution continued its good work from year to year—saving many lives, and occasionally losing a few brave men in its tremendous battles with the sea. District or branch societies were established in most of the coast towns. Ultimately it began to be recognized that inland towns owed something to the lifeboat cause, as well as towns on the coast, and now such cities as Manchester, Liverpool, Glasgow, Edinburgh, &c., have presented lifeboats to the institution and become annual contributors. Since the adoption of the self-righting boats, loss of life in the service has been comparatively small and infrequent.

Towards the middle of this century the lifeboat cause appeared to lose interest with the public, though the life-saving work was prosecuted with unremitting zeal, but the increasing loss of life by shipwreck, and a few unusually severe disasters to lifeboats, brought about the reorganization of the society in 1836. The late Prince Albert became the patron of the institution in conjunction with the late king of the Belgians, and afterwards Her Majesty the Queen, who had been its patron since her accession, became an annual contributor to its funds. About the same time its present secretary, Mr Richard Lewis, barrister-at-law, was appointed. The following year (1837) the Duke of Cumberland became its president, and from that time forward a tide of prosperity set in, which is literally unrepresented in the history of benevolent institutions, both in regard to the great work accomplished and the pecuniary aid received. Its flow of property has never since been checked. In 1850 its committee undertook the immediate superintendence of all the lifeboat work on the coasts, with the aid of local committees. Periodical inspections, quarterly exercise of crews, fixed rates of payments to coxswains and men, and quarterly reports were instituted, at the time when the self-righting self-empowering boat came into being. This boat was the result of a hundred-guinea prize, offered by the president, for the best model of a lifeboat, with another hundred to defray the cost of a boat built on the model chosen. In reply to the offer no fewer than two hundred and eighty models were sent in, not only from all parts of the United Kingdom, but from France, Germany, Holland, and the United States of America. The prize was gained by Mr James Beesling of Great Yarmouth, whose model, slightly modified by Mr Penke, one of the committee of inspection, became the foundation of the present boat, which, having been still further improved as time and experience have suggested, is now probably as near to perfection as can be attained.

The earliest year permitted to exhibit the progressive work of the institution is to contrast the report of 1860 with that of 1880. In the former year the receipts had dwindled down to £84 of subscriptions and donations, which, with £270 of dividends (on a capital of £9000) and a balance of £476 on hand, gave an available income of £350. The expenditure was £350, and the lives saved were about one hundred. In 1880 donations and annual subscriptions amounted to £28,240, dividends and interest (on a capital of £331,000) amounted to £9266. The total income was £38,506, besides legacies in the same year to the amount of £40,789. The expenditure, including liabilities, was £40,596, and the number of lives saved was about seven hundred. In the past twenty disastrous years (1861), the institution has saved 966 lives by its boats, and granted rewards for the saving of 156 more, besides rescuing 93 vessels from destruction. The total number of lives saved either by the lifeboats, or by special exertions for which the institution has granted rewards, since its formation, is 28,724, for which services 66 gold medals, 939 silver medals, and 209,000

in cash have been granted as rewards. So highly are the services of the institution appreciated that donations of boats, gifts of money, acknowledgments, and legacies come in from nearly all quarters of the globe, in sums varying from a shilling to £10,000.

Rocket Apparatus.—This, next to the lifeboat, is the most important and successful means by which shipwrecked persons are rescued on the British shores. Many vessels are cast every year on the rocky parts of the coasts, under cliffs, where no lifeboat could be of service. In such places the rocket alone is available. It is worked by the men of the coastguard, with the aid, in a few places, of volunteer rocket brigades. The courage and skill displayed in its use are evinced by the saving of many lives every year, and by the fact that a large proportion of the medals given by the lifeboat institution for heroic conduct are awarded to the men of the coastguard, who, besides managing the rockets, frequently man the lifeboats and also effect rescues in their own boats. The number of lives saved by means of the rocket apparatus in the year ending 30th June 1881 was 657. This, however, is the greatest number saved in any one year since 1856, at which date the life-saving rocket apparatus was placed under the entire control and management of the Board of Trade. The rocket stations on the coast at the 30th June 1881 numbered 288. The Board of Trade now gives a sum of money for each life saved, besides awarding silver and bronze medals for acts of special gallantry.

The apparatus consists of five principal parts, viz, the rocket, the rocket-line, the whip, the hawser, and the self-lubricating. The mode of working it is as follows: A rocket, having a light line attached to it, is fired over the wreck. By means of this line the wrecked crew haul out the whip, which is a double or endless line, rove through a block with a tail attached to it. The tail-block, having been detached from the rocket-line, is fastened to a mast, or other portion of the wreck, high above the water. By means of the whip the rescuers haul off the hawser, to which is hung the travelling or sliding lifeboat. When on the hawser the hawser has been fast to the mast, about 18 inches above the whip, and its other end is tacked fast to an anchor on shore, the lifeline is run out by the rescuers, and the shipwrecked persons, getting into it one at a time, are hauled ashore. Sometimes, in cases of urgency, the lifeboat is lowered by means of the whip alone, on which the system of the board with instructions to wrecked crews, printed in English and French, is sent off with the whip, as ignorance in regard to the mode of working the apparatus has been the cause of much loss of life. Such ignorance is culpable, because the Board of Trade issues enamelled plates with instructions, which are supplied gratuitously to shipowners and masters to be placed on conspicuous parts of their vessels, and are fixed in public places along the British coast, while every certificated officer in the mercantile marine is required to understand the working of the rocket apparatus.

The late Captain G. W. Mauley, F.R.S., in 1807 invented, or at least introduced, the mortar apparatus, on which the system of the rocket apparatus is founded. Previously, however, in 1791, the idea of throwing a rope from a wreck to the shore by means of a shell from a mortar had occurred to Sergeant Bell of the Royal Artillery, and about the same time, to a Frenchman named La Fere. Both of whom made successful experiments with their apparatus. In the same year (1807) a rocket was proposed by Mr Trengrove of Helston in Cornwall, also a hand and lead line as means of communicating with vessels in distress. The *heaving-cable*, a fruit of the latter suggestion, is now used at every station in the kingdom. In 1814 forty-five mortar stations were established, and Mauley reserved £2000, also addition to previous grants, in acknowledgment of the good service rendered by his invention. Mr John Dennett of Newport, Isle of Wight, introduced the rocket, which was afterwards extensively used. In 1826 four places in the Isle of Wight were supplied with Dennett's rockets, but it was not till after Government had taken the apparatus under its own control, in 1836, that the rocket now in use was adopted. It was invented by Colonel Boxer, and its peculiar characteristic lies in the combination of two rockets in one case, one being a continuation of the other, so that, after the first compartment has carried the machine to its full elevation, the second gives it an additional impulse, whereby a great increase of range is obtained. The rocket has now entirely superseded the mortar in England.

The *United States Life-Saving Service* is chief among the lifeboat societies of other nations, both as regards the extent of coast embraced and the amount of work done. There are several points of difference between this service and that of England which are noteworthy. In the first place the whole or nearly the whole of its

support is provided for by annual grants of money from Congress. Secondly, besides protecting its vast extent of seaboard, it is to provide for the shores of its great lakes, or fresh-water seas. Then, the coasts of America, unlike those of England, are destitute of human habitations in many places, which renders necessary the constant employment of sailmen for the express purpose of looking out for vessels in distress and manning the surf-boats. It also necessitates the erection of houses of refuge, procured so as to afford shelter and food to shipwrecked crews for a considerable time, at places where, without such provision, those who escape the sea would probably perish from hunger and exposure.

The shores of the United States—lakes and sea—are over 10,000 miles in extent, embracing almost every variety of climate and formation of land. This vast extent of coast-line is divided into 12 districts, with a total of 279 stations. Of these 139 are on the Atlantic, 34 on the lakes, and 6 on the Pacific. Those on the desolate coast of Florida are houses of refuge only, without boats or apparatus. Many of the stations are closed during the fine months of the year, then crews being disbanded till the winter gales again summon them to the heroic and dangerous work of saving the shipwrecked. That they render noble service in this way may be gathered from the annual reports. The report for 1830 shows that the distresses to shipping in that year amounted to 300; that on board of the vessels thus endangered there were 1989 persons, of whom 1980 were saved and only 9 lost. The property imperilled at the same time was estimated at, in round numbers, \$760,000, of which over \$640,000 worth was saved, besides which, in one hundred and twenty-eight instances, stranded vessels were hove off, and piloted out of danger by the surfmen. The total number of lives saved by this service, since the introduction of the present system in 1871, to the close of the fiscal year in June 1881, was 11,864, the total number of persons sheltered 2610, and the number of days shelter afforded 7350, the total value of property saved, \$14,958,875.

Owing to the flat shores of the Atlantic coast, and the sparseness of the population, heavy boats are found unsuitable. Only a few boats on the English model exist in the service. The boats chiefly in use are surf-boats, incapable of sea-sighting, and liable to be swamped, but which nevertheless serve well suited for the work, and are admirably managed. They are very light, and can, on their transporting carriages, be easily dragged along the shore by their crews. The cork life-belts worn by the men are of the plan first designed in 1854 by Rear-Admiral Ward. For projecting a line over a stranded vessel, the men use the mortar, or other piece of ordnance, to the rocket. In addition to the travelling life-buoys, they use a mattress car, or small covered boat, which can hold three or four persons, who, entering it by a small manhole, are slung in and drawn ashore, safely protected from injury, even though overboarded by the surf. Thus also, contrivances have been of great service in rescuing invalids, children, and aged persons. The total cost of the service is somewhere about £200,000 a year.

The history of the United States Life-Saving Service may be said to have begun in 1848, though half a century before that the Humane Society of Massachusetts had erected some huts of shelter and stationed some boats on the coast. In that year the United States Government was led to consider the subject of loss on their shores, chiefly through the energy of the Hon. W. A. Newell of New Jersey, a member of the House of Representatives. Captain Douglass Ottinger (the inventor of the life-buoy) was charged with the management and reconstruction of the service. The impetus given to it at this time was never quite lost. Again, in 1854, renewed efforts were made to improve the service, but no great progress was made till the year 1871, when the present effective system was organized, new stations were built; the patrol system between the stations was introduced; the regular keeping of journals and sending in of reports was ordered; libraries for the use of the men were sent to stations, uniformity in signals was arranged, and a thorough reform in all departments accomplished.

The French Society for Saving Life from Shipwreck, modelled on the basis of the English system, is a vigorous and highly efficient. It continues steadily to extend its operations along the coasts of France, besides introducing its life-saving apparatus into Algeria and other colonies. It was founded in the year 1865, and from that year onward has continued to do good and ever-increasing service in the saving of life from shipwreck. As the date of its report ending 30th June 1881, its lifeboat stations numbered 69, and its mortar or other projectile stations 391. During the year its life-boats and gun apparatus had saved 200 lives and 16 ships, to which may be added 81 lives, for the saving of which the society had granted rewards. From the time of its commencement in 1865 to the above date it has rendered the following noble service:—

Lives saved by its own boats and apparatus	1,826
Lives saved by other means, for which the society granted rewards in gold, silver, and bronze medals, and cash	308

Total of lives saved from the beginning 2,129

Besides this it has saved 146 vessels and succoured 546, and has awarded 28 gold, 120 silver, and 316 bronze medals, 1313 diplomas d'honneur, and about £20,400 in recompenses to those who have assisted in saving life in circumstances of unusual danger. It has also spent about £53,000 in the purchase and repair of its matériel. The reports of the society show that its work is appreciated. At 31st December 1880 the subscriptions and donations together amounted to nearly £2260, and the legacies bequeathed to it the same year were about £1000. The boats chiefly made are built on the model of those of the English institution. The gun is adapted to the rocket in connexion with the life-saving apparatus. In addition to its direct work of saving life, the French society has accomplished much good indirectly by its influence. It has been instrumental in bringing about this result, that, among the qualifications for a captain's certificate in the French mercantile marine, a thorough knowledge in detail of the means of saving life from shipwreck is required. It has also laboured to extend the usefulness and reduce the cost of the gun and rocket apparatus, besides securing that this apparatus, on Mr. Delvigne's system, shall be supplied to every ship of the French navy.

The German Association for the Rescue of Life from Shipwreck, under the patronage of the emperor William, was founded at Kiel in May 1850, and is a prosperous body in regard to its work and funds. It is maintained by voluntary contributions, and has 21 local branches on the coast and 27 in the interior, besides 140 agencies over the country. Previous to 1865 several private societies for saving life from shipwreck existed in the chief seaports of the North and Baltic. These have been absorbed in the present association, the proceedings of which are reported in a paper entitled *From Shore and Sea*, published at Bremen once a quarter, and largely modelled on the *Lifeboat Journal* of the English institution. The association provides the whole extent of the German coast with life-saving apparatus. It has 74 lifeboat stations, 30 of which are provided with the mortar or rocket apparatus. With these means it has, in the year 1880-81, saved 132 lives and 2 ships. The total number of human lives saved by the association since its commencement in 1854. From May 1860 to May 1881 the amount subscribed by its members was £257,300. As in America, the heavy self-righting and self-comprising life-boats have been found to be unsuitable to the thinly peopled and flat sandy beaches of Germany. Lighter and shallower boats have therefore been adopted. These are non-plated and not self-righting, but almost impossible to capsize. The stations are visited at least once a year by an inspector, and the whole system seems to be well regulated and thoroughly efficient.

In addition to the above, lifeboat societies or other lifeboat organizations—formed more or less on the basis of the Netcolt Lifeboat Institution of Great Britain—are to be found in Russia, Italy, and Spain.

Life-saving Hammocks, &c.—Various forms of buoyant mattresses, pillows, and india-rubber cloth life jackets and belts have been contrived. Among these may be specially mentioned the air lifeboat of Admiral Ward, which has four compartments, separately inflated, so that the puncture of one does not quite destroy the belt. Admiral Ryder's hammock also deserves notice. Its virtue lies simply in a cork mattress, which, when rolled up in its hammock, forms an efficient lifebuoy capable of supporting a man with his head and shoulders well above water, and it enables three men to float in an upright position. Cork mattresses are said to be cheaper and more comfortable than those stuffed with hair. Two such hammocks lashed together, about 26 inches apart, will enable two or three men to propel themselves easily through the water. The advantage of having such mattresses in a ship is obvious, for every one on board would be thus provided with a life-preserver.

It has also been suggested that the cushions of dock and cabin seats should, in a similar way, be made life-preservers, and that cabin furniture should be constructed so as to form rafts in cases of emergency. It is well to know, on the authority of the *Philosophical Magazine* (vol. xc. p. 369), that even a hat in a pocket handkerchief and hat in the crown downwards may be used to sustain a drowning man. It need scarcely be added that empty water-cans, tightly bunged, with ropes arranged for clinging to, form pretty good life-preservers.

(R. M. B.)

LIFTS may properly be held to include all sorts of apparatus whose object is the lifting of weights. When the apparatus consists of comparatively small, separate, and portable pieces, it is called *lifting tackle*. When the lifting apparatus reaches that degree of size and complication that entitles it to be called *machinery*, there seems to be no general technical term that will include all kinds, but for the different classes of lifting machines there are such special names as *cranes*, *hoists*, *elevators*, *lifts*, *winding engines*, and *lift pumps*.

There is very little distinction made between hoists,

elevators, and lifts. The word *hoist* refers more particularly to machines used in warehouses and factories for raising goods from one story to another. They are worked by hand or by power, and are for comparatively light loads. *Elevator* is used in two different senses. It refers to apparatus for lifting passengers to the upper stories of buildings. It also refers to the very different sort of apparatus used in grain-mills and storehouses for transferring the grain from one floor to another. The grain is drawn along channels or pipes, which are sometimes vertical and more often inclined, by means of a rotating archimedean screw, or of a strap continuously travelling upwards through the interior of the channel and carrying, fastened to it, a series of small buckets. Occasionally, if the inclination to the horizontal be small, a broad strap of the same width as the bottom of the channel runs along that bottom, and carries the grain with it simply lying on its upper surface. This latter method of transportation is more efficient, however, as a horizontal carrier or distributor than as a means of lifting. Grain might also easily be blown up a pipe by an air-blast, but the writer does not know any instances of this method having been used. *Lifts* are constructed either for raising passengers in buildings or for heavier loads, such as freighted trucks and waggons, or the superstructure of bridges and large roofs during their erection.

In lifts or elevators, the working force is either hand, steam, or hydraulic power. Gas-engines are unsuitable as direct sources of power for lifts, but they may be advantageously used to store hydraulic power in an accumulator from which water is supplied to work an hydraulic lift. Electricity has quite recently been used, but has not yet been tried sufficiently to allow of any valuable opinion being formed of its ultimate practical success.

The lift consists of (1) a box or "cage" to contain the persons or material to be raised, (2) a vertical square well or shaft, to the walls of which are attached guides to prevent the cage swinging to and fro; (3) a rope or chain by which to haul the cage upwards from above, or else a long rod or pillar by which to push it up from below, (4) a "barrel" or "sheave" over which to wind the chain or rope, and which is mounted on a shaft lying in bearings firmly supported by the building, or else a cylinder to contain water or steam to actuate the lifting rod; (5) mechanism through which the working power is transmitted to the barrel, or else water or steam piping connecting the cylinder above mentioned with the source of power; and (6) the driving engine or other source of power.

Most accidents happen to lifts through the hauling chain or rope breaking. For the sake of safety, therefore, particular care should be exercised in the choice of material for this part, and an appliance should always be attached to the cage whereby, if the rope breaks, the cage is caught immediately in whatever position it may be at the time of the breakage.

For light loads hempen ropes are sufficient and more convenient than chains, because they are noiseless in their action. If of the best quality (Manila) they are quite as reliable as ordinary chains, and an advantage claimed for them is that their gradual destruction by wear becomes easily apparent, and gives timely warning before they become dangerous, whereas the failure of a chain may take place without any easily visible previous sign having been given. For very heavy loads, however, chains or wire ropes should be used in preference to hempen ropes. Wire ropes may be made stronger for a given weight per foot of length than chains are, but unfortunately as commonly manufactured their quality cannot be certainly relied on. Like hempen ropes, they are almost noiseless.

To insure smoothness and noiselessness in passenger lifts, the sheave over which the rope passes is lined in the groove with leather.

For the sake of safety, the rope by which the cage hangs is often duple. Sometimes even three or four are used. In order that these should give additional safety, each rope must be capable of supporting the load by itself. Generally the load is lifted by one or other kind of power, and descends by the weight of the cage itself. This weight is always much more than sufficient for the purpose, and therefore counterpoises are introduced to balance the greater part of it, thus lessening the work to be done during ascent by an amount equal to the product of the balance weight and the height of the lift. In the commonest arrangement, the balance weights are hung on the same rope as that by which the cage is suspended. This passes over a pulley whose diameter is half the width of the well, so that the cage end of the rope rises vertically from the centre of the roof of the cage. This pulley is keyed on a horizontal shaft, which is driven by power from below, either directly by means of a rope or chain passing over another pulley, or else through intermediate spur gearing. The actual working rope is in this case not attached to the cage. Less frequently the rope from the engine forms one of the suspenders of the cage, the balance weights being attached by separate ropes.

The rope or chain by which the load hangs has to be so strong that its own weight is very considerable. A large excess of strength being more in demand in this kind of machinery than in other kinds, a greater stress than about 1 ton per square inch cannot be put upon the chain or rope (supposed to be of iron). This would make the rope weigh 3·4 lb per foot of length for every ton of load carried. If the height of lift were, for example, 60 feet, then, comparing the top and bottom positions of the cage, there would be in the former 60 feet less of rope on the cage side of the pulley, and 60 feet more on the counterpoise side, than in the latter position, so that if the counter-weight just balanced the load when the cage was at the bottom, it, along with the rope, would outweigh the cage in its highest position by the weight of 120 feet of rope, that is 408 lb for every ton of load, or nearly $\frac{1}{4}$ th of the whole load. Since the whole load—that is, that of cage, ropes, and passengers or goods—is three or four and sometimes five or six times as great as the net load, this is a very serious increase on the *unavoidable* loss of balance resulting from the fact that the cage is alternately loaded and unloaded. The difficulty can be got over by extending the rope downwards from the balance weight to pass underneath a grooved pulley at the bottom of the well, and up from this to the under side of the cage, where it is attached. There will then be an equal length of rope always hanging on each side of the top bearing pulley; but an extra amount of friction occurs at the bearing journals due to the weight of the extra rope. The lower half of the rope may be of cheap inferior material, since there is very little stress upon it.

A precisely similar difficulty occurs if the cage be lifted from below by an hydraulic ram or piston-rod. Occasionally the weight of the cage and ram is left unbalanced. In this case the water pressure on the ram or piston has to support the whole load. Suppose the pressure in the reservoir from which the water is drawn to remain steady during the ascent, then evidently at the top of its stroke the water pressure on the ram is less than at the bottom of its stroke, by the weight of a column of water of section equal to that of the ram, and height equal to the lift. Suppose, for example, that the water pressure at the level of the face of the ram in its highest position is 200 lb per square inch. Then for every ton of total load there must be provided about 11 square inches of piston area. A column of water of this horizontal section and 1 foot high weighs about 4·75 lb. This would give a difference of supporting pressure of 285 lb for every ton of total load in a lift of 60 feet, that is, about $\frac{1}{4}$ th of the total load.

of the cage and the ram is balanced by counterpoises on chains fastened to the top of the cage and passing over a pulley overhead, while the water pressure is used to overcome only the friction, and the additional load of passengers or goods. In this case again, owing to the passage of the chains over the pulleys, the balance is disturbed in a rise of 50 feet, by about 1 lb the weight of the cage and the ram, while the upward water pressure on the ram is the same rise diminished by 4 lb. The former disturbance of balance is a *decrease* of the load resting on the base of the ram, while the latter is a *decrease* of the supporting pressure on the same base. If these were made equal, the cage and load would be perfectly balanced in every position. To make them equal, it would be necessary simply to adjust the ratio of the part of the load borne by the counterpoise to the part borne by the water. Let the former part be W_1 and the latter W_2 , the total load being $W_1 + W_2$. Then for a water pressure of 200 lb per square inch, it would be necessary to have

$$\frac{1}{2}W_1 = \frac{1}{2}W_2, \text{ or } W_1 = \frac{1}{2}W_2 = \frac{1}{2}(W_1 + W_2)$$

For a pressure of 400 lb per square inch, the equation would be

$$W_1 = \frac{1}{4}W_2 = \frac{1}{4}(W_1 + W_2).$$

For 100 lb per square inch it would be

$$W_1 = \frac{1}{2}W_2 = \frac{1}{2}(W_1 + W_2).$$

Thus adjustment would necessitate a large unnecessary consumption of water, because the weight of cage and ram always bears a much greater ratio to the extra weight of passengers or goods than any of the above fractions $\frac{1}{2}$, $\frac{1}{4}$, or even $\frac{1}{2}$. The adjustment being attainable by other means, this waste can in no case be desirable.

If a second cylinder stand beside the lift-well and be connected by a pipe to the cylinder directly underneath the cage, so that there is a continually open passage between the two cylinders, then the supporting rod underneath the cage, together with the column of water leading from its base through the pipe to the second cylinder, is the exact counterpart in compression of the overhead ropes in tension in the other class of machine, and, as counterweights are hung upon these ropes, a balancing weight may be laid on the top face of the water in the second cylinder.

The balance weight, equaling that of cage and ram, rests on a plunger or piston fitting this cylinder, and the rod is extended upwards into a third smaller cylinder, on the plunger of which is admitted, by means of the valve worked from the cage or landing-platforms, an extra amount of water pressure suf-

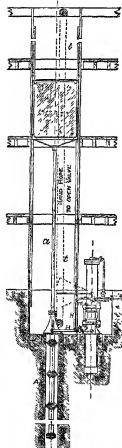


Fig. 1.

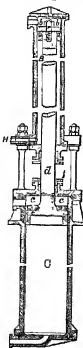


Fig. 2.

ficient to elevate the extra load of passengers or goods. This is the arrangement in Tamm's hydraulic balanced lift. The for example, the ratio of the rope in the overhead arrangement passes from one cylinder to the other, and

never, in the same way as the rope passes from the cage side to the counterweight side of the overhead pulley. This is the lift used, which may be made correct for one position of the lift, becomes disturbed for other positions by a similar amount to that already unbalanced. A perfect balance of the constant part of the total load, namely, that of the cage and ram, is, however, obtained for all positions of the cage by the arrangement shown in figs. 1 and 2. This is the design of Mr. Edward Ellington, described by him in a paper read before the Institution of Mechanical Engineers in January 1882. The whole load is borne by the rod a underneath the cage, which enters as a ram into the vertical cylinder A . This rod is made solid in order to reduce the area of the cylinder as much as possible, and, therefore, also the area of the well that has to be bored in the ground to contain this cylinder. This class of lifts is especially expensive on account of this boring, and the objection to them on the score of expense is lessened by making the well small. The rod is made only just strong enough to safely bear the load on it. Its section should be designed with reference to the length of lift, because the longer the free length of the supporting pillar the greater is its tendency to buckle under a given load. If l be the stress per square inch calculated to be admissible on its section, and if W be the weight of cage and ram together and W' that of passengers or goods to be raised, the section is made equal to $\frac{W+W'}{l}$. Since

this same load has to be supported by the water pressure on the lower end of this rod, that water pressure is made also equal to h . This cylinder A is kept always in open communication with the lower end of the cylinder B . In this moves a piston b fastened to the top of the thick piston rod d . This passes downwards into the third cylinder C , and to its lower extremity is fastened the long piston e . These pistons have a common stroke, which is much shorter than the lift of the cage. The cylinders are correspondingly shorter than A , and they stand above ground. The ratio of the strokes may range from $\frac{1}{2}$ to $\frac{3}{4}$, and is the same as the ratio of the annular area of the under side of the piston b to that of the rod a . If b and d be the areas of the piston and piston rod, and c that of the rod supporting the cage, the ratio of the strokes is $b-d : c$. Suppose the piston b to be at the top of its stroke and the cage to be consequently at the bottom of the lift-well, then, if in this position the piston b be at a height above the lower end of A equal to h inches, and if w be the weight of a cubic inch of water, then, the pressure per square inch on a being h , that on the lower side of piston b is $h-hw$. The whole upward pressure on this piston is therefore $(b-hw)(b-d)$, and a downward pressure equal to or rather more than this must be exerted on the top of the rod a to lift the cage. This is supplied by admitting the water from the main, or from the hydraulic accumulator if force-pumps are employed to provide water-pressure, into the upper ends of the cylinders B and C . The lower end of C is always kept in open communication with the atmosphere. The water is continually admitted to B , and the water pressure on the top surface of piston b is designed to balance the constant load of cage and ram when this piston is at the top of its stroke. During the ascent of the cage, the water is admitted into C by a valve moved from the cage or platforms by means of the rope f , and the water pressure on the annular top surface of piston c , when that piston is at its highest position, is designed to balance the extra load of passengers or goods. During the descent, the cage being empty, the connection between C and the accumulator is shut by the valve actuated from the cage, and the water is allowed to escape freely to the atmosphere. If the pressure on c becomes equal to atmospheric pressure, it is the pressure per square inch of the working water at the level of the piston b at its highest position, and c be the area of the cross-section of cylinder C , and if h' be the length of plunger e , then in this position the whole downward force that is borne by the water is underneath the piston b , and distributed over its area to b , and $ph + (p + h'w)(c-d)$, when the pressure is on piston c , and simply ph when this pressure is cut off from C (To this should be added the weight of b , d , and c , but for our present purpose of explanation only this may be left out of account.) The former quantity has to equal $(b-hw)(b-d)$, and the latter should equal

$$\frac{W}{b-hw} - h'w(c-d).$$

These two equations serve to determine two of the quantities involved in terms of the other.

When the water pressure is admitted to the upper side of b alone, the intensity of pressure on the under side of b is evidently as many times greater than the intensity on its upper side as the area of its upper side is greater than that of its lower surface. Thus any increase of intensity on the upper surface will cause a correspondingly greater increase of intensity on the lower. Now if the pressure on the under side of b were to remain the same while the cage ascended, the pressure on the lower end of a would decrease by an amount proportional to the change in their difference of level. If, for example, the ratio of the strokes $b-d : c$ is $3 : 1$, then, as the cage rises 6 inches, b will fall 1 inch, and h , the difference of level

between b and a , will be decreased 7 inches. The pressure per square inch on a would decrease 7 psi, that on the under side of b kept constant. But, as the upper side of b also sinks 1 inch, the pressure per square inch on it will increase by 7. It now the ratio of this upper force of b to its lower area be made T , this increase of pressure on the top face will cause an increase of 7 psi on the lower face, and this just offsets the diminution of pressure on a due to the column 1 inch of the edge and fall of the lower side of b . Thus the imbedded edge will be in perfect balance, at whatever height it stands, if the areas b and $b-d$ are given the ratio

$$\frac{b}{b-d} = \frac{b-d}{a} + 1$$

The ratio $b-d$ of the two strokes having been already chosen, this equation gives b directly. From the other two equations c and the necessary pressure p are found. This pressure p may be obtained by hydraulic pumps, and an amount not loaded to the right amount. If, however, the water from the mains is to be used, the ratio of the strokes on the side of a may be modified so as to suit the available working pressure p . If p be proportional for the extra load at a given height, it will not be correct for all other heights, but this is not highly consequential, because the extra load itself is vanishingly small, so that no adjustment of d except of its maximum desired amount is possible. An excess of pressure on c above that needed for any given load has the effect simply of accelerating the speed of descent, and this is modified roughly by partially closing the valve admitting water to c .

We have shown this lift for description as the latest improvement in the design of hydraulic lifts. In it no water is wasted in raising or lowering the constant load.

When the hydraulic power is applied to the cage through a chain of rope passing over an overhead pulley, the hydraulic cylinder is usually laid horizontal for facility of setting and examination. Of course this arrangement involves much greater frictional resistance to the motion of the apparatus, but in it all the severely stressed parts may be in tension. There is an security when they are so than when they are in compression. Tange Brothers' hydraulic lift is an example of this.

Accidents to lifts occur in two ways. First, the suspending chain or rope may break, or, in those supported from below, the run may break, at the cylinder or in pipes enclosing the water way. To lessen the risk of such mishaps the only method is to insist on good design in the details, good materials (which should be subjected to test before being used) and good workmanship. The connection at both ends of the rope or chain to the load suspended from it, or the joining of the different sections of the run to each other and to the cage, is a point especially important. If such a breakage does actually occur, however, the cage is usually kept from falling by a device known as a toothed rack.

The connection at both ends of the rope or chain to the load suspended from it, or the joining of the different sections of the run to each other and to the cage, is a point especially important. If such a breakage does actually occur, however, the cage is usually kept from falling by a device known as a toothed rack. Tange Brothers have for this purpose at each corner of the cage a toothed rack. The suspending rope sustains the cage through levers as shown in fig. 5. So long as there is a considerable pull on the rope, the levers keep the cams in the position shown. If the strain on the rope is relieved by accident to its powerful spiral springs immediately the cams swing outwards and the rack becomes buried in the wooden guide-posts. A toothed rack is sometimes bolted to the vertical posts and tooth-shaped plungers are forced forward by springs to engage with the rack when the rope breaks. Similar arrangements are not placed between the top of the cage and the cage of direct acting hydraulic lifts, but it is a mistaken idea that they are not as necessary in this case as in the other. Such appliances should be examined and tested at regular frequent intervals. They are apt to get out of working order though durable. A double rope is a greater safeguard against accident.

In chain or rope lifts the gearing or other machinery may break, and in consequence the cage might run down with dangerous rapidity without the rope either breaking, or being wholly relieved of tension, so that the above catches may not come into action. This may be prevented by a self-acting clutch on the shaft, which prevents the barrel rotating unless the clutch is specially released. The most perfect and mechanically beautiful of the many devices that have been invented for this purpose is Weston's frictional automatic coupling. Fig. 4 shows it as applied to a hand shaft-hoist. To the shaft a is keyed a ratchet wheel b . A pawl gearwork this prevents the shaft from ever rotating except in one direction. The plate c is also keyed to the shaft. The leading rope sheave d and the winding barrel e both run loose on the shaft. Their opposing end surfaces are cut helically, so that, according to the relative angular positions of d and e , they are either jammed against each other and between c and b , or are loose and free to rotate round the shaft. On pulling the sheave d in one direction all the parts are frictionally

coupled together, and the barrel hauls up the load. The axial pressure producing friction between c and b and between d and e is greater than the load being hauled up in the ratio of the circumference of the barrel to the pitch of the helix. As there are two frictional surfaces, the whole friction is double this axial thrust multiplied by the coefficient of friction, and this friction must act at such a mean radius from the shaft as to balance the load on the shaft as to horizontal pressure.

If this is so for one load, it is so also for all others, as the friction is proportional to the load. To get sufficient friction for heavy loads with a diminished axial thrust, the very ingenious design shown in fig. 5 is adopted. Here the shaft a is driven by power, and is keyed to the boss d with a helix cut on one end. This helix abuts against a similar helix on the pumion e , which drives the hoisting barrel on a second shaft. The ratchet wheel b abuts against the collar f on the shaft a , b runs loose on the shaft and is cast on the end of a hollow drum containing three disks of hard wood, P, P, P. These disks contact with f along the interior of the drum, but are prevented from turning except along with the drum. The interlocking between these wood disks are two iron disks, O, O, which may slide axially along the boss of the pumion e , but are prevented from rotating except along with this pumion. The axial pressure is transmitted through the surfaces of the disks P and O, and, these being six pairs of surfaces between which this pressure is exerted, a very slight axial thrust produces sufficient friction at these surfaces to couple the ratchet wheel b to the pumion e . So long as this is exerted all the parts are jammed together, and the pawl engaging in b prevents the load lowering. When, however, the shaft a is rotated backwards, the helices disengage and the friction no longer binds e with b , so that e along with d and a can be rotated backwards and the load thus lowered. The weight of the load keeps e following d closely in its backward motion, and as soon as the operation of machine ceases to turn the shaft backwards the whole arrangement becomes once more frictionally bound together, and the ratchet wheel prevents further lowering. Fig. 6 shows another arrangement whereby the pumion e is unaccepted and allowed to lower the load by only a slight backward motion of the shaft a , it being unnecessary to rotate the shaft back and continuously.

This last is obviously the most handy arrangement, and when worked carefully is as absolutely safe as the other. This device in a modified form is used in Tange's lifts.

Thomas & Sons, of Cardiff, have a similar patent safety shaft coupling, which, although it has a very different form, is constructed on exactly the same principle as that of fig. 5.

Steam has been used as a motive power in long cylinders similar to those in hydraulic lifts. It has the great advantage of being very little weight, so that the difference of head occasioned by the rise of the piston is practically nil. The disadvantage is that the steam rapidly condenses, and thus the load could not be held up at any desired height for a length of time, without a continual fresh supply of steam to the cylinders. It is not likely to come into general use for passenger lifts, but may be used advantageously for goods lifts and heavy cranes.

(R. H. S.)

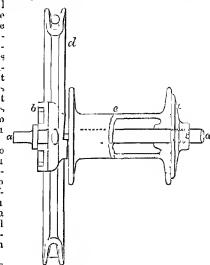


Fig. 4

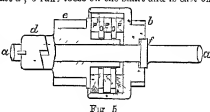


Fig. 5

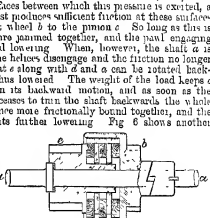


Fig. 6

LIGHT

SOUND may be defined as any effect on the sense of hearing, and in the same way **Light** may be defined as any effect on the sense of sight. This is the purely subjective use of the terms. But both terms are quite as frequently used in the objective as in the subjective sense. Thus, as **Sound** may be defined in terms of the motion of the air in the cavity of the external ear, mechanically affecting the tympanum, so **Light** may be defined by the mechanical effect produced upon the extension of the optic nerve which forms the sensitive surface of the retina.

In treating of **Light** it will be convenient to use the term in a sort of mixed sense, at least until we come to discuss the different theories which have been devised to account for the propagation of the agent which causes vision. Then we shall have to use the term entirely in the objective sense. On the other hand, in Physiological Optics we are concerned chiefly with the subjective sense of the term.

The present article is intended to give a general sketch of the subject of Optics, so far as it can be treated by the help of elementary mathematics, but with sufficient detail to show the connexion of its various branches, and to enable the reader who desires further information on any point to judge for himself under what heading he will find it in this work. The subject is arranged in the following order:—

Early History of Optics
Preliminary Statements with regard to Vision, Distinct Visions, the Colour-Sense, and the Duration of Visual Impressions
Sources of Light
General Reflections on the Mechanism of Propagation of Light
Division of the Subject into Geometrical and Physical Optics.

GEOMETRICAL OPTICS.

Rectilinear Propagation of Light in Homogeneous Media, Shadows, Common Obscurity, &c.
Intensity of Illumination, as depending on the Distance of the Source and the Obliquity of the Rays. Brightness and Intrinsic Brightness
Photometry.
Velocity of Light.
Behaviour of Light at the Common Surface of Two Homogeneous Media.
Reflection. Plane, Spherical, and Cylindrical Mirrors. Real and Virtual Images.
Single Reflection. Composite Nature of White Light. Refractive Index. Dispersion. Prisms; Strahlender Lines. Irregularity of Dispersion. Achromatism. Lenses. Telescope, Microscope. Pure Spectrum. Refraction by Cylinder. Rainbow.
Refraction in a Non-homogeneous Medium. Hamilton's Characteristic Function. Mirage.
Absorption, Abnormal Dispersion, Fluorescence, Phosphorescence.

PHYSICAL OPTICS. UNDULATORY THEORY.

Nature and Propagation of Waves. Huygens's Principle. Explanation of Reflection and Single Refraction. Disproof of the Corpuscular Theory.
Sketch of the History of the Undulatory Theory. Young's Discovery of Interference.
Interference Bands. Spectrum formed by Gratings. Measure of Wave-Length. Loss of Semundulation. Newton's Rings. Colours of Thin Plates and of Grooved Surfaces.
Relation between Wave-Length and Refractive Index.
Double Refraction. Wave-Surface in Iceland Spar.
Polarization. Transverse Vibrations. Nature of Unpolarized Light.
Plane, Circularly, and Elliptically Polarized Light. Nicol's Prism. Depolarization by Doubly-Refracting Plate. Fresnel's Rhomb.
Doppler's Principle. Measurement of the Relative Velocity of Luminous Source and Spectator.

Under OPTICS (GEOMETRICAL, PHYSICAL, and PHYSIOLOGICAL) further developments will be given; and the

connexion between light and radiant heat will be discussed under **RADIATION**.

EARLY HISTORY OF THE SUBJECT—It is to sight that the we are mainly indebted for our knowledge of external things. All our other senses together, except under very special conditions, do not furnish us with a tithe of the information we gain by a single glance. And sight is also that one of our senses which we are able most effectively and extensively to aid by the help of proper apparatus—not merely (as by spectacles, invented circa 1300) for the cure of natural defects, but (as by the telescope and microscope) for the examination of bodies either too distant or too minute to be studied by the unaided eye.

It is very remarkable, under these circumstances, to find how slowly men have reached some even of the simplest facts of optics. We can easily understand how constant experience must have forced on them the conviction that light usually moves in straight lines,—i.e., that we see an object in the direction in which it really lies. But how they could have believed for ages that objects are rendered visible by something projected from the eye itself—so that the organ of sight was supposed to be analogous to the tentacula of insects, and sight itself a mere species of touch—is most puzzling. They seem not till about 350 B.C. to have even missed the question—If this is how we see, why cannot we see in the dark? or, more simply,—What is darkness? The former of these questions seems to have been first put by Aristotle.

The nature and laws of reflexion were, of course, forced on the ancients by the images seen in still water; and the geometrical of the Hæcetic school were well acquainted with these laws. To Hero of Alexandria we owe the important deduction from them that the course of a reflected ray is the shortest possible.

The general nature of refraction also was known, with some of its special applications, such as, for instance, to burning-glasses and to magnifiers. These were probably either spherical glass shells filled with water (Pliny, *H.N.*, xxxvi. 67 [25]; Lact., *De Ira Dei*, c. 10) or balls of rock crystal (Pliny, xxxvi. 10).

In the first century of our era Ptolemy pointed out how a coin at the bottom of an empty cup, where the eye cannot see it, can be made visible by filling the cup with water; and he showed that, in a similar way, the air may render the sun visible to us while it is still under the horizon. Shortly after this date Ptolemy (the celebrated astronomer) published his great work on Optics. He treats of vision, refraction, the theory of plane and concave mirrors, and refraction. He measured, with considerable accuracy, the angles of incidence and refraction, for rays passing from air into water and into glass, and from water into glass; it was not, however, till more than fifteen hundred years had passed that the true relation between these angles was discovered. In addition to what has just been mentioned, the ancients' knowledge of optics was limited to a very superficial acquaintance with some of the properties of rainbows, halos, mirage, &c. But it was fragmentary in the extreme—though it far surpassed in amount as well as in accuracy their knowledge of the other branches of physical science.

It is not easy to understand the ideas of the ancients about colour. That it is a property of a body—just as its density, its hardness, or its smell is a property—was probably held by them. But they also imagined that a body could communicate its colour to light; thus, for instance, the clouds were, by some of them, supposed

to communicate their colours to the sunbeams which form a rainbow.

Our next glimpse of real progress dates from the 11th or 12th century, when ALHAZEN (*q.v.*)¹ wrote a treatise on optics in Arabic, which for five hundred years or more was a recognized authority on the subject. It was, in many parts, founded on the work of Ptolemy, but with considerable additions and improvements. Alhazen gives an anatomical description of the eye, and points out, fairly enough, how with two eyes we see only one image. But he also points out that we see each object, however small, by a *penetral* of diverging rays,—not (as the ancients imagined) by a single ray. Alhazen accounts for twilight, and shows how by it to measure the height of the atmosphere. He also gives the now generally received explanation of the curious fact that the sun and moon appear larger when rising or setting than when they are high in the heavens.

The farther progress of the subject we need not now trace. From the end of 16th century that progress has been extremely rapid. The dates of the more important steps, and the names of their authors, will be given when we treat of these, in their turn, in the course of the article; and we will give them the additional interest of being presented, when this can readily be done, in the author's own words.

Vision.

PRELIMINARY STATEMENTS.—Before we commence a more rigorous treatment of the subject, it may be well to make a few preliminary statements as to the nature of vision and the conditions for distinct vision. Properly speaking, these belong to OPTICS (PHYSIOLOGICAL) (*q.v.*), but it is impossible to treat intelligibly any part of our subject without presupposing some, generally very slight, knowledge of other parts. And the few preliminary statements we have now to make are in no respect theoretical, while they are so simple that any one may at once test their truth for himself.

Distance of distinct vision.

Except in the case of a very abnormal eye (extremely short-sighted or long-sighted as the case may be) there is a distance from it—usually somewhere about 10 inches—at which if an object be placed it is seen more distinctly than if placed at any other distance. Almost every one, perhaps without knowing it, habitually places at or about that distance from his eye an object which he wishes to examine carefully. When he places it at a smaller distance he becomes conscious of the effort required to see it distinctly. He has, in fact, to alter the form of the optical machinery of the eye, by a muscular effort, so that it may become capable of bringing to a focus on the retina rays more divergent than those for which the parts were in their unstrained state adapted. A corresponding effort, but usually much more slight, is commonly felt to be required if the object be at a distance greater than 10 inches.

Limits of distinct vision.

Hence we arrive at the conclusion that, for the minimum of strain on the eye, rays should fall on it diverging as if they came from a point about 10 inches distant. But for all ordinary eyes any divergence from double of this (*i.e.*,

divergence as if from a distance of 5 inches) to zero (*i.e.*, parallel rays) is consistent with the possibility of distinct vision. Rays either more divergent than the former limit, or convergent, are unfit to produce distinct vision. Hence every optical instrument, whatever be the reflexions or refractions to which light has been subjected in passing through it, must finally allow the light to escape either in parallel rays or with a divergence within the above specified limits, if it is to be employed by an ordinary eye. The comparatively slight differences which exist among ordinary eyes are easily compensated by the rack-work, or screw adjustment, which is invariably attached to the eye-piece of a good telescope and to the body of a good microscope. Every motion of this rack-work alters the divergence of the rays as they finally escape from the instrument. Any eye, however abnormal, if it be capable of producing distinct vision at all, has only to be furnished with suitable spectacles in order that it may behave exactly as does a normal eye. The statement, however, refers only to sharpness of definition, not in any degree to colour. The deficiency which causes *colour-blindness* cannot be supplied by any conceivable process. A definite part of the ordinary organ of vision is wanting (or inactive) in such cases—while the merely optical parts of the eye are usually in perfect order.

Another fact which must be stated here is that, to produce vision of a body in its natural position, the image on the retina, as seen from the back, must be inverted—not merely as regards up and down, but also as regards right and left. Thus, in the ordinary astronomical telescope, the image on the retina is not inverted, and we therefore see an inverted image.

A third is that our judgment of the relative distances of objects is formed mainly by the use of the two eyes simultaneously. One eye, kept still, can inform us only of relative distance in virtue of the greater or less effort to see distinctly (already spoken of). With both eyes, or with one eye moved from side to side, *parallax* comes in, and gives us the *stereoscopic* effect, as it is called. This power of judging distance is, of course, greater as the eyes are set more widely apart. There is, practically, no limit to the effective distance between the eyes when the proper instrumental methods (as with the telescope) are employed.

It is also necessary to premise a few words about colour.

The various homogeneous rays of the solar spectrum have each a colour of its own which no refraction can modify. But what about the many colours which do not occur in the spectrum? To such a question as "What is yellow?" the answer is, "Each particular kind of yellow may be any one of an infinite number of different combinations of homogeneous rays." And the same is true, in general, of all other colours. Clerk Maxwell found that a yellow equivalent to that of the spectrum can be obtained by mixing in proper proportions certain homogeneous red and green rays. This single example is sufficient to show that the colour-sense is of a very singular nature. This question will be fully treated in OPTICS (PHYSIOLOGICAL); but for our present purpose it is only necessary to say that we now know (after Wüch and Young) that the normal eye has only three colour-sensations—a red, a green, and a violet,—and that the apparent colour of any light which falls on it depends merely on the relative intensities of the excitement produced by the light on the three organs of sense corresponding to these sensations. This is true, however, only within certain limits of intensity; for extremely bright light, whatever be its real colour, seems to excite all the three sensations simultaneously, much as white light does; and with very feeble light (as, for instance, that of an ordinary aurora or of a lunar rainbow) we are sometimes scarcely conscious of

¹ The proper name of this geometer is El-Hazan (or by other accounts Muhammad) bin al-Hazan bin al-Estheran, and it is as Ibn al-Estheran that he is commonly referred to. See Woepcke, *L'Algèbre d'Omar Alkhiyari* (Paris, 1851), p. 73 *sq.*, and Bar Hebraeus, *Chronica*, p. 221 *sq.* Several of his mathematical treatises exist in English libraries (see the Catalogues of the Br. Mus., Bodl., and India Office MSS.); but the only copy of his great optical work—the *Kitab al-Mandari*—known to be in Europe is No. 1011 of the Leyden collection, with the commentary *Sharh al-Mandari* of Kamil ed-Din Abul Hasan (Cat. Cod. Or. Leyd. Bat., III. 61). A smaller work (Woepcke, *op. cit.*) was based on the optical treatise ascribed to Alhazen and Ptolemy, and Ibn al-Estheran claims to have restored the lost first book of the latter. The Arabs had Alhazen's Optics (*Kitab al-Mandari*) in the version of Nasir ed-Din Tusi (*H. Khatt.*, No. 10,582; Loth, *MSS. of India Office*, No. 748).

Colour-blindness

colours. In *colour-blindness* one or more of these organs of sense is wanting, or imperfect. The most common form, Daltonism, depends on the absence of the red sense. Great additions to our knowledge of this subject, if only in confirmation of results already deduced from theory, have been obtained in the last few years by Holmgren¹; who has experimented on two persons, each of whom was found to have one colour-blind eye, the other being nearly normal. In this way was obtained, what could otherwise have been matter of conjecture only, a description of colour-blind vision in terms of (at least approximately) normal vision.

Duration of visual impressions

Finally, the sensation of sight is not limited to the duration of the mechanical action on the eye. It is known that we do not see a sudden flash (an electric spark for instance) until a measurable, though very short, period has elapsed. This depends on the rate at which an excitation is propagated along the optic nerve. But the familiar experiment of whirling a red hot stick in a dark room shows that the sensation of sight lasts for a short period after the mechanical action which produced it has ceased. This period is probably different for different eyes, and for different amounts of excitement even in the same eye. (If the light be very intense the effect lasts much longer, but completely changes its character.) For our present purpose it may be assumed that the duration is somewhere about $\frac{1}{4}$ th of a second. Thus, if the end of the red-hot stick describes a circle once in $\frac{1}{4}$ th of a second, we see the complete circle, if in a longer period, we only see at once such a part of it as was described in $\frac{1}{4}$ th of a second. Connected with this is the remarkable result obtained experimentally by Swan,² that the amount of sensation is, for flashes of short duration, directly proportional, not only to the brightness of the flash, but also to its duration. A flash which lasts for $\frac{1}{4}$ th of a second produces the full effect on the eye; but an electric spark, as a flash of lightning, which certainly does not endure for more than $\frac{1}{1000}$ th of a second, produces at most only $\frac{1}{1000}$ th of the effect it would produce if it lasted $\frac{1}{4}$ th of a second. On this short duration of visual impressions depends the action of the *chaumatrope*, the *wheel of life*, &c. By various kinds of machinery a succession of views of an object in different positions or forms is presented to the eye, each for a brief interval. The result is that we fancy we see one and the same object going through a species of *continuous* motion, or of change of form, which would present it to the eye in these successive positions or forms. Thus, a tadpole may be represented as wriggling about, or as developing continuously into a frog, &c.

Intensity as depending on duration of exciting cause.

SOURCES OF LIGHT.—This subject will be fully treated in other parts of this work under various heads: from the purely scientific point of view under **RADIATION**; from the more practical side under **LIGHTING** (**ΕΛΚΤΙΣΜΟΣ**), &c. For our present purpose a very brief summary of the question will suffice; and we do not require to investigate the *process* by which, in any case, the light is produced.

Incandescence

1. The main source of light is *incandescence*. (It is usually understood that to be *incandescent* a body must be at a high temperature.) This may be due to any of a number of causes, such as the following:—

(a) *The Potential Energy of Gravitation of Scattered Fragments of Matter.*—When these fall together, as in the formation of the sun and stars, heat enough is generated by impact to render the whole vividly incandescent. It is probable that the light of nebulae, and the *proper* light of comets, is due to this cause. The proximate causes in all these cases is the kinetic energy of the fragments

before impact. To this class, therefore, can be reduced the light given out when a target is struck by a cannon shot.

(b) *The Kinetic Energy of Current Electricity or of an Electric Discharge.*—Here we have lightning, the electric light, and probably also the light of the aurora.

(c) *The Potential Energy of Chemical Affinity.*—The lime-light, gas-light, candle and lamp-light, fire-light, the magnesium light, &c.; also phosphorus, dead fish (f), &c., glowing in the dark.

(d) *Friction*, as in the trains of sparks from a grindstone or brake; though here, in general, chemical affinity also has a share.

(e) *Sudden great Compression of a Gas*, as of air by meteoric stones and falling stars.

2. Another very curious source, not (so far as is known) reducible to incandescence, is the *giving out* (usually in excited or altered form) of light previously absorbed:—fluorescence, phosphorescence, &c.

3. A third source is *physiological*:—fire-flies, glow-worms, *Medusa*, dead fish (f), &c., the eye of a cat

Any not black and not transparent body, exposed to any of these sources of light, becomes in its turn what may for our purposes also be treated as a source.

As will be shown in **RADIATION**, the only bodies which, when incandescent, give *every* constituent of white light are bodies which are black in the sense of absorbing each and every ray which falls upon them. Such bodies are not necessarily solids—though the best examples we have of them are lamp-black, and (somewhat less perfect) charcoal and gas-coke.

Newton's speculations on these subjects, taken from the *Newtonian "Queries"* at the end of his *Optics*, give an exceedingly interesting sketch of the state of this subject in his time. We quote a few of the more curious. There is a strange admixture of errors, but a still more strange anticipation of some of the most important of modern discoveries.

"Query 6. Do not Black bodies conserve heat more easily from light than those of other colours do, by reason that the light falling on them is not reflected outwards but enters the bodies, and is often reflected and refracted within them, until it is stifled and lost?"

"Query 8. Do not all Fixed bodies, when heated beyond a certain degree, emit light and shade; and is not this emission performed by the vibrating motions of their Parts. And do not all bodies, which abound with Terrestrial parts, and especially with Sulphureous ones, emit light, as often as those Parts are sufficiently agitated; whether that agitation be made by heat, or by friction, or percussion, or putrefaction, or by any vital motion, or any other cause?"

"Query 9. Is not Fire a body heated so hot, as to emit light copiously? For what else is a red hot iron than fire? And what else is a burning coal than red hot wood?"

"Query 10. Is not Flame a vapour, fume, or exhalation heated red hot, that is, so hot as to shine? For bodies do not flame without emitting a copious fume, and this fume burns in the flame. The *Ignis Fatuus* is a vapour shining without heat, and is there not the same difference between the vapour and flame, as between rotted wood abating without heat and burning coals of fire? In distilling hot spirits, if the head of the still be taken off, the vapour, which ascends out of the still, will take fire at the flame of a candle, and turn into flame, and the flame will run along the vapour from the candle to the still. Some bodies heated by motion or fermentation, if the heat grow useless, fume copiously; and if the heat be great enough, the fumes will shine, and become flame. Metals in fusion do not flame for want of a copious fume, except spelter, which fumes copiously, and thereby flames. All flaming bodies, as oil, tallow, wax, wood, fossil coals, pitch, sulphur, by flaming waste and vanish into burning smoke; which smoke, if the flame be put out, is very thick and visible, and sometimes smells strongly, but in the flame loses its smell by burning; and, according to the nature of the smoke, the flame is of several colours; as that of sulphur, blue; that of copper, green with sublimis great; that of tallow, yellow; that of camphire, white. Smoke passing through flint cannot but grow red hot; and red hot smoke can have no other appearance than that of flame. . . .

"Query 11. Do not Great bodies conserve their heat the longest, their parts heating one another; and may not Great bodies and Fixed bodies, when heated beyond a certain degree, emit light?"

¹ *Proc. Roy. Soc.*, Jan. 1881.

² *Trans. Roy. Soc. Edin.*, 1849, 1861.

coquishly, as by the emission and re-action of its light, and the reflexions and refractions of its rays within its pores, to grow still hotter, till it comes to a certain period of heat, such as is that of the sun! And are not the sun and fixed stars great earths vehemently hot, whose heat is conserved by the greatness of the bodies, and the mutual action and re-action between them, and the light which they emit, and whose parts are kept from running away, not only by their fixity, but also by the vast weight and density of the atmospheres incumbent upon them, and very strongly compressing them, and containing the vapours and exhalations which arise from them! . . . And the same great weight may condense those vapours and exhalations, as soon as they shall at any time begin to ascend from the sun, and make them presently fall back again into him, and by that action increase his heat, much after the manner that in our earth the air increases the heat of a culinary fire. And the same weight may hinder the globe of the sun from being diminished, unless by the emission of light, and a very small quantity of vapours and exhalations."

THEORIES OF PROPAGATION OF LIGHT.—We may begin by assuming that the sensation of light is due to a mechanical action on the retina (see EYE). Now such a mechanical action must have a mechanical cause, and, as far as we can judge with our present knowledge, this latter must consist of impacts on the retina, due to moving matter. This matter may have travelled all the way from the source of light, or it may have been set in motion in the eye by a disturbance (analogous to a wave) which has travelled from the source. What is transferred, or what moves, is a quite independent question. Light must, as far as we can conceive, consist in the motion of particles of some kind from external objects to the eye, or in the propagation of some disturbance or wave-motion in an as yet unknown medium. Though it has been proved, as we will presently show, that some of the consequences of the first supposition are entirely inconsistent with observed facts, the nature of the propagation of the supposed luminous particles is still a very interesting study, and indeed many of the fundamental propositions in optics follow more easily from this hypothesis than from the other. We will therefore *not* at present dismiss this hypothesis, but will refer freely to it now and then, until its truth is shown to be inconsistent with experiment.

This view, associated with the names of Newton, Laplace, and Biot, is known as the *corpuscular theory* of light. A formidable objection to it, *in limine*, will be easily seen to be furnished by the velocity of light. Since every point of every visible body must (on this theory) send such corpuscles to the eye, moving as we shall find at a rate of nearly 200,000 miles per second, their masses must be inconceivably minute in order that their united momentum may not amount to something comparable with that of a cannon shot, a supposition of course utterly destructive of all belief in the hypothesis. But, as we shall see, there are still higher grounds of objection, and such as no mere smallness of mass or size of each corpuscle can explain away.

The rival theory labours under considerable disadvantages, inasmuch as the theory of wave-propagation is very much more obscure and difficult than that of the motion of free particles; but the student, who has mastered the fundamental difficulties of sound (see ACOUSTICS), which presents a fair although not an exact analogy, will find it comparatively easy to obtain a clear conception of the fundamental principles of the explanation offered by the *undulatory theory* of light.

The difference between these two theories of light may be illustrated by contrasting wind moving at the rate of 1100 feet per second (an inconceivably violent hurricane) and sound, gentle or violent, moving at precisely the same rate—yet how different in its effects!

DIVISION OF THE SUBJECT.—Optics, or the science of Light, is usually divided into two parts. A simple illustration of the nature of this division will be found in

the different conditions of fluid equilibrium according as Geom. we do not or do introduce the idea of action between metrical the fluid and the containing vessel (CAPILLARY ACTION, and physical optics g *). In the first or hypothetical case it is known that the free surface must be horizontal, and that all its separate parts must lie in the same plane, in the second, *i. e.*, the actual, case we find molecular action modifying these results, sometimes indeed to a very large extent, so that no part of the free surface is plane, and no two portions of it are at the same level. So in what is called GEOMETRICAL OPTICS it is assumed from experiment that light moves in straight lines in air, while PHYSICAL OPTICS, or the undulatory theory, agrees with experiment in showing that under certain circumstances a ray of light bends round an obstacle. But as, in obtaining the main facts of fluid equilibrium, capillary forces may be neglected, so, for the explanation of the ordinary phenomena of light, even with accuracy sufficient for the construction of the very finest telescopes and microscopes, it suffices that Geometrical Optics, based on laws *nearly* verified by experiment, be followed out to its consequences. The residual phenomena then came in to be treated by the undulatory theory. Foucault divides the subject, in consequence of this distinction, into two parts, *viz.*, (1) that in which we deal with the direction only of the rays, and (2) that in which we deal with the physical properties of the rays themselves.

In this order we will consider the subject, giving the Proposed explanations of the approximate experimental laws of *order of treatment* Geometrical Optics, as we reach them, in the language of either theory. But before we come to the residual phenomena we shall have found that the corpuscular theory must be rejected, and we will therefore give, without detail, the principles of the undulatory explanation, which will be fully discussed in a special article.

GEOMETRICAL OPTICS.

Rectilinear Propagation of Light.

It is approximately true that, in any homogeneous medium, *light moves in straight lines*.

If an opaque body be placed anywhere in the straight line between the eye and an object, the object is concealed. Through a long straight tube no objects can be seen but those situated in the direction of its axis produced. This is so fundamental a fact, or it is so evident a result of experience, that it is the foundation of every process which involves the direction in space of one object as regards another,—whether it be for the aiming with a rifle, the pointing of a telescope, or for the delicate observations of a geodetic survey. But we must carefully observe the restrictions under which the statement is made. Not merely is it said to be only approximately true, but it is so only in a homogeneous medium. To both of these restrictions we will revert later.

(a) On this is founded the geometrical theory of *shadows*, *Shadows*.

—a subject of some importance, especially as regards eclipses. In this application the results may be considered as absolutely true, though, as we shall see in a subsequent page, the statement is liable in certain delicate cases to somewhat startling exceptions. When an opaque body is placed between a screen and a luminous point, it casts a shadow on the screen. (The sun's image formed by a lens or burning glass of short focus is our best mode of attempting to realize the conception of a luminous point; but a fair approximation may be made by piercing a very small needle-hole in a large plate of thin metal, and placing it close to any bright flame or incandescent body.) The outline of the shadow is, of course, to be found by drawing straight lines from the luminous point so as to touch the

See h 115.
on air
suppl
tab of
light

See
undulatory
theory.

Undula-
tory
theory.

opaque body all round. These lines form a cone. The points of contact form a line on the opaque body separating the illuminated from the non-illuminated portion of its surface. Similarly, when these lines are produced to meet the screen, their points of intersection with it form a line which separates the illuminated from the non-illuminated parts of the screen.

This line is called the boundary of the *geometrical shadow*. A common but beautiful instance of it is seen when a very small gas-jet is burning in a ground-glass shade, near the wall of a room. In this case the cone, above mentioned, is usually a right cone with its axis vertical. Thus the boundary of the geometrical shadow is a portion of a circle on the roof, but a portion of an hyperbola on the vertical wall. If the roof be not horizontal, we may obtain in this way any form of conic section. Interesting and useful hints in *perspective* may be obtained by observing the shadows of bodies of various forms cast in this way by rays which virtually diverge from one point *e.g.*, how to place a plane quadrilateral of given form so that its geometrical shadow may be a square, how to place an elliptic disk, with a small hole in it, so that the shadow may be circular with a bright spot at its centre, &c.

When there are more luminous points than one, we have only to draw separately the geometrical shadows due to each of the sources, and then superpose them. A new consideration now comes in. There will be, in general, portions of all the separate geometrical shadows which overlap one another in some particular regions of the screen. In such regions we still have full shadow, but around them there will be other regions, some illuminated by one of the sources alone, some by two, &c., until finally we come to the parts of the screen which are illuminated directly by all the sources. There will evidently be still a definite boundary of the parts wholly unilluminated, *i.e.*, the true shadow or *umbra*, and also a definite boundary of the parts wholly illuminated. The region between these boundaries—*i.e.*, the partially illuminated portion—is called the *penumbra*.

Fig. 1 shows these things very well. It represents the shadow of a circular disk cast by four equal luminous

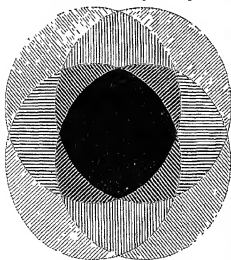


Fig. 1.

points arranged as the corners of a square,—the disk being large enough to admit of a free overlapping of the separate shadows. The amount of want of illumination in each portion of the penumbra is roughly indicated by the shading. The separate shadows are circular, if the disk is parallel to the screen. If we suppose the number of sources to increase indefinitely, so as finally to give the appearance of a luminous surface as the source of light, it

is obvious that the degrees of darkness at different portions of the penumbra will also increase indefinitely, *i.e.*, there will be a gradual increase of brightness in the penumbra from total darkness at the edge next the geometrical shadow to full illumination at the outer edge. It is most instructive to contrast with the above figure that now given (Fig. 2), in which the size of the disk is considerably diminished—everything else being unchanged. Here there is no true shadow—only four *equally bright* portions of the penumbra, each illuminated by three of the sources.



Fig. 2.

Thus we see at once why the shadows cast by the sun, stars, or moon are in general so much less sharp than those cast ^{now} by the electric light (when it is not surrounded by a semi-opaque screen). For, practically, at moderate distances from the electric arc, it appears as a mere luminous point. But, if we place a body at a distance of a foot or two only from the arc, the shadow cast will have as much of penumbra as if the sun had been the source. The breadth of the penumbra when the source and screen are nearly equidistant from the opaque body is equal to the diameter of the luminous source. Simple as is the question from the point of view we have adopted, it may to some persons appear simpler to imagine themselves placed (as spectators) on the screen in different parts of the shadow or penumbra, and to consider what portions of the luminous source they would then be in a position to see.

This is what happens to us when we observe an eclipse. Eclipse of the sun. When the eclipse is total, there is a real geometrical shadow,—very small compared with the penumbra (for the *apparent* diameters of the sun and moon are nearly equal, but their distances are as 370 : 1); when the eclipse is annular, the shadow is all penumbra. In a lunar eclipse, on the other hand, the earth is the shadow-casting body, and the moon is the screen, and we observe things according to our first point of view.

Suppose, next, that the body which casts the shadow is light, a large one, such as a wall, with a hole in it. If we were passing through the hole, the whole screen would be in geometrical shadow. Hence the illumination of the screen by the light passing through the hole is precisely what would be cut off by a disk which fits the hole. Fig. 3, which is the

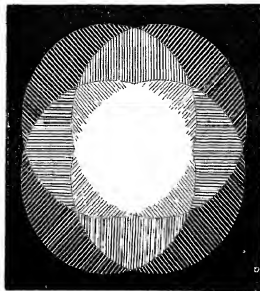


Fig. 3.

shadow. Hence the illumination of the screen by the light passing through the hole is precisely what would be cut off by a disk which fits the hole. Fig. 3, which is the

complement of fig. 1, gives therefore the effect of four equal sources of light shining on a wall through a circular hole. And it is evident that, with the change of a word here and there, the previous reasoning may be applied to this case also. The umbra in the former case becomes the fully illuminated portion, and vice versa.

The penumbra remains the penumbra, but it is now darkest where before it was brightest, and vice versa. For further information we subjoin the complement (fig. 4) of the second case above,—the same four sources, but the smaller hole.

Here we have four equally bright, separate images

labeled
by the
hole



Fig. 4

—one belonging to each of the sources. Thus we see how, when a small hole is cut in the window-shutter of a dark room, a picture of the sun, and bright clouds about it, is formed on the opposite wall. This picture is obviously inverted, and also reversed, for not only are objects depicted lower the higher they are, but also objects seen to the right are depicted to the left, &c. But it will be seen unperturbed (though still inverted) if it be received on a sheet of ground glass and looked at from behind. The smaller the hole (so far at least as Geometrical Optics is concerned) the less confused will the picture be. As the hole is made larger the illuminated portions from different sources gradually overlap, and when the hole becomes a window we have no indications of such a picture except from a body (like the sun) much brighter than the other external objects. Here the picture has ceased to be one of the sun, it is now a picture of the window. But if the wall could be placed 100 miles off, the picture would be one of the sun. To prevent this overlapping of images, and yet to admit a good deal of light, is one main object of the lens which usually forms part of the camera obscura.

The formation of pictures of the sun in this way is well seen on a calm sunny day under trees, where the sunlight penetrating through small chinks forms elliptic spots on the ground. During a partial eclipse these pictures have, of course, a crescent form. When detached clouds are drifting rapidly across the sun, we often see the shadows of the bars of the window on the walls or floor suddenly shifted by an inch or two, and for a moment very much more sharply defined. They are, in fact, shadows cast by a small portion of the sun's limb, from opposite sides alternately. Another beautiful illustration is easily obtained by cutting with a sharp knife a very small T aperture in a piece of note paper. Place this close to the eye, and an inch or so behind it place another piece of paper with a fine needle-hole in it. The light of the sky passing through the needle hole forms a bright picture of the T on the retina. The eye perceives this picture, which gives the impression of the T much magnified, but turned upside down.

showing
image

Phenomenon
of light
observed

Another curious phenomenon may fitly be referred to in this connection, viz., the *phantoms* which are seen when we look at two parallel sets of palisades or railings, one behind the other, or look through two parallel sides of a meat-safe formed of perforated zinc. The appearance presented is that of a magnified set of bars or apertures which appear to move rapidly as we slowly walk past. Their origin is the fact that where the bars appear nearly to coincide the apparent gaps bear the greatest ratio to the dark spaces; i.e., these parts of the field are the most highly illuminated. The exact determination of the appearances in any given case is a mere problem of convergents to a continued fraction. But the fact that the

apparent rapidity of motion of this phantom may exceed in any ratio that of the spectator is of importance,—enabling us to see how velocities, apparently of impossible magnitude, may be accounted for by the mere running along of the condition of visibility among a group of objects no one of which is moving at an extravagant rate.

(b) Another important consequence of this law is that *illumination of the medium is transparent the intensity of illumination within which a luminous point can produce on a white surface directly exposed to it is inversely as the square of the distance.*

The word transparent implies that no light is absorbed or stopped. Whatever, therefore, leaves the source of light must in succession pass through each of a series of spherical surfaces described round the source as centre. The same amount of light falls perpendicularly on all these surfaces in succession. The amount received in a given time by a unit of surface on each is therefore inversely as the number of such units in each. But the surfaces of spheres are as the squares of their radii,—whence the proposition. (We assume here that the velocity of light is constant in the medium, and that the sources give out its light uniformly and not by fits and starts.) When the rays fall otherwise than perpendicularly on the surface, the illumination produced is proportional to the cosine of the obliquity; for the area seen under a given spherical angle increases as the secant of the obliquity, the distance remaining the same.

As a corollary to this we have the further proposition *English*—that the apparent brightness of a luminous surface (seen ^{near} at different distances through a transparent homogeneous medium) is the same at all distances.

The word brightness is here taken as a measure of the amount of light falling on the pupil per unit of spherical angle subtended by the luminous surface. The spherical angle subtended by any small surface whose plane is at right angles to the line of sight is inversely as the square of the distance. So also is the light received from it. Hence the brightness is the same at all distances.

The word brightness is often used (even scientifically) in another sense from that just defined. Thus we speak of a bright star, of the question—When is Venus at its brightest? &c. Strictly, such expressions are not defensible except for sources of light which (like a star) have no apparent surface, so that we cannot tell from what amount of spherical angle their light appears to come. In that case the spherical angle is, for want of knowledge, assumed to be the same for all, and therefore the brightness of each is now estimated in terms of the whole quantity of light we receive from it. It is in this sense ^{Maximum} that we use the word when we speak of Venus at its brightest, for if we take the former definition of brightness the solution of this once celebrated problem would be very different from that usually given. As the question, however, is an interesting one both in itself and historically, we give an approximate solution of it. The approximation assumes what is certainly not true, that the illuminated portion of Venus always appears *uniformly* bright, and of the same degree of brightness in all aspects.

Let a be the radius of the earth's orbit, b that of the orbit of Venus, d the distance between the planets when Venus is brightest. Then if θ be the apparent angular distance of the earth from the sun as seen from Venus, the illuminated part of the disk of Venus as seen from the earth is

$$\frac{1 + \cos \theta}{2}$$

of the whole disk. Hence

$$\frac{1 + \cos \theta}{2^2}$$

is a maximum,—with the obvious trigonometrical relation $a^2 = b^2 + d^2 - 2bd \cos \theta$.

Substituting for $\cos \theta$, and putting the differential coefficient $=0$, we have a quadratic equation of which the only admissible root is the positive one

$$r = \sqrt{3a^2 + b^2} - 2b.$$

From this the other quantities can be calculated.

Effect of contraction of pupil. But another matter has to be taken into consideration when we apply the above definition of brightness in practice. For the aperture of the pupil is usually very much contracted when we look at a brightly illuminated sky or cloud. Thus there is a rough compensation which, to a certain extent, modifies the effect on the retina.

Argument for finite number of stars. Founded on the above is Cheseaux's celebrated argument about the finite dimensions of the stellar universe. For it is easy to see, as below, that if stars be scattered through infinite space, with average closeness and brightness such as is presented by those nearest us, and if stellar space be absolutely transparent, the whole sky should appear of a brightness like that of the sun. Cheseaux and Olbers endeavoured to show that, because the sky is not all over as bright as the sun, there is absorption of light in stellar space. This idea was ingeniously developed by Struve.

Consider a small spherical angle ω . The number of stars included in it whose distances are between r and $r + \delta r$ from the earth is proportional to

$$\omega r^2 \delta r.$$

The whole amount of light received from such a portion of the sky must be therefore as

$$\int_0^{\omega} \delta r,$$

provided that no star intercepts the light coming from another. This condition is unattainable, so that the conclusion is that the brightness is as great as it can be with the materials employed. Every portion of the background shines as if it were a star.

Brightness at different obliquities. (c). A third very important fact, connected with our present subject, but not immediately deducible from our principle, is—*The brightness of a self-luminous surface does not depend upon its inclination to the line of sight.*

Thus a red-hot ball of iron, free from scales of oxide, &c., appears flat in the dark, so, also, the sun, seen through mist, appears as a flat disk. This fact, however, depends ultimately upon the second law of thermodynamics, and its explanation will be fully given under RADIATION.

It may be stated, however, in another form, in which its connexion with what precedes is more obvious—*The amount of radiation, in any direction, from a luminous surface is proportional to the cosine of the obliquity.*

General principles of the theory of illumination. The flow of light (if we may so call it) in straight lines from the luminous point, with constant velocity, leads as we have seen to the expression $\frac{\mu}{r^2}$ (where r is the distance from the luminous point) for the quantity of light which passes through unit of surface perpendicularly to the ray in unit of time, μ being a quantity indicating the rate at which light is emitted by the source. This represents the illumination of the surface on which it falls. The flow through unit of surface whose normal is inclined at an angle θ to the ray is of course

$$\frac{\mu}{r^2} \cos \theta,$$

again representing the illumination. These are precisely the expressions for the gravitation force exerted by a particle of mass μ on a unit of matter at distance r , and for its resolved part in a given direction. Hence we may employ an expression

$$V = \pm \frac{\mu}{r},$$

which is exactly analogous to the gravitation or electric potential, for the purpose of calculating the effect due to any number of separate sources of light.

And the fundamental proposition in potentials, viz., that if a be the element normal at any point of a closed surface, the integral

$$\iint \frac{aV}{dn},$$

taken over the whole surface, has the value

$$= 4\pi\mu.$$

where μ is the sum of the values of μ for each source lying within the surface, follows almost intuitively from the mere consideration of what it means as regards light. For every source external to the closed surface sends in light which goes out again. But the light from an internal source goes wholly out; and the amount per second from each unit source is 4π , the total area of the unit sphere surrounding the source.

It is well to observe, however, that the analogy is not quite complete. To make it so, all the sources must lie on the same side of the surface whose illumination we are dealing with. This is due to the fact that, in order that a surface may be illuminated at all, it must be capable of scattering light; i.e., it must be to some extent opaque. Hence the illumination depends mainly upon those sources which are on the same side as that from which it is regarded.

Though this process bears some resemblance to the least analogy employed by Sir W. Thomson for investigations in statistical electricity (*Cambridge Mathematical Journal*, 1844) and to Clerk Maxwell's device of an incompressible fluid without mass (*Proc. Phil. Trans.*, 1868), it is by no means identical with them. Each method deals with a substance, real or imaginary, which flows in conical streams from a source so that the same amount of it passes per second through every section of the cone. But in the present process the velocity is constant and the density variable, while in the others the density is virtually constant and the velocity variable. There is a curious reciprocity in formulae such as we have just given. For instance, it is easily seen that the light received from a uniformly illuminated surface is represented by

$$\iint \cos \theta \frac{\mu}{r^2}.$$

As we have seen that this integral vanishes for a closed surface which has no source inside, its value is the same for all shells of equal uniform brightness whose edges lie on the same cone.

We have said that light moves in straight lines in a homogeneous medium. This rectilinear path follows at rehearsal once from the corpuscular theory, as well as from the undulatory theory of light: in the first case there is no deflecting cause, so each corpuscle moves in a straight line; in the second, the direction of propagation of a plane wave progresses in a uniform isotropic medium is always perpendicular to its front. Looking along a hot poker or the boiler of a steamboat, we see objects beyond distorted; i.e., we no longer see each point in its true direction. Here we have a non-homogeneous medium, the air being irregularly expanded in the neighbourhood of the hot body. To homogeneous media, the reduplication of images of a distant object seen through an irregularly heaped atmosphere, the scintillation or twinkling of stars, and the uselessness of even the best telescopes at certain times, &c. It is interesting to note here that Newton says—"Long telescopes may cause objects to appear brighter and larger than short ones can do; but they cannot be so formed as to take away that confusion of the rays which arise from the tremors of the atmosphere. The only remedy is a most serene and quiet air, such as may perhaps be found on the tops of the highest mountains, above the grosser clouds."

PHOTOMETRY.—The principle above explained suggests many simple methods of comparing the amounts of light given by different sources. If, for instance, a porcelain plate, or even a sheet of paper, of uniform thickness, have one half illuminated directly by one source of light, the other by a different source, and if one or other of these sources be moved to or from the plate till the halves appear equally illuminated, it is obvious that the amounts of light given out by the two sources are directly as the squares of their distances from the screen. This is the principle of Ritchie's photometer. Rumford suggested the comparison of the intensity of the shadows of the same object thrown side by side on a screen by the two lights to be compared. In this case the shadow due to one source is

PHOTOMETRY.—The principle above explained suggests many simple methods of comparing the amounts of light given by different sources. If, for instance, a porcelain plate, or even a sheet of paper, of uniform thickness, have one half illuminated directly by one source of light, the other by a different source, and if one or other of these sources be moved to or from the plate till the halves appear equally illuminated, it is obvious that the amounts of light given out by the two sources are directly as the squares of their distances from the screen. This is the principle of Ritchie's photometer. Rumford suggested the comparison of the intensity of the shadows of the same object thrown side by side on a screen by the two lights to be compared. In this case the shadow due to one source is

* Express the formulae of which the proof has been indicated. Green's theorem, and the consequences, follow immediately. But we need not give these here.

* Option, end of part I.

lit up by the other alone, and here again the amounts of light given out by the sources are as the squares of their distances from the screen when the shadows are equally intense. The shadow-casting object should be near the screen, so as to avoid penumbra as much as possible; yet not too near, so that the shadows may not overlap.

Dansen's
photo-
meter.

Dansen has recently suggested the very simple expedient of making a grease-spot on white paper for photometric purposes. When the paper is equally illuminated from both sides, the grease-spot cannot be seen except by very close inspection. In using this photometer, the sources are placed in one line with the grease-spot, which lies between them and can be moved towards one or other. To make the most accurate determinations with this arrangement the adjustment should first be made from the side on which one source lies, then the screen turned round and the adjustment made from the side of the other source,—in both cases, therefore, from the same side of the paper screen. Take the mean of these positions (which are usually very close together), and the amounts of light are as the squares of the distances of the sources from this point.

Wheat-
stone's

Wheatstone suggested a hollow glass bead, silvered internally, and made to describe very rapidly a closed path, for use as a photometer. When it is placed between two sources, we see two parallel curves of reflected light, one due to each source. Make these, by trial, equally bright; and the amounts of light from the sources are, again, as the squares of the distances. These simple forms of apparatus give results which are fairly accurate, so long at least as the qualities of the light furnished by the two sources are nearly the same. But, when we endeavour to compare differently coloured lights, the result is by no means so satisfactory. In fact, we cannot well define equality of illumination when the lights are of different qualities. In the undulatory theory, no doubt, we can distinctly define the intensity of any form of radiation.

Difficul-
ties of
photo-
metry.

But the definition is a purely dynamical one, and has not necessarily any connexion with what we usually mean by intensity, viz. the amount of effect produced upon the nerves of the retina. Thus the theoretical intensities of a given violet and a given red source may be equal, while one may appear to the eye very much brighter than the other. Think, for instance, of a colour-blind person, who might, under conceivable circumstances, be unable to see the red at all. We are all as it were colour-blind as far as regards radiations whose wave-lengths are longer or shorter than those included in the range of the ordinary solar spectrum.

Chemical
photo-
metry.

Other modes of measuring the intensity of light usually depend upon more reconcitable physical principles,—such as, for instance, the amounts of chemical action of certain kinds which can be produced by an exposure of a given duration to the light from a particular source. But all have the same grand defect as the simpler processes,—they are not adapted to the comparison of sources giving different qualities of light. And those last mentioned are liable to another source of error, viz. the action of radiations which are not called light, only because they are not visible to the eye, for in all other respects they closely resemble light, and are often more active than it is in producing chemical changes.

Velocity
of light.

VELOCITY OF LIGHT.—Light moves with a velocity of nearly 186,000 miles per second. Of this we have four distinct kinds of proof, on each of which depends a method which is capable of giving pretty accurate results.

Römer's
method.

1. *Römer's Method*.—By this the finite velocity of light was discovered in 1676. Suppose, to illustrate this, that at a certain place a cannon is fired precisely at intervals of an hour while the weather is perfectly calm. A person

provided with an accurate watch travels about in the surrounding district. When he first hears the cannon let him note the time by his watch, then on account of the non-instantaneous propagation of sound, if at the next discharge he be *nearer* the gun than before, the report will arrive at his ear *before* the hour's interval has elapsed; if he be *further* from the gun, the interval between the discharges will appear longer than an hour; and the number of seconds of defect or excess will evidently represent the time employed by sound in travelling over a space equal to the difference of his distances from the gun at the successive observations.

Now the satellites of Jupiter are subject—like our moon, only much more frequently—to eclipses, and the interval between two successive eclipses can easily be observed. The almost sudden extinction of the light is a phenomenon similar to the discharge of the gun; and, if light take time to move from one place to another, we should find the interval between successive eclipses too short when we are approaching Jupiter, too long when we are receding from him. Such was found to be the case by Römer; and he also found that the shortening or lengthening of the interval depended upon the rate at which the earth was approaching to or receding from Jupiter. The inevitable conclusion from these facts is that light is propagated with finite velocity. Römer calculated from them that light takes about $16\frac{1}{2}$ " to cross the earth's orbit. The exact velocity deduced by this method is, after making all corrections, and assuming the most probable value of the solar parallax, about 186,600 miles per second.

2. *Bradley's Method*.—This depends on the aberration of Bradley's light, discovered by Bradley in 1728. When in a calm method, rainy day one stands still he holds his umbrella vertical in order to protect himself. If he walk he requires to hold it forwards, and more inclined the faster he walks. In other words, to a person walking the rain does not appear to come in the same direction as to a person standing still.¹ Now the earth's velocity in its orbit is a very large quantity, some $16\frac{1}{2}$ miles per second, or about $\frac{1}{1000}$ th of that of light. Hence the light from a star does not appear to come in the proper direction unless the earth be moving exactly to or from the star, and, as the direction of the earth's motion is continually changing, so the directions in which different stars are seen are always changing, and thus this phenomenon, called the "aberration of light," proves at once the finite velocity of light and the earth's motion round the sun.

As an additional illustration of the phenomenon, suppose a bullet fired through a railway carriage, in a direction perpendicular to the sides of the carriage. If the carriage be standing still, the bullet will make holes in the sides, the line joining which is perpendicular to the length of the carriage; if it be in motion, then the second side of the carriage will have moved through a certain space during the interval occupied by the bullet in passing from side to side, and thus the line joining the holes in the sides (i.e., the line pursued by the bullet relatively to the carriage), will be inclined at an angle greater than a right angle to the direction of the train's motion.

It is evident that the path apparently described by each star during a year, in consequence of aberration, will be found by laying off from the star lines which bear the same ratio to the star's distance as the velocity of the earth does to that of light,—their directions being always the same as that of the earth's motion at every instant. This is precisely the definition of the HODOGRAPH (η) of the earth's orbit. Hence, on account of the finite velocity of

¹ In fact, to estimate the relative direction and velocity of two moving bodies we must subtract the vector velocity of the first from that of the second.

light, each star appears to describe in space a circle (not an ellipse) of fixed magnitude in a plane parallel to that of the ecliptic. As seen from the earth, therefore, stars will appear to describe paths which are the projections of these circles on the celestial sphere. These are in general ellipses, but circles for stars at the poles of the ecliptic and straight lines for stars in the ecliptic. This is found to be quite consistent with observation, and the major axes of these ellipses, the diameters of the circles, or the lengths of the lines subtend equally angles of about $41''$ at the earth. Hence the velocity of light is to the velocity of the earth as $1 : \tan \frac{1}{2} 41''$, that is, about 10,000 : 1.

Do these methods depend, for their final result, upon a true knowledge of the earth's distance from the sun. But the most accurate measurements of this quantity are probably to be obtained from the velocity of light itself, this being independently determined by the physical processes next to be described. Thus the earth's distance from the sun will in future be measured rather by the constant of aberration, or by the acceleration or retardation of the eclipses of Jupiter's satellites, than by a transit of Venus, by the moon's motion, or by the parallax of Mars. Thus Romer's and Bradley's processes are now applied to the determination of solar parallax.

Foucault's method.

—3 *Foucault's Direct Measurement of the Velocity of Light.*—To illustrate the next and by far the most convincing popular proof of the finite velocity of light, suppose a person looking at himself in a mirror, before which is moving a screen with a number of apertures, the breadth of each aperture being equal to the distance between any two of them. If the screen be at rest with an aperture before the mirror, the light from the observer's face passes through the aperture and is reflected back, so that he sees himself as if the screen were not present. Suppose the screen to be moving in such a way that, when the light which passed through the aperture returns to the screen after reflection, the unperforated part of the screen is in its way, it is evident that the observer cannot see himself in the mirror. If the screen pass twice as fast, the light that escaped by one aperture will, after reflection, return by the next, so that he will see his image as at first. If three times as fast, the second unperforated part of the screen will stop the returning light, so he cannot see his image. To apply this practically a thin metallic disk had a set of teeth cut on its circumference so that the breadth of a tooth was equal to that of the space between two teeth. This disk could be set in very rapid rotation by a train of wheelwork, and the rate of turning could easily be determined by Savart's method (see *Acoustics*, vol. I. p. 108). Light passed between two teeth to a mirror situated at 10 miles' distance, which sent it back by the same course, so that when the wheel was at rest the reflected light could be seen. On turning the disk with accelerated velocity the light was observed to become more and more feeble up to a certain velocity, at which it was extinguished; turning faster it reappeared, growing brighter and brighter till the velocity was doubled; then it fell off, till it vanished when the velocity was trebled, and so on. It is evident from the first illustration above that the velocity of light in air is to that of the tooth, at the first disappearance of the reflected light, as the distance of the mirror from the disk is to the half breadth of the tooth. It is not to be supposed that the description we have just given embodies all the details of this remarkable experiment. On the contrary, telescopes were used at each station to prevent loss of light as much as possible, and many other precautions were adopted which would be unintelligible without references to later parts of this article. This method and its first results were published in 1849 in the *Comptes Rendus*. The experiments gave, on their very careful repetition by

Cornu in 1874, the value 186,700 miles for the velocity in *vacuo* (*Nature*, xi. p. 274).

4 *Foucault's Method.*—This was described in 1850 to Foucault's Academy of Sciences. It depends upon the principle of the rapidly revolving plane mirror introduced by Wheatstone to demonstrate the non instantaneous propagation of an electric discharge. The mirror was made to revolve from 600 to 800 times per second, by means of a *arcs* (see *Acoustics*) driven by steam. A ray of sunlight fell upon it from a small aperture crossed by a grating of platinum wires. Between the wires and the mirror was placed an achromatic lens—the wires being farther from it than its principal focus, but not twice as far—so that the rays falling on the mirror were slowly convergent. They formed an image of the wires at a distance of about 4 metres from the mirror. In certain positions of the revolving mirror, the rays fall upon a concave mirror of 4 metres radius whose centre of curvature was at the centre of the revolving mirror. They were, therefore, reflected back directly to the revolving mirror, and, passing again through the lens, formed an image of the wire grating which, when the adjustment was perfect, coincided with the grating itself. This coincidence was observed by reflexion from a piece of unannealed glass, placed obliquely in the track of the rays, the image in which was magnified by an eye-piece. It is obvious that, when the mirror is made to turn, the light which comes back to it after passing to the fixed mirror, finds it in a position slightly different from that in which it left it. That difference is due to the amount of rotation during the time of passage of the light to and fro along an air-space of 4 metres. Accordingly, as soon as the mirror began to rotate with considerable velocity, the coincidence between the wires and their images was destroyed; and the two were separated more and more widely as the velocity of rotation was increased. It was easy to calculate, from the measured dimensions of the apparatus, the amount of deflexion, and the rate of rotation of the mirror; the velocity of light. The rate of rotation was, of course, given by the pitch of the note produced by the discs.

Foucault's early results with this apparatus showed that the velocity of light which had been deduced from the old methods was too large; and he concludes his first paper by the statement that the determination of the distance of the earth from the sun must now be made by physical instead of astronomical methods. Foucault's process has recently been very considerably improved by Mitchell, who, in 1879, found for the velocity of light in *vacuo* 186,380 miles per second (*Nature*, vol. xxi. p. 226).

By interposing a tube filled with water, and having flat glass ends, between the fixed and revolving mirrors, Foucault found that (for the same rate of rotation) the displacement of the image was greater than before in the proportion of the refractive index of water to unity. Thus in air it was at once evident, by a mode of experimenting exposed to no possible doubt, that light moves faster in air than in water, and, therefore, as will be seen later, that the corpuscular theory of light must be abandoned.

Other methods of determining the velocity of light in air, and for comparing the velocity of light in air and water (on which depends the most definite proof of the erroneousness of the corpuscular theory), and in still and moving water, will be afterwards explained. They give results of very great value, but we cannot introduce them here, as they depend upon somewhat more recondite principles of physical optics.

It is interesting to observe that, as the nearest fixed star is probably about 200,000 times farther from us than the sun is, we now see such a star by light which left it more than three years ago. If, as is now supposed, ~~the light~~

TIME of
passage
of light
from the
object
-rays

(such as Mira Ceti) owe their rapid periodical changes of brightness to eclipses, and if different homogeneous rays travel with different velocities in free space, it is evident that such stars would show a gradual change of colour as they wax, and an opposite change as they wane. Nothing of the kind has as yet been observed, though it has been carefully sought for. Hence we have every reason to conclude that, in free space, all kinds of light have the same velocity. It will be seen later that *dispersion* has been accounted for by the different velocities of light of different wave-lengths in the same refracting medium,—this being a consequence of the ultimate grained structure of ordinary matter, which is on a scale not incomparably smaller than the average wave-length.

Behaviour of Light at the Common Surface of Two Homogeneous Media.

Effect at
a surface
of separa-
tion
between
two
media

When a ray of light, moving in one homogeneous medium, falls on the bounding surface of another homogeneous medium, it is in general divided into several parts, which pursue different courses. These parts are respectively—(a) reflected, (β) refracted (singly or doubly); (γ) scattered; (δ) absorbed.

In the first two categories the result is two or three rays of light pursuing definite paths according to laws presently to be given. The fraction of the incident light which is reflected is in general greater as the angle of incidence is greater. In one important class of cases the reflexion is *total*. But at direct incidence the reflected portion is much greater for some bodies, such as mercury, than for others, such as water or glass. In bodies which give no scattering, the refracted portion of a ray consists of all the non-reflected portion, and therefore usually diminishes as the angle of incidence increases.

In the third category the common surface of the two media becomes illuminated, and behaves as if it were itself a source of light, sending rays in all directions. It may be objected to this, that in many cases the rays are scattered while penetrating the second medium. But in such cases the second medium cannot be called *homogeneous*. This will come up for discussion when we treat of absorption and colours.

In the fourth category the light ceases for an instant to exist as light; but its energy may either become heat in the absorbing body, or it may again be given out by the absorbing body in the form of light, but of a *degraded* character. This is called *fluorescence*, or *phosphorescence*, according as the phenomenon is practically instantaneous or lasts for a measurable time.

In category (a) the light is sent back into the first medium; in (β) it penetrates into the second; in (γ) it goes, in general, mainly to the first; in (δ) it is shared by both.

Visi-
bility of
non-
luminous
objects

It is by scattered light that non-luminous objects are, in general, made visible. Contrast, for instance, the effects when a ray of sunlight in a dark room falls upon a piece of polished silver, and when it falls on a piece of chalk. Unless there be dust or scratches on the silver you cannot see it, because no light is given from it to surrounding bodies except in one definite direction, into which (practically) the whole ray of sunlight is diverted. But the chalk sends light to all surrounding bodies from which any part of its illuminated side can be seen; and there is no special direction in which it sends a much more powerful ray than in others. It is probable that if we could, with sufficient closeness, examine the surface of the chalk, we should find its behaviour to be of the nature of reflexion, but reflexion due to little mirrors inclined in all conceivable aspects, and at all conceivable angles, to the incident light. Thus scattering may be looked upon as ultimately due to

reflexion. When the sea is perfectly calm, we see in it one intolerably bright image of the sun only. But when it is continuously covered with slight ripples, the definite image is broken up, and we have a large surface of the water shining by what is virtually scattered light,—though it is really made up of parts each of which is as truly reflected as it was when the surface was flat.

We have spoken above of the behaviour of light at the Gradual common surface of two media. Now we do not by this phrase necessarily mean two media different in their chemical composition. We mean merely media *optically* different. Thus water with steam above it, and in very unusual cases layers of water or air of different temperatures, other give surfaces of separation at which reflexion and refraction may and do take place. But, except in such special cases, we rarely have an abrupt change, such as is necessary for reflexion, between two portions of the same substance in the same molecular state. In general the transition is gradual, and special mathematical methods must be applied for the purpose of tracing the behaviour of the ray, which is now really travelling in a non-homogeneous medium.

REFLEXION OF LIGHT.—It light be reflected from a Reflexion plane surface bounding two dissimilar isotropic media, the incident and reflected rays are in one plane with, and are equally inclined (on opposite sides) to, the perpendicular to the reflecting surface at the point of incidence. This is sometimes stated in the form—*The angles of incidence and of reflexion are equal to one another, and in one plane*. The best experimental proof of the truth of this statement is deduced from the use of a reflecting surface of mercury in observations with the mural circle. The graduation of such an instrument is the most perfect that human skill can accomplish, and no one has ever been able to find by it the slightest exception to the preceding statement.

The principle of Hadley's quadrant, and of the sextant as now used (an invention of Newton's), is founded on this fact. If a plane mirror on which a ray falls be turned through any angle about an axis perpendicular to the plane of reflexion, the reflected ray is turned through twice that angle. This is an immediate consequence of the above law. For, if the plane be turned through any angle θ , the perpendicular to it is turned through the same angle. Hence the angle between the incident ray and the perpendicular is increased or diminished by θ , and therefore that between the incident and reflected rays (which is double of this) is altered by 2θ . A plane mirror is now extensively used for the purpose of indicating, by the change of direction of a reflected ray, the motion of a portion of an instrument to which the mirror is attached. Thus the magnetometers of Gauss, the tuning-forks of Lissajous, and the electrometers and galvanometers of Sir W. Thomson are all furnished with mirrors. The law of reflexion is also the basis of the goniometer, for the measurement of the angles of crystals and prisms.

It follows from this law that, if a ray pass from one point to another, after any number of reflexions at fixed surfaces, the length of its whole path from one point to the other is the least possible—subject to the condition that it shall meet each of the reflecting surfaces. For the point in a given plane the sum of whose distances from two given points (on the same side of the plane) is the least possible is that to which, if lines be drawn from the points, they are in one plane with the normal (or perpendicular) to the given plane and make equal angles with it. And, as the same is true of each separate reflexion, it is true for the whole course of the ray, since for any one of the reflecting surfaces may be substituted its tangent plane at the point of incidence.

It is to be remarked that there are exceptions to this form of the statement. The true form is, that the actual path of a ray, under the given conditions, is less in length than any other path (satisfying the conditions) which is nowhere faintly divergent from it. This may be best seen by another method. Suppose a series of ellipses to be described whose foci are the source of light and an assigned point which it is to be reached by the reflected ray. Let this system turn about the line joining the foci, it generates a series of prolate spheroids, such that the time of light's passing from one focus to a point in any one of the surfaces, and thence to the other focus, is the same whatever point be chosen on that particular surface. If we take any point *without* that surface, find the corresponding time as obviously greater. Hence to find the path of that one of a system of rays diverging from a given point which, after reflection at a given surface, shall pass through a given point, we have only to imagine spheroids constructed as before. Of these one at least will touch the given surface. All points on the surface is the *nearest point* of the point of contact (mark this limitation) will in general be outside the spheroid. Hence this point gives the shortest path. But the spheroid and the reflecting surface have the same tangent plane, and therefore the parts of the ray are equally inclined to the surface.

Images by reflection

Formation of Images by Reflection at a Plane Surface.—We may assume here—what is indeed evident from the rectilinear propagation of light—that objects are rendered visible to the eye by rays *diverging* from them. Hence, if we have a set of reflected or refracted rays diverging from any point, or diverging as if they came from any point, they will convey to the eye the impression of the existence of a luminous source at that point. The eye, in fact, can only tell us what effect is produced upon it, i.e., what sort of mechanical action it is subjected to. Its indications must therefore depend only upon what reaches it, and in no other sense whatever upon the source or the path of light. This point from which rays diverge, or appear to diverge, is called an *image*.

The image of any point in a plane mirror is found by drawing from the point a perpendicular on the mirror and producing it till its length is doubled.

The extremity of the line so drawn is the image of the point; or, in other words, rays proceeding from the point *diverge* after reflection as if they came from the image so found. The image in this case is called *virtual*, to distinguish it from cases, subsequently to be mentioned, where it is *real*—the distinction being that the rays have actually passed through a real image, while they only appear to come from a virtual one.

To prove this it is only necessary to observe that, if A (fig. 5) be a luminous point or a point from which rays

Real and virtual images.

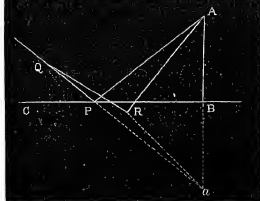


Fig 5

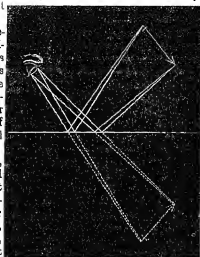
diverge, and CB any section of the mirror by a plane through AB, the perpendicular to it, and if we make Ba=AB, and take any point P, then, joining AP, aP, and producing the latter, the angles APB, aPB, and therefore CPQ are equal; also the plane of the paper contains the perpendicular to the mirror at P. Hence PQ is the reflected ray; or the ray, after reflection, appears

to come from a. Hence a is the image—a virtual one, as before noticed. Also, if R be any point whatever (not P) in the plane of the mirror, we have obviously aR=RA. Hence the path AR, RQ is equal to aR, RQ, two sides of the triangle aRQ, of which aQ, which is equal to the actual path (AP, PQ), is the third side.

Fig. 6 represents the pencils of diverging rays by which two points of the image are rendered visible to an eye placed in front of the mirror.

From the requisite modification of this figure it follows that one can see his whole person in a mirror of only half his height and breadth.

Duck's ghost, which has played a prominent part in popular entertainments for some years back, is the image, in a large sheet of unsilvered



Duck's ghost

Fig 6

plate glass hung at the front of the stage, of an actor or figure strongly illuminated, and concealed from the audience in a sort of enlarged prompter's box. Any one can see the phenomenon completely by looking into a plate-glass window on a sunny day, when he sees the passers-by apparently walking *inside* the house.

The principles already stated suffice fully for the explanation of the curious vistas of images formed by two *parallel* plane mirrors facing one another at opposite sides of a room. The only additional observation necessary on this subject is that, if the mirrors are silvered on the back, the light at each reflexion has to pass twice through the glass. Thus, if the glass be pinkish or greenish, the various images are more and more coloured as they are due to more numerous reflexions.

These principles also easily explain the KALEIDOSCOPE (qv) of Sir D. Brewster, where images are formed by two mirrors inclined to one another.

It is easy to see that the series of images of a luminous point produced by such an arrangement after one, two, &c., reflexions must all lie on a circle, also that, if the angle between the mirrors be an aliquot part of four right angles, these images will form a finite number of groups, each consisting of an infinite number of images which have exactly the same position.

The explanation of the law of reflection which is furnished by the corpuscular theory is excessively simple. We have only to suppose that at the instant of its impact on the reflecting surface the velocity of a corpuscle *perpendicular* to the surface is reversed, while that *parallel* to the surface is unchanged. It bounces off, in fact, like a billiard-ball from the cushion. The undulatory theory gives an explanation, which is, in reality, quite as simple, but requires a little more detail for those who are not familiar with the common facts of wave-motion. We therefore reserve it for a time.

Reflection at a Spherical Surface.—Let APB (fig. 7) be Spherical a section of a concave spherical mirror by a plane passing through its centre of curvature O, and through the luminous point U. Then, if any ray from U, as UP, meet the surface, it will be reflected in a direction PV, such that UP, PO, and PV are in one plane, and so that PO bisects

the angle UPV (This follows because OP , a radius of the sphere, is normal to the surface at P). Hence it is



Fig 7

approximately true that, if V be the intersection of PV with OU ,

$$\frac{VO}{AV} = \frac{OU}{UP}$$

The full consequences of this *exact* statement will be developed under OPTICS (GEOMETRICAL). For our present purpose, an approximation will amply suffice. Let us suppose P to be so near to A that no sensible error is introduced by writing A for P in the above formula. This amounts to supposing the mirror's breadth to be very small in comparison with its radius of curvature. The formula now becomes

$$\frac{VO}{AV} = \frac{OU}{AU}$$

or, what is the same,

$$\frac{AO - AV}{AV} = \frac{AU - AO}{AU}$$

and V is, to the degree of approximation above stated, independent of the position of the point P . If we call r the radius AO of the mirror, $u = AV$ the distance of the source, and $v = AU$ the distance of the point V from the mirror, this becomes

$$\frac{r - v}{u} = \frac{r}{v}, \text{ or } \frac{1}{u} + \frac{1}{v} = \frac{2}{r}. \quad (a)$$

The formula, or the out, shows at once that this relation between U and V is *reversible*, i.e., all rays from V , falling on the mirror, will be made to converge at U . These points are therefore called *conjugate foci*.

The simplicity of (a) is remarkable, so, also, is that of its interpretation. For the rays passing from a source to a given object, like the mirror, are less and less divergent as the source is farther off. Hence (a) signifies that the (algebraic) sum of the divergences of the incident and reflected rays is equal to that divergence which the mirror can convert into parallelism.

In fact the rigorous geometrical relation may be written in the obvious form $AVP - AUP = 2\Delta OP$,—which, when all three angles are small, is simply (a). A similar statement may easily be made in the case of refraction.

Before we proceed to develop the consequences of this simple formula, we may point out that it is applicable to all cases,—to convergent rays falling on a concave mirror, to divergent rays falling on a convex mirror, &c., &c. The reader may easily verify this by trial for himself. But it follows at once from the necessary interpretation of the negative sign in geometry. Thus, if the mirror were convex, O would be to the *left* of A , as the figure is drawn, and AO , if formerly positive, would now be negative. Thus, for a convex mirror, the formula is

$$\frac{1}{u} + \frac{1}{v} = -\frac{2}{r}$$

If the incident rays be *emergent*, U is to the left of A , and therefore AU , or v , is negative; and so on.

We must now study the *relative* positions of U and V , in order to find the size and position of the image for different positions of the object.

Returning to the formula (a) above, we see that the following pairs of values of u and v satisfy it:—

u	v
Infinite	$\frac{r}{2}$
Greater than r	Greater than $\frac{r}{2}$, less than r
r	∞
Less than r , greater than $\frac{r}{2}$	Greater than r
$\frac{r}{2}$	Infinite
Greater than 0, less than $\frac{r}{2}$	Negative
0	0

Thus, when the source is at a practically infinite distance (as the sun or a star) the image is formed at a distance f from the mirror equal to *half* its radius of curvature. It is then said to be in the *principal focus*. As the source comes nearer, the image comes out to meet it, and they coincide at the centre of curvature of the mirror. In fact, a ray leaving the centre of the mirror must meet the surface at right angles, and thus go back by the way it came. When the source comes still nearer, the image goes further off, until, when the source is at the principal focus, the image is at an infinite distance, that is, the rays go off parallel to one another. This is the mode in which a concave reflector is employed for lighthouse purposes. When the source comes still nearer, the image is behind the mirror, i.e., the incident rays are so divergent that part of their divergence remains after reflexion. This remnant of divergence becomes greater and greater as the source is nearer to the mirror, i.e., the (then *virtual*) image comes closer to the mirror, which finally behaves, for a very near source, almost precisely like a plane mirror.

All of these phenomena can be beautifully seen in a dark room by employing a beam of sunlight, rendered distinctly visible, in the fashion noted by Lucretius, by the motes in the air.

For further explanation pictures are given (figs 8, 9). Paths of showing the course of the pencil of rays when (1) a *real* object forms an image.

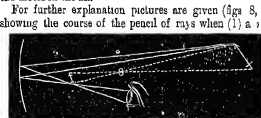


Fig 8

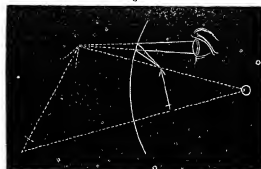


Fig 9

and (2) a *virtual* image is formed by a concave mirror. It will be seen at once that, in the cases figured, the *real* image is *inverted* and less than the object, the *virtual* image *erect* and larger. In fact the size of a small object is obviously to that of its image in proportion to their distances from O , the centre of curvature of the mirror. Also the image is erect when it lies on the same side

of the centre of curvature with the object, inverted, if on the opposite. In other words, the image is inverted if the rays cross one another's path, erect if they do not.

Caustics

When the breadth of the mirror is large compared with its radius, the approximation upon which all these results depend can no longer be made. There is then no definite image even of a luminous point. It becomes spread over what is called a *caustic*, a section of which is the bright curve familiar to every one who has looked at a cup of milk in sunshine.

Spherical aberration

Even when the approximation is close enough for ordinary purposes, it is not so for astronomical purposes, and the effect of its inexactness upon the image is known as *spherical aberration*. For the fine mirrors of reflecting **TELESCOPES** (γ) the spherical form cannot be employed, the surface of the mirror must be of *parabolic* section.

Cylindrical mirror

Cylindrical Mirrors.—As a simple example of the application of the law of reflexion at curved surfaces, when the rigorous solution is demanded, let us take the case of a vertical right cylinder, the object being a drawing on a horizontal plane. Such mirrors, with the frightfully distorted drawings, necessary to give an image of natural proportions, were very common fifty years ago, but are now rarely seen. They are still, however, valuable as illustrations of our subject.

Let the plane of the object cut the axis OB of the cylinder at right angles in O (fig 10), and let A be the position of the eye, and BOA a ray from a point B of the object, reflected at Q. Draw QP perpendicular to the axis. Then AQ and QR are in the same plane with QP (the normal to the surface) and make equal angles with it. Hence, when this figure is projected by vertical lines on the plane of the object, it takes the form in fig 11, and AQ, QR now make equal angles with OQ. Also, if AB be drawn (in fig 10) perpendicular to OF, the ratio of AQ to QB in fig 11 is equal to that of BP to FO in fig 10.

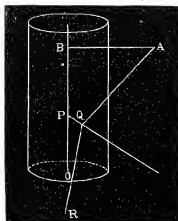


Fig. 10.

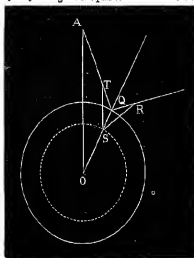


Fig. 11

Take OS, QO, QR, QA, and draw ST parallel to OA. Then it is obvious that $SR = ST = \frac{QS \cdot OA}{QO}$;

and also that the angles QSR and QST are equal. Hence the following theorems, which enable us at once to draw a figure on the object plane such that its image shall appear of any assigned form.

1. Any line, such as QR, on the object plane, drawn from a point Q in the section of the cylinder so that the angles QQR and QQA are equal, is seen after reflexion as a generating line of the cylinder.

2. If an epicycloid be described by lines of fixed length OS, SR, turning about O with angular velocities 1 and 2, and both coinciding with OA at starting, its image will be a circular section of the cylinder.

Thus, if we imagine as drawn on the cylinder any number of vertical and horizontal sections, forming a network, the object corresponding to them can be traced as a number of intersecting straight lines and epicycloids. Thus we have a well-known means of drawing the required object. A similar process may be applied to other modes of using such mirrors.

Diagrams for cylindrical mirror

When the cylinder has a small diameter, it may be usefully employed to intercept and reflect part of a beam of sunlight entering a dark room. It is easy to see, by a geometrical construction, that the reflected rays will, in this case, form a right cone, whose axis is that of the cylinder; and one of its generating lines will be parallel to the incident ray. Thus the angle of the cone becomes smaller as the inclination of the reflecting cylinder to the ray becomes less. If the ray, at the point of interruption, was at the centre of a spherical dome, after reflexion it will form on the dome a circle, small or great, which passes through its original point of incidence.

Reflection from polished metal

In the language of QUATERNIONS (γ), let α be the incident ray, β the axis of the cylinder, τ any normal to the cylinder, ρ the reflected ray. Then the law of reflexion gives

$$\nabla \cdot \tau \rho \alpha = 0$$

The property of the normal gives

$$S\beta\tau = 0.$$

Eliminating τ , we have at once

$$\frac{\rho^2}{\alpha^2} = \left(\frac{S\beta\rho}{S\alpha\beta} \right)^2,$$

the equation of a right cone.

Imitations, more or less perfect, of primary and secondary rainbows can easily be made by this process,—the sunbeam being led through a prism just before it falls on the cylindrical rod. This experiment is a very striking one, but, though capable of giving much information, it is of that dangerous kind which is liable to mislead instead of instructing an audience.

If we look at a great number of thin cylindrical rods, parallel to one another, and illuminated by sunlight, the rays which reach the eye must, by what we have already said, each form a side of some right cone (of definite angle) whose axis is parallel to each of the cylinders. The appearance presented will therefore be that of a luminous circle, passing through the sun. Its angular diameter becomes less as the axes of the cylinders are less inclined to the incident rays.

This phenomenon is beautifully shown by some specimens of crystals, especially of Iceland spar, which are full of minute tubes parallel to one another. In a plate of such a doubly-refracting crystal, however, there are necessarily four images. That which is *throughout* due to the ordinary ray (this term will be explained later) shows perfectly the phenomenon above described. The light of the luminous circle is white. The other three curves are not circles, and in them the colours are separated. One of them, which is elliptical, is usually very much brighter than either of the remaining two.

REFRACTION.—If homogeneous light be refracted at a Ordinary plane surface separating two homogeneous isotropic media, the incident and refracted rays are in one plane with the normal to the surface, and the sines of their inclinations to it are in a constant ratio

Refraction

The law of single refraction was put in a form equivalent to this (all but one word) for the first time by Snell in Leyden, some time before 1626. It was first published in 1637 by Descartes, who undoubtedly obtained it from Snell; but he gave it without any mention of its author.

The one word referred to is *homogeneous* as applied to the incident light. For the fact that white light consists of innumerable different homogeneous constituents, which are separated from one another by refraction, was first established by Newton. We quote his own account of this important discovery from his letter to Oldenburg, dated Feb. , 1672:—

Newton
on the
composition
of
white
light.

"To perform my late promise to you, I shall without further ceremony acquaint you, that in the year 1666 (at which time I applied myself to the grinding of peack-glasses of other figures than spherical) I procured me a triangular glass-prism, to try therewith the celebrated phenomena of colours. And in order thereto, having darkened my chamber, and made a small hole in my window-shutts, to let in a convenient quantity of the sun's light, I placed my prism at its entrance, that it might be thereby refacted to the opposite wall. It was first a very pleasing divertissement, to view the varied and mixt colours produced thereby, but after a while applying myself to consider them more circumspectly, I became surpris'd to see them in an oblong form, which, according to the received laws of refractions, I expected should have been circular. They were terminated at the sides with straight lines, but at the ends the decay of light was so gradual, that it was difficult to determine justly what was their figure, yet they seem'd semicircular.

"Comparing the length of this coloured spot with its breadth, I found it about five times greater; a disproportion so extravagant, that it could not be a mere effect of the irregularity of grinding from whence it might proceed. I could scarce think, that the various thickness of the glass, or the termination with shadow or darkness, could have any influence on light to produce such an effect. Yet I thought it not amiss, first to examine these circumstances, and so tried what would happen by transmitting light through parts of the glass of divers thicknesses, or through holes in the window of divers bignesses, or by setting the prism without, so that the light might pass through it, and be refacted, before it was terminated by the hole: but I found none of those circumstances material. The fashion of the colours was in all these cases the same.

"Then I suspected, whether by any unevenness in the glass, or other contingent irregularity, these colours might be thus dilated. And to try this, I took another prism like the former, and so placed it, that the light passing through them both, might be refacted contrary ways, and so by the latter returned into that curve from which the former had diverged it. For by this means I thought the regular effects of the first prism would be destroyed by the second prism, but the irregular ones more augmented, by the multiplicity of refractions. The event was, that the light, which by the first prism was diffus'd into an oblong form, was by the second reduced into an orbicular one, with as much regularity as when it did not at all pass through them. So that whatever was the cause of that length, it was not any contingent irregularity.

"I then proceeded to examine more critically, what might be effected by the difference of the incidence of rays coming from divers parts of the sun, and to that end, I measured the several lines and angles belonging to the image. Its distance from the hole or prism was 22 foot, its utmost length 12½ inches, its breadth 2½; the diameter of the hole ½ of an inch. The angle which the rays, tending towards the middle of the image, made with those lines, in which they were here proceeded without refraction, was 44 deg. 56 min. and the vertical angle of the prism 68 deg. 19 min. Also the refractions on both sides the prism, that is, of the incident and emergent rays, were, as near as I could make them, equal; and consequently about 64 deg. 4 min. And the rays fell perpendicularly upon the wall. Now embracing the diameter of the hole from the length and breadth of the image, there remains 13 inches in the length, and 2½ the breadth, comprehended by those rays which passed through the center of the said hole; and consequently the angle of the hole, which that breadth subtended, was about 81 min. measurable to the sun's diameter; but the angle which its length subtended, was more than 5 such diameters, namely, 2 deg. 49 min.

"Having made these observations, I first computed from them the refractive power of that glass, and found it measured by the ratio of the sines 20 to 81; and then by that ratio I computed the refractions of two rays flowing from opposite parts of the sun's discus, so as to differ 81 min. in their obliquity of incidence, and found that the emergent rays should have comprehended an angle of about 81 min. as they did before they were incident.

"But because this computation was founded on the hypothesis of

the proportionality of the sines of incidence and refraction, which though by my own experience I could not imagine to be so erroneous, as to make that angle but 81 min. which in reality was 2 deg. 49 min. yet my curiosity caused me again to take my prism and having placed it at my window, as before, I observed, that by turning it a little about its axis to and fro, so as to vary its obliquity to the light, more than an angle of 4 or 5 degrees, the colours were not thereby sensibly translated from their place on the wall; and consequently by that variation of incidence, the quantity of refraction was not sensibly varied. By this experiment, therefore, as well as by the former computation, it was evident, that the difference of the incidence of rays, flowing from divers parts of the sun, could not make them after decumescence diverge at a sensibly greater angle, than that which they before converg'd; which being at most but about 81 or 83 min. these still remained some other cause to be found out, from whence it could be 2 deg. 49 min.

"Then I began to suspect, whether the rays, after their impaction through the prism, did not move in curve lines, and according to their more or less curvity, tend to divers parts of the wall. And it increased my suspicion, when I remembered that I had often seen a tennis-ball, struck with an oblique racket, describe such a curve line. For, a circular as well as a progressive motion being communicated to it by that stroke, its parts, on that side where the motion concurs, must press and beat the contiguous air more violently than on the other, and there exists a salientcy and re-action of the air proportionably greater. And for the same reason, if the rays of light should possibly be globular bodies, and by their oblique passage out of one medium into another acquire a circulating motion, they ought to feel the greater resistance from the ambient matter, on that side where the motions concur, and therefore be continually bowed to the other. But notwithstanding this plausible ground of suspicion, when I came to examine it, I could observe no such curvity in them. And besides (which was enough for my purpose) I observed, that the difference betwixt the length of the image and the diameter of the hole, through which the light was transmitted, was proportionable to their distance.

"The gradual removal of these suspicions at length led me to the *experimentum crucis*, which was this. I took two boards, and placed one of them close behind the prism at the window, so that the light might pass through a small hole, made in it for that purpose, and fall on the other board, which I placed at about 12 feet distance, having first made a small hole in it also for some of that incident light to pass through. Then I placed another prism behind this second board, so that the light impacted through both the boards might pass through that also, and so again refracted before it arriv'd at the wall. This done, I placed at my right hand, and turn'd it to and fro slowly about its axis, so much as to make the several parts of the image, cast on the second board, successively pass through the hole in it, that I might observe to what places on the wall the second prism would refract them. And I saw, by the variation of these places, that the light, tending to that end of the image towards which the refraction of the first prism was made, did in the second prism suffer a refraction considerably greater than the light tending to the other end. And so the true cause of the length of that image was detected to be no other, than that light is not uniform or homogeneous, but consists of *diverse rays*, some of which are more refrangible than others, so that without any difference in their incidence on the same medium, some shall be more *refracted* than others, and therefore that, according to their particular degree of refrangibility, they were transmitted through the prism to divers parts of the opposite wall."

The constant ratio mentioned in the above statement of Rømer's law of refraction is called the *refractive index*. Its true numerical value depends upon the nature of the two media, ^{index} and also upon the quality of the homogeneous light. It is usually greater for orange light than for red, for yellow than for orange, and so on,—so that the violet rays are often called the "more refrangible" rays.¹

The following experimental facts are additions to the law.

When refraction takes place from a rarer into a denser medium, the angle of refraction is usually less than that of incidence.

If the refractive index for a particular kind of light from a medium A into another B be μ , that from B to A is $\frac{1}{\mu}$.

In other words, a refracted ray may be sent back by the path by which it came.

If μ_1 be the refractive index for a particular ray from A

¹ This statement is, however, liable to some very singular exceptions, which will be mentioned later, when we are dealing with anomalous dispersion.

into B, and μ_2 that for the same ray from A into C, that from B into C is $\frac{\mu_2}{\mu_1}$.

These being premised, let us consider a source of homogeneous light in air shining on a surface of water. Here we may take μ as about equal to $\frac{4}{3}$.

Let MN (fig 12) be the perpendicular to the water surface at the point where the incident ray AP meets it. In the plane APM make the angle QPN such that:

$$\sin \angle APM = \frac{3}{4} \sin \angle QPN,$$

then PQ is the refracted ray. If QP be produced backwards to meet the vertical line BA in g, we may present this statement in the form

$$\frac{FB}{FA} = \frac{PD}{PQ},$$

or

$$PA = \frac{3}{4} PQ$$

If the rays fall nearly perpendicularly on the surface, we may put (approximately) B for P, and we have

$$Bq = \frac{3}{4} BA$$

Hence, an eye placed under water

and nearly in the vertical through A, sees a virtual image of A at g, one third farther from the surface of the water

As P is taken farther and farther from A, the angle of incidence becomes more nearly a right angle, and the sine of the angle of refraction becomes more nearly equal to $\frac{3}{4}$.

A ray cannot go from air into water so as to make, with the perpendicular to the surface, an angle whose sine is greater

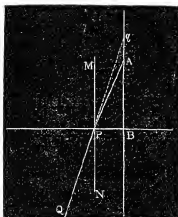


Fig 12

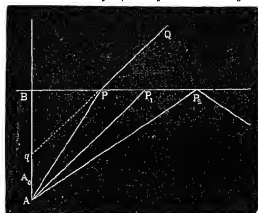


Fig 13

than $\frac{3}{4}$. The true nature of this curious statement is, however, best seen when we suppose the source to be under water, and the light to be refracted into air. If APQ (fig 13) be the course of a ray, we have as before

$$AP = \frac{3}{4} PQ$$

Hence, if P_1 be taken so that

$$AP_1 = \frac{3}{4} P_1 B,$$

it is clear that g coincides with B, or the ray AP₁, refracted at P₁, runs along the surface of the water. If AP₁ be less than $\frac{3}{4}$ P₁B, no point g can be found, so that the ray AP₁ cannot get out of the water. It is found to be completely reflected in the water. This reflexion unaccompanied by refraction is called *total reflexion*. The limiting angle of incidence (at P₁) which separates the totally reflected rays

from those which (at least partially) escape into air is called the *critical angle*. When an equilateral triangular prism of glass is placed in a ray of sunlight, and made to rotate, we see (besides the spectra formed by refraction) beams of white light reflected alternately from the outside and the inside of each face. The totally reflected ray from the inside is seen to be very much brighter than that reflected from the outside.

To an eye placed nearly in the vertical of A, A appears at A₀, where

$$A_0 B = \frac{3}{4} AB$$

Thus a clear stream, when we look vertically into it, appears to be of only $\frac{3}{4}$ ths of its real depth. But when we look more and more obliquely, seeing A for instance by the ray QP, the image appears nearer and nearer to the surface; or, if A be at the bottom, the water will appear more and more shallow; and all objects in it will appear to be crowded towards the surface. Thus the part of a stick immersed in water appears bent up towards the surface of the water.

Again, to an eye at A, all objects above the water will be seen within a right cone of which AB is the axis and AP, a side. The rest of the water surface, outside the cone just mentioned, shows us objects at the bottom by reflexion in a perfect mirror.

All this is on the supposition that the light is homogeneous. But when white light is emitted by A, the point A₀ will be nearer the surface for each constituent the greater is the refractive index. Thus a white point at A will appear drawn out into a coloured line whose lower end is red and upper end violet.

It is easily seen from the law of refraction that light, on passing through a plate of homogeneous material with parallel faces, finally emerges in a direction parallel to that at incidence, and therefore white light comes out from it still white. If the plate be water in a glass vessel with parallel sides, a body placed close to one side, while the eye is close to the other, appears to be at $\frac{3}{4}$ ths of its real distance from the eye.

The explanation of the law of refraction, on the corpuscular theory, was given by Newton. It is still of importance, as the earliest instance of the solution of a problem involving molecular forces. Newton shows that, as the molecular forces on a corpuscle balance one another at every point inside either of the media, its velocity must be constant in each, but that in passing through the surface of separation of the two media the square of the velocity perpendicular to the surface undergoes a finite change.

Thus, if v be the velocity in air, a the angle of incidence, then in glass the velocity parallel to the surface is still v sin a, but that perpendicular to the surface is $\sqrt{v^2 \cos^2 a + c^2}$. Thus the whole velocity is $\sqrt{v^2 + c^2}$, and, if a' be the angle of refraction,

$$\sqrt{v^2 + c^2} \sin a' = v \sin a.$$

Prisms—When the surfaces are plane, but not parallel, Prisms. we have what is called a prism.

The general nature of the action of a prism will be easily understood by the help of the previous illustrations, if we restrict ourselves to the case of a prism of very small angle and to rays passing nearly perpendicularly to each of its faces. Thus, the rays falling nearly at right angles to its surface from a point A (fig 14) will, after the first refraction, appear to diverge from a luminous line RV, red at the end next to A, violet at the other. This line is in the perpendicular AB from A to the first surface of the prism. Draw from R and V perpendiculars RS, VT to the second surface of the prism. Join BS, BT, and draw Ar, Av parallel to them so as to cut RS in r and VT in v. To an eye behind the prism, the bright point A will appear to be drawn out into a coloured line rv, red at the end nearest to A.

If A be a narrow bright line of light, parallel to the edge of the prism, it will appear to be drawn out into a rectangle consisting of images of the line ranged parallel to one another, and due to the various homogeneous constituents of white light in order of their refrangibility. If the light do not contain rays of every degree of refrangibility, some of these images will be wanting, and there will be corre-

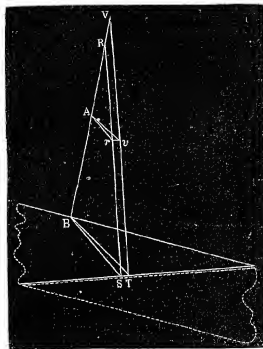


Fig 14

sponding dark lines or bands crossing this spectrum (as it is called). The amount by which any part of this spectrum is shifted from the true position of the bright slit depends (*ceteris paribus*) upon the amount of the refraction. It also depends on the angle of the prism. And, for a given angle, the length of the spectrum depends upon the difference between the refractive indices for the red and the violet rays. This is called the *dispersion*.

If a second prism, of the same glass, and of the same angle, as the first, be placed in a reversed position behind it (as indicated by the dotted lines in the figure), the effect of the two would be simply that of a plate of glass with parallel faces, the emergent rays would each be parallel to its original direction, and there would be no separation of colours. The reversed prism would therefore undo the work of the direct prism. Then we should have no dispersion, but we should also have no refraction. We have, however, as has already been shown, an increase of divergence, &c., the image is nearer to the eye than the object. Blair, Brewster, and Amici devised combinations of two pairs of prisms of the same glass, those of each pair having their edges parallel, such that the combination acted as a sort of achromatic telescope of low power.

Newton, from some rough experiments, hastily concluded that the amount of dispersion is in all substances proportional to that of the refraction. If such were the case it is easy to see that prisms of two differently refracting materials and of correspondingly different angles, combined (as above described) so as to annul the dispersion, would likewise annul the refraction. Thus Newton was led to suppose that refraction without dispersion is impossible.

It was found by Hall in 1733, and afterwards (independently) by Dollond, that this idea is incorrect—that, in fact, we have in certain media large refraction with com-

paratively small dispersion, and *vice versa*, and thus that the dispersion may be got rid of while a part of the refraction remains. James Gregory had previously conjectured that this might be done by using, as is done in the eye, more media than one. Thus we have for certain specimens of flint and crown glass, whose optical constants were carefully measured by Fraunhofer, the following values of the refractive index for three definite kinds of homogeneous light —

	C	D	F
Flint glass.	1.6297	1.6350	1.6483
Crown glass.	1.5268	1.5298	1.5340

The rays C and F are in the red and greenish blue respectively, and are given off by incandescent hydrogen. D is the orange-yellow ray of sodium.

When the angle of the prism is very small (the only case we treat here), we may consider Ax as approximately a straight line, whose length is (*ceteris paribus*) proportional to the angle of the prism. Also the distances Ar , Ax , are to one another in the proportion of the refractive indices of red and violet rays, each diminished by unity. Hence, for a prism of flint glass such as was employed by Fraunhofer, the distances from A to its images formed by these three kinds of homogeneous light respectively are very nearly as

630, 635, 648

When a prism of crown glass is used they are nearly as

627, 630, 636

The differences between the numbers for C and F are

For flint glass	18
„ crown glass	9

as 2 : 1. Hence if we make the small angle of the crown-glass prism twice that of the flint, and observe A through the two prisms, with their edges turned in opposite directions, the C and F images will coincide. Both, however, will be displaced from the real direction of A as if a prism had been employed, with its edge turned as that of the crown glass was, and to the same extent as that prism would have displaced them had its refractive index been about 1.31 and the same for the two kinds of light C and F.

In fact, the displacements by the flint prism are as

630, 648,

and those by the crown prism (to the opposite side) are as

1651, 1672

The differences, in favour of the crown prism, are as

424, 424

This combination of prisms is called *achromatic*, or colourless, but is not perfectly so. For if we inquire into the displacement of the D image, we find that it is as

635

for the flint prism, but as

1080

in the opposite direction, for the crown prism. Hence its whole displacement is as

125,

a little greater than that common to C and F. The reason for this is obvious from Fraunhofer's numbers given above. The interval from C to D is to that from C to F in a greater ratio in crown than in flint glass,—so that the spectra given by these media are not similar. The rays of higher refrangibility are more separated in proportion to those of lower refrangibility in flint than in crown glass. This is the *irrationality of dispersion*—which, so far as we yet know, renders absolute achromatism unattainable. Three lenses in combination give a better attempt at achromatism than can be made with two, and some re-

markable results were obtained by Blair,¹ with two glass lenses enclosing a lenticular portion of a liquid.

LAYS IN
the SOLA
SPECTRUM

By looking through a prism at a very narrow slit formed by the window shutters of a darkened room, Wollaston (in 1802) found that the light of the sky (*i.e.*, sunlight) gives a spectrum which is *not continuous*. It is crossed by dark bands, as already hinted. These bands are due to the deficiency of intensity of certain definite kinds of homogeneous light. They were, independently, rediscovered, and their positions measured, by Fraunhofer² in 1817 with far more perfect optical apparatus. He also found similar, but not the same, deficiencies in the light from various fixed stars. The origin of these bands will be explained in RADIATION, along with the theory of their application in spectrum analysis. In optics they are useful to an extreme degree in enabling us to measure refractive indices with very great precision. Wollaston's own account of his discovery is as follows:—

"If a beam of day-light be admitted into a dark room by a crevice $\frac{1}{4}$ th of an inch broad, and received by the eye at the distance of 10 or 12 feet, through a prism of flint-glass, *free from strain*, held near the eye, the beam is seen to be separated into the four following colours only, red, yellowish-green, blue, and violet, in the proportions represented in fig.

"The line A limit bounds the red side of the spectrum is somewhat confused, which seems to result from the want of power in the eye to converge red light. The line B, between red and green, in a certain position of the prism is perfectly distinct, so also the D and E, the two limits of violet. But C, the limit of green and blue, is not so clearly marked as the rest, and there are also on each side of this limit other distinct dark lines *f* and *g*, either of which in an imperfect experiment might be mistaken for the boundary of these colours.

"The position of the prism in which the colours are most clearly divided is when the incident light makes about equal angles with two of its sides. I then found that the spaces AB, BC, CD, DE occupied by them were nearly as the numbers 16, 23, 38, 25."

The mode of formation of a spectrum which was employed by Newton, and which is still used when the spectrum is to be seen by many spectators at a time, differs from that just explained in this, that the light from a source A is allowed to pass through the prism, and to fall on a white screen at a considerable distance from it. In this case the paths of the various rays as they ultimately escape from the prism are found by joining the points *r*, ... *v*, with the prism and producing these lines to meet the screen. Unless one surface of the prism be covered by an opaque plate, with a narrow slit in it parallel to the edge of the prism, the spectrum produced in this way is very impure, *i.e.*, the spaces occupied by the various homogeneous rays overlap one another. To make it really pure an achromatic lens is absolutely requisite. This leads us, naturally, to the consideration of the refraction of light at spherical surfaces.

Refraction at a Spherical Surface.—Following almost exactly the same course as that taken with reflexion above, let O (fig 16) be the centre of curvature of the spherical refracting surface AB. Let U be the point-source of homogeneous light, and let PV be the prolongation (backwards) of the path pursued, after refraction, by the ray UP

Then, *rigorously*, we have

$$\sin UTO = \mu \sin OPV,$$

where μ is the index of refraction between the two media employed. This may be written (by omitting a common factor) as

$$\frac{OU}{UO} = \frac{OV}{VO}$$

It, as before, the breadth of the surface be small compared with its radius of curvature, we may approximate



FIG 16

(sufficiently for many important practical purposes) by writing A for P. Thus we have

$$\frac{OU}{UO} = \frac{OV}{VO}$$

Retaining the same notation as in the case of reflexion, we get

$$\frac{u-r}{u} = \frac{v-r}{v},$$

or

$$\frac{\mu}{v} - \frac{1}{u} = \frac{\mu-1}{r} \quad \dots \dots (1)$$

Notice that, if we put $\mu = -1$, this becomes the formula for reflexion at a concave mirror.

Lenses.—Suppose now that, after passing a *very short* Th distance into the refracting medium, the ray escapes again into air through another spherical surface whose centre of curvature also lies in the line OA. Let *s* be the new radius of curvature, *v* the value of the quantity corresponding to *v* for the escaping ray. Then, remembering that the refractive index is now $\frac{1}{\mu}$, we have (by the previous formula)

$$\frac{1}{\mu} - \frac{1}{v} = \frac{1}{s} - \frac{1}{u},$$

or

$$\frac{1}{v} - \frac{\mu}{s} = \frac{1-\mu}{s} \quad \dots \dots (2)$$

Adding (1) and (2) we get rid of *v*, which indicates the behaviour of the rays in the substance of the lens, and have

$$\frac{1}{w} - \frac{1}{u} = (\mu-1) \left(\frac{1}{r} - \frac{1}{s} \right).$$

This contains the whole (approximate) theory of the behaviour of a very thin lens.

When the source is at an infinite distance, or $u = \infty$, we have

$$\frac{1}{w} = (\mu-1) \left(\frac{1}{r} - \frac{1}{s} \right) \\ = \frac{1}{f} \text{ suppose}$$

This quantity *f*, defined entirely in terms of the refractive index and of the curvatures of the two faces of the lens, is called the *principal focal distance*. If μ be greater than 1, *i.e.*, as in the case of a glass lens in air, *f* is positive if

$$\frac{1}{r} > \frac{1}{s}$$

be so; and it obviously retains the same value, and sign, if the lens be turned round. For, in the formula, *r* and *s* simply change places, and they also change signs; *i.e.*, we must

¹ *Trans. R.S.E.*, vol. III (1791)

² *Gilliet's Analysis*, III

³ "The correspondences of these lines with those of Fraunhofer I have, with some difficulty, ascertained to be as follows:—

A, B, *f*, C, G, D, R, Wollaston's lines
B, D, *b*, F, G, H, Fraunhofer's lines.

There is no single line in Fraunhofer's drawing of the spectrum, nor is there any in the real spectrum, consistent with the line C of Wollaston; and indeed he himself describes it as not being "so clearly marked as the rest." I have found, however, that this line C corresponds to a number of lines half-way between D and F, which, owing to the absorption of the atmosphere, are particularly visible in the light of the sky near the horizon. — Brewster, *Report on Optics*, Brit. Association, 1882

put $-s$ for r and $-r$ for s . This leaves the result unchanged.

All lenses, therefore, whose sections are of any of the forms in fig 16, whichever way they are turned, render

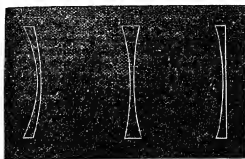


Fig 16

parallel rays which pass through them *diverge*. Their characteristic is that they are thinnest at the middle. But

$$\frac{1}{s} - \frac{1}{s'}$$

is negative for lenses whose sections are of any of the forms shown in fig 17. Such lenses, whichever way they are turned, render parallel rays *convergent*. Their characteristic



Fig 17

is that they are thickest at the middle. But these characters are interchanged when μ is less than 1, as, for instance, when the lens is an air-space surrounded by water. The similarity on reversal is *not* in general true in a second approximation.

The formula for a thin lens now takes the form,

$$\frac{1}{s} - \frac{1}{s'} = \frac{1}{f}$$

and differs from that for a curved reflecting surface only in the sign of the second term. With the proper allowance for this, then, all that we have said of reflection at spherical mirrors holds true of refraction through thin lenses with spherical surfaces.

We may now put the whole matter in the excessively simple form which follows —

A thin lens increases or diminishes by a definite quantity the convergence or divergence of all rays which pass through it.

This quantity is the divergence or convergence of rays falling on the lens from or passing from it to its principal focus. Or it is the convergence or divergence which the lens produces in parallel rays. Thus, if the distance of an object from a convex lens is twice the focal length of the lens, the image is formed at the same distance from the lens, and is equal in size to the object.

Images produced by lenses.

Figs. 18 and 19 show the production of a real image and of a virtual image by lenses which produce convergence of parallel rays—along with the rays by which these are seen by an eye placed behind the lens. In either case it is obvious that the sizes of object and image are, respectively, as their distances from the centre of the lens

Fig. 18 shows how a lens produces a real inverted image (real) of a body placed farther from it than its principal focus. This is the case in the camera obscura, in the solar

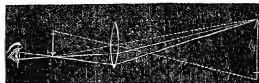


Fig 18

microscope, and in the object glass of a telescope. Fig. 19 shows how a virtual image is formed of a body placed nearer to a lens than its principal focus. This is the case of a single lens used as a microscope. In the former case the divergence of the incident rays is so small that the lens renders them convergent. In the latter the divergence is so great that the lens can only diminish, not destroy it.

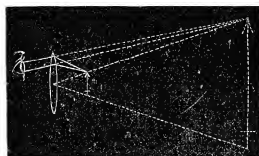


Fig 19

In using a hand-magnifier in this way, we so adjust it, by practice, that the enlarged image appears to be formed at the distance from the eye at which vision is most distinct. It is obvious that the amount of magnification must, then, be greater as the focal length of the lens is less.

We can now understand the working of the ordinary astronomical telescope (fig 20). The object glass furnishes an inverted but real image of a distant body, *within our reach*. We can, therefore, place the eye-glass (like the single microscope above spoken of) so as to form a virtual magnified image of this real image treated as an object. It is still, of course, inverted. It is easy to see that the

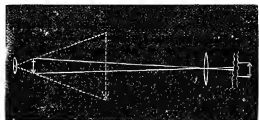


Fig 20

angle subtended at the eye by the virtual image seen through the eye-piece is to that subtended by the object at the unaided eye approximately as the focal length of the object lens is to that of the eye lens. These angles are, in fact, those subtended at the centres of the two lenses by the real image. This ratio is, therefore, called the *magnifying power* of the telescope.

The compound microscope, in its simplest form, is precisely the same arrangement as the astronomical telescope. The only difference is that the object, being at hand, can be placed near to the object-glass (still, however, beyond its principal focus), so that the real image formed is already considerably larger than the object, and is then still further magnified by the eye-glass.

The magnifying power of a single lens, when used as a hand microscope, is to be measured by the ratio of the angle under which the virtual image of an object is seen (at the distance of most distinct vision) to that at which the object itself would be seen (at that same distance), *i. e.*, it is the ratio of 10 inches to the focal length of the lens.

Combinations of Lenses in Contact.—From the formula

$$\frac{1}{f} = (\mu - 1) \left(\frac{1}{r} - \frac{1}{s} \right)$$

we see that the focal length of a simple lens is less as μ is greater. Thus all that we have just said is true for homogeneous light alone. But if we combine two thin lenses, placing them close together, we may arrive at an approximately achromatic arrangement. For we have, for the first lens

$$\frac{1}{w} = \frac{1}{w} - \frac{1}{f},$$

For a second, close to it, we have

$$\frac{1}{x} = \frac{1}{x} - \frac{1}{f'}.$$

For the two, considered as one, we have

$$\frac{1}{x} \frac{1}{u} = \frac{1}{f} + \frac{1}{f'}.$$

Now

$$\frac{1}{f} + \frac{1}{f'} = (\mu - 1) \left(\frac{1}{r} - \frac{1}{s} \right) + (\mu' - 1) \left(\frac{1}{r'} - \frac{1}{s'} \right),$$

and there is an infinite number of ways in which r' and s' can be chosen, when r and s are given, such that the values of the right hand side shall be equal for two values of μ and the corresponding values of μ' . Any one of these gives an achromatic combination, of the necessarily imperfect kind described above in considering prisms. But, as we have now the curvatures of *four* surfaces to deal with, we can adjust these so as not only to make the best attainable approximation to achromatism, but also to reduce the unavoidable spherical aberration to a minimum.

These questions, however, are beyond the scope of this article. We can remark only that the adjustment for two rays, for which the refractive indices are μ and $\mu + \delta\mu$ in the first medium, and μ' and $\mu' + \delta\mu'$ in the second, requires the one relation

$$\frac{\delta\mu}{\mu - 1} \frac{1}{f} + \frac{\delta\mu'}{\mu' - 1} \frac{1}{f'} = 0,$$

which involves only the ratio of the focal lengths of the two lenses—leaving their forms absolutely undetermined. But, if both μ and μ' be greater than unity, the signs of f and f' must be different,—*i. e.*, in an achromatic combination of two lenses one must be convex and the other concave.

The reader must, however, be reminded that we are dealing with a first approximation only, and that spherical aberration does not come in till we reach a second. The details for a proper achromatic combination will be given in OPTICS (GEOMETRICAL).

Before leaving this subject, we must find the behaviour of two thin lenses which are placed at a finite distance from one another. For the first lens we have, as before,

$$\frac{1}{w} = \frac{1}{u} - \frac{1}{f}.$$

If the second lens be placed at a distance a behind the first, the rays which fall on it appear to come from a distance $w + a$. Hence, for the light emerging from the second lens, we have

$$\frac{1}{a} = \frac{1}{w + a} - \frac{1}{f'}$$

When w is infinite, we have from the last two equations

$$\frac{1}{x} = \frac{1}{f} + \frac{1}{f'}$$

It is obvious that a combination of this nature offers the

same kind of facilities for the partial cure of dispersion and of spherical aberration as when the lenses are in contact, with one additional disposable constant. Thus we have compound achromatic eye-pieces, which can be corrected for spherical aberration also.

Formation of a Pure Spectrum.—We may now go back to the formation of an image by a prism, and inquire how, by the use of an achromatic lens, we can project a pure spectrum on a screen. We have seen that a thin prism, for rays falling nearly perpendicular to it, forms a virtual and approximately rectilinear image of a luminous point, in which the colours are ranged in order of refrangibility. Suppose the light which passes through the prism to fall on an achromatic lens, placed at a distance greater than its focal length from the virtual image above mentioned. These rays after passing through the lens will proceed to form, at the proper distance, a real linear coloured image of the luminous point, in which (as in the virtual image) the colours do not overlap. Instead of a luminous point, rays diverging from a very narrow slit parallel to the edge of the prism are employed. It is usual to place the lens at double its focal distance from the virtual image, and thus the real image is formed at an equal distance on the other side of it, and is of the same size. It may now, if required, be magnified by means of an achromatic eye-piece. Or, in other words, it may be examined by means of a telescope. In fact a telescope, whose object glass is covered by a thin prism, has been usefully employed during a total eclipse in examining the light of the solar corona. A similar arrangement, made to have an exceptionally large field of view, is employed to find the nature of the spectra of meteorites or falling stars.

Refraction at a Cylindrical Surface.—A very simple, but interesting, case of refraction at a cylindrical surface is furnished by a thermometer tube. It is easily seen that the diameter of the bore appears, to an eye at a distance large as compared with the diameter of the tube, to be greater than it really is, in the proportion of the refractive index of the glass to unity. Thus in flint glass it appears magnified in about the ratio 5 : 3. Hence the mercury appears completely to fill the external surface of such a tube, if the bore be only $\frac{1}{3}$ ths of the external diameter. But a far more interesting case is that of parallel rays falling on a solid cylinder of glass or water. Its interest consists in the fact that by its aid we can explain the phenomena of the rainbow. We, accordingly, devote special attention to it. The problem, without losing any of its applicability to the rainbow, is much simplified by supposing the rays to be incident in a direction perpendicular to the axis of the cylinder, for in this case the whole course of each ray is in a plane perpendicular to the axis. We need not treat here of rays which pass close to the axis of the cylinder. For such the cylinder acts as a lens, and its focal length (to the usual first approximation) can easily be obtained by methods such as those given above.

What we are mainly concerned with is the behaviour of the rays which escape into the air, after one or two reflexions at the inner surface of the cylinder.

Suppose first that we consider a ray once reflected in the interior of the cylinder. Let SP (fig. 21) be one of the set of incident parallel rays, and let its path be SPQPS'. This involves refraction at P, reflexion at Q, and again refraction

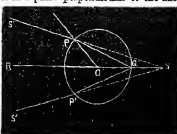


Fig. 21

What we are mainly concerned with is the behaviour of the rays which escape into the air, after one or two reflexions at the inner surface of the cylinder.

Suppose first that we consider a ray once reflected in the interior of the cylinder. Let SP (fig. 21) be one of the set of incident parallel rays, and let its path be SPQPS'. This involves refraction at P, reflexion at Q, and again refraction

Achromatic eye-pieces

Lenses in contact

Achromatic lenses

tion at P'. But it is obvious from the symmetry of the circular section, and from the laws of refraction and reflection, that this path is symmetrical about the line OQ which joins the axis of the cylinder to the point at which the ray is reflected. Hence SP, SP' meet OQ in the common point s, and the amount by which the direction of the ray has been turned round by the refractions and the reflection is twice the supplement of half the angle at s. But the angle POQ is double OTQ the angle of refraction, while OPs is equal to the angle of incidence. Hence the half angle at s is the excess of twice the angle of refraction over the angle of incidence.

Turn now to fig 22, in which we have two concentric circles whose radii are to one another as the refractive index of the cylinder is to unity. If A be any point on a diameter, and tangents Ap and Aq be drawn from it, we see at once that the sines of the angles at A are to one another as the radii of the circles. Hence, if OAp be the angle of incidence, Oaq is the corresponding angle of re-

function, and it is easy to see that the half angle α (in fig. 22) will in fig. 22 be represented by the *arcus* of OA2 over OA1, α now when OA2 is large, both of these angles are small, and thus their difference is likewise small. As OA becomes less, the difference of the angles becomes greater, but only up to a certain point, for when OA is near the outer circle the angle OA2 begins to increase much faster than does OA1. If hence these A's single definite position of A for which the difference is a maximum. In the first figure these changes in the angles of incidence and refraction, for the members of a group of parallel rays, correspond to the varying positions of P in the circular section of the cylinder. Hence there is one position of P for which the angle α is a maximum. Now one of the conditions of a maximum or minimum of any quantity is that, near it, the value of the quantity *changes very slowly*. Thus a number of issuing rays are crowded together near the direction corresponding to the maximum, the others being more widely scattered,—while for all of them the angle α is a smaller. Newton gives us as an illustration of this, the very slow change of length of the day when the sun is near one of the tropics.

Now suppose the diameter of the cylinder to be small compared with the distance of the eye from it. In this case the point s may be considered as being in the axis of the cylinder.

Let $S\alpha E_1$ (fig. 23) be made equal to the maximum value of α , then an eye placed anywhere in the line αE_1 will receive the rays which are congregated towards the maximum. An eye *within* the angle $S\alpha E_1$ (as at E_2) will receive some

of the straggling rays, while an eye outside that angle (as at E_1) will see nothing. Let there now be imagined a great number of parallel cylinders, let E_1E_2 be drawn parallel to the incident rays, and make the angle $\angle E_1E_2S'$ equal to $\angle E_1E_2S$. Then the eye at E_1 will see the concentrated rays (already spoken of) in the directions E_1E_2 and E_1E_2' . From points within $\angle E_1E_2S'$ some straggling rays will reach it, from wants outside that angle none.

Now suppose cylinders to be placed in great numbers P_1, P_2, P_3, \dots ^{parallel to} $all\ directions$ perpendicular to the incident rays, as in *E*. ^{parallel to} $all\ directions$ *E* we shall see a bright circle of light whose centre is H ^{parallel to} $all\ directions$ in *E*. Inside that circle there will be feeble illumination; ^{parallel to} $all\ directions$ outside it, darkness. This is obviously the case of the rainbow, where we have spherical drops of water instead of the cylinders above spoken of. For each spherical drop is effective only in virtue of a section through its centre, containing the incident ray and the eye, and such sections are the same as those of the cylinders.

Thus far we have been dealing with *parallel* rays of *homogeneous* light, and the appearance (to the degree of approximation we have adopted) is that of a bright circle whose centre is diametrically opposite to the source of light, whose radius is (for raindrops) about $42^{\circ} 2'$, and whose area is slightly illuminated.

Introduce the idea of the different kinds of homogeneous white light which make up sunlight, and we find a circular (almost light-pure) spectrum—the less refrangible rays being on the outside. Next we introduce the consideration of the finite disk of the sun, and we have an infinite series of such arrangements superposed on one another, the centre of each individual of the series being at the point diametrically opposite to the point of the sun's disk which produced it. This leaves the *general* aspect of the phenomenon unchanged, but altogether destroys the purity of the spectrum.

If we next consider light which has been twice reflected within the cylinder, we have a figure like the diagram fig 24, where the lettering is as nearly as possible the



Fig. 22

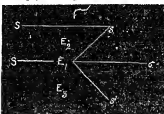


Fig. 25

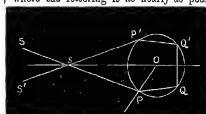


Fig. 2

To find it, we have

$$\frac{\pi}{2} - 4\epsilon - 3\mu - \theta,$$

with

$$\sin \theta = \mu \sin \phi.$$

Differentiating, &c., as before, we find

$$8 \cos \theta = \mu - 1,$$

whence, finally,

$$\sin \frac{1}{2}\theta = \frac{\mu^2 + 18\mu^2 - 27}{8\mu^2}.$$

This quantity increases with μ , for its differential coefficient is

$$\frac{1}{8} \left(\frac{9}{\mu^3} - 1 \right)^2,$$

which is necessarily positive (It vanishes, no doubt, for $\mu=3$, but then so does θ).

For $\mu=\frac{4}{3}$ the value of $\sin \frac{1}{2}\theta$ is

$$0.4908 \text{ nearly,}$$

so that

$$\theta = 50^\circ 58'.$$

Second-
ary rain-
bow.

Carrying out the same steps of reasoning as before, and applying the result to raindrops, we find a second rainbow concentric with the first, but with a greater radius, viz., about $61''$ (for yellow light). All the above remarks about the impurity of the spectrum, &c., apply to this bow also. In this bow the less refrangible rays are on the *inner* side, and the straggling rays illuminate feebly the space *outside* it. Hence the space between the red boundaries of the two bows has no illumination from rays reflected either once or twice within the water drops.

What we have now given is nearly all that geometrical optics can tell us about the rainbow. It seems that the first really important steps in the explanation, viz., (1) that the primary bow is due to rays falling on the outer portions of the drops, which suffer two refractions and one reflexion before reaching the eye, and (2) that the secondary bow is due to rays falling on the inner side, and suffering two refractions and two reflexions, are due to Theodorich, about 1811. His work was not published, and its contents were first announced by Venturi¹ in the present century. These results were, independently, discovered by De Dominis² in 1611. Neither of these writers, however, pointed out the concentration of the rays in particular directions. This was done by Descartes in 1637, by the help of Snell's law. He calculated with great labour the paths of each of 10,000 parallel rays falling on different parts of one side of the drop, and showed that from the 8600th to the 8600th the angle between the extreme issuing rays is measured in minutes of arc,—thus discovering by sheer arithmetic the maximum which, as we have seen above, is so easily found by less laborious methods. Newton's addition to this theory consisted mainly in applying his discovery of the different refrangibilities of the different homogeneous rays. The explanation was then thought to be complete. For a long time this was held to be one of Newton's most brilliant discoveries. It is well to notice that he himself speaks of it in its true relation to the work of his predecessors. He merely says,—"But whilst they understood not the true origin of colours, it is necessary to pursue it here a little further." And he said well, for a full investigation conducted on the principles of the undulatory theory introduced, as was first pointed out by Young, certain important modifications in the above statements. Of these we need mention only one, viz., that in each bow there is more than one maximum of brightness for each homogeneous ray. The *spurious* bows, as they are called, which often appear like ripples, inside the primary and outside the secondary bow, and which depend upon the fact just mentioned, have

Spurious
bows.

¹ *Commentarii operis in storia e in teoria dell' Ottica*, Bologna, 1814.

² Newton, in his *Optics*, says the work of De Dominis was written twenty years before it was published.

no place in even Newton's theory. About them, in fact, geometrical optics has nothing to say. Young, in 1804, took the first step for their explanation. They were fully investigated, from the undulatory point of view, by Airy, in 1836-38, and his results were completely verified by the measurements of Hallows Miller in 1841.³ Miller used a fine cylinder of water escaping vertically from a can. This is one of the reasons which induced us to treat the subject as a case of refraction and reflexion in a right cylinder.

The overlapping of the colours in the rainbow, due to the White apparent size of the sun's disk, is occasionally so greatly exaggerated that only faint traces of colour appear. This may happen, for instance, when the sun shines on raindrops in the lower strata of the atmosphere through clouds of ice-crystals in the higher strata. By reflexion from the faces of these crystals, the source of light is spread over a much larger spherical angle, and there is no sharp edge to it as in the case of the unclouded disk. The rainbow is then much broader and fainter than usual, and nearly white. The size of the drops also produces modifications which are not indicated by the geometrical theory.

When the moon is the source of light, the rainbow is so *Lunar* faint that it is often difficult to distinguish the colours; *bow* but with full moon, and other favourable circumstances, it is easy to assure one's self that the colours are really present.

The refraction of sunlight, or moonlight, through ice-Halos, crystals forming cirrus clouds, gives rise to coloured *halos*, *parhelia*, *paraselenae*, &c. Their approximate explanation depends upon the behaviour of prisms with angles of 60° or 90° , and therefore does not come within the scope of the present article. They must not, however, be confounded with *coronae*, those rings which encircle the sun or moon *Coronae* when seen through a mist or cloud. Halos have definite radii depending on the definite angles of ice-crystals; the size of a corona depends on the size of the drops of water in a mist or cloud, being smaller as the drops are larger. Thus their diminution in radius shows that the drops are becoming larger, and implies approaching rain. They are due to *diffraction*, and can only be explained by the help of the undulatory theory.

Refraction in a Non-Homogeneous Medium.—The principles already explained are sufficient for the purpose of *homoe-* treating this question also. But they require, for the *success* application, the artifice of supposing the medium to be made up of layers, in each of which the refractive power is the same throughout the layer, but finitely differs from one layer to another, and then supposing these layers to become infinitely thin and infinitely numerous. In this case there will of course be only an infinitely small difference in properties between contiguous layers; and the abrupt change of direction which accompanies ordinary refraction is now replaced by a *continuous curvature* of the path of the ray.

Glimpses of a more general method had been obtained even in Hamilton's 17th century; and in the 18th these had become a constant *homoe-* process so far as application to the corpuscular theory is concerned, general. But it was reserved for Sir W. R. Hamilton (q.v.) to discover the invest- existence of what he called the *characteristic function*, by the help of *gustions* of which all optical problems, whether on the corpuscular or on the undulatory theory, are solved by one common process. Hamilton was in possession of the germs of this grand theory some years before 1824, but it was first communicated to the Royal Irish Academy in that year, and published in imperfect statements some years later. The following is his own description of it. It is extremely important as showing his views on a very singular part of the more modern history of science.

³ These who have meditated on the beauty and utility, in theoretical mechanics, of the general method of Lagrange, who have felt the power and dignity of that central dynamical theorem which is deduced, in the *Mécanique Analytique*, . . . must feel that mathe-

³ Airy's paper is in vol. vi. of the *Cambridge Phil. Trans.*, Miller's in vol. vii.

metrical optics can only *claim* attain a coordinate rank with mathematical mechanics, when it shall possess an appropriate method, and become the unfolding of a central idea.

It appears that if a general method in deductive optics can be attained at all, it must flow from some law or principle, itself of the highest generality, and among the highest results of induction. . . . (That) must be the principle, or law, called usually the Law of Least Action; suggested by questionable views, but established on the widest induction, and embracing every known combination of media, and every straight, or bent, or curved line, ordinary or extraordinary, along which light (whatever light may be) extends its influence successively in space and time, namely, that the linear path of light, from one point to another, is always found to be such that, if it be compared with the other infinitely various lines by which in thought and in geometry the same two points might be connected, a certain integral or sum, called often *action*, and depending by fixed rules on the length, and shape, and position of the path, and on the media which are traversed by it, is less than all the similar integrals for the other neighbouring lines, or, at least, possesses, with respect to them, a certain *stationary* property. From this Law, then, which may, perhaps, be named the Law of STATIONARY ACTION, it seems that we may most fully and with best hope set out, in the synthetic or deductive process and in the search of a mathematical method.

"Accordingly, from this known law of least or stationary action I deduced (long since) another connected and coextensive principle, which may be called by analogy the LAW of VARYING ACTION, and which seems to offer naturally a method such as we are seeking, the one law being as it were the last step in the ascending scale of induction, respecting linear paths of light, while the other law may usefully be made the first in the descending and deductive way.

"The former of these two laws was discovered in the following manner. The elementary principle of straight rays showed that light, under the most simple and usual circumstances, employs the direct, and therefore the shortest, course to pass from one point to another. Again, it was a very early discovery (attributed by Laplace to Ptolemy), that, in the case of a plane mirror, the bent line formed by the incident and reflected rays is shorter than any other bent line having the same extremities, and having its point of bending on the mirror. These facts were thought by some to be instances and results of the simplicity and economy of nature; and Fermat, whose researches on maxima and minima are claimed by the Continental mathematicians as the germ of the differential calculus, sought analogies to trace some similar economy in the more complex case of refraction. He believed that by a metaphysical or cosmological necessity, arising from the simplicity of the universe, light always takes the course which it can traverse in the shortest time. To reconcile this metaphysical opinion with the law of refraction, discovered experimentally by Snell, Fermat would to suppose that the two lengths, or *indices*, which Snell had measured on the incident ray prolonged and on the refracted ray, and had observed to have one common projection on a refracting plane, are inversely proportional to the two successive velocities of the light before and after refraction, and therefore that the velocity of light is diminished on entering those denser media in which it is observed to approach the perpendicular; for Fermat believed that the time of propagation of light along a line bent by refraction was represented by the sum of the two products, of the incident portion multiplied by the index of the first medium, and of the refracted portion multiplied by the index of the second medium; because he found, by his mathematical method, that this sum was less, in the case of a plane refractor, than if light went by any other than its actual path from one given point to another, and because he perceived that the supposition of a velocity inversely as the index reconciled his mathematical discovery of the minimum of the foregoing sum with his cosmological principle of least time.

Descartes attacked Fermat's opinions respecting light, but Leibnitz zealously defended them; and Saul Huygens was led, by reasonings of a very different kind, to adopt Fermat's conclusions of a velocity inversely as the index, and of a *uniformity* time of propagation of light, in passing from one given point to another through an ordinary refracting plane. Newton, however, by his theory of emission and attraction, was led to conclude that the velocity of light was *directly*, not *inversely*, as the index, and that it was *increased* instead of being *diminished* on entering a denser medium; a result incompatible with the theorem of the shortest time in refraction. This theorem of shortest time was accordingly abandoned by many, and among the rest by Maupertuis, who, however, proposed in its stead, as a new cosmological principle, that *celestial* law of least action which has since acquired so high a rank in mathematical physics, by the improvements of Euler and Lagrange.

"Maupertuis gave the name of *action* to the product of space and velocity, or rather to the sum of all such products for the various elements of any motion,—conceiving that the more space has been traversed and the less time it has been traversed in, the more action may be considered to have been expended, and by combining this idea of action with Newton's estimate of the velocity of light as

increased by a denser medium, and as proportional to the refracting index, and with Fermat's mathematical theorem of the minimum sum of the products of path and indices in ordinary refraction at a plane, he concluded that the course chosen by light corresponded always to the *least possible action*, though not always to the least possible time. He proposed this view as reconciling physical and metaphysical principles which the results of Newton had seemed to put in opposition to each other, and he soon proceeded to extend his law of least action to the phenomena of the shock of bodies. Euler, attached to Maupertuis, and pleased with these novel results, employed his own great mathematical powers to prove that the law of least action extends to all the curves described by points under the influence of central forces; or, to speak more precisely, that if any such curve be compared with any other curve between the same extremities, which differs from it indefinitely little in shape and in position, and may be imagined to be described by a neighbouring point with the same law of velocity, and if we give the same of action to the integral of the product of the velocity and element of a curve, the difference of the two neighbouring values of this action will be indefinitely less than the greatest linear distance (itself indefinitely small) between the two near curves; a theorem which I think may be advantageously expressed by saying that the action is *stationary*. Lagrange extended this theorem of Euler to the motion of a system of points or bodies which act in any manner on each other; the action being in this case the sum of the masses by the foregoing integrals.

"Laplace has also extended the use of the principle in optics, by applying it to the refraction of crystals, and has pointed out an analogous principle in mechanics, for all imaginable connections between force and velocity."

We give, first, a very brief indication of the nature of Hamilton's Varying method, as applicable directly to the corpuscular theory. Here the action of a corporeal is the quantity which possesses the stationary property. Let v be the velocity at any point a, y, s of the medium, ds an element of the path, α, β, γ the direction cosines of ds , which theory are supposed to enter linearly and homogeneously into the expression for v . Then the action V is given by

$$V = \int v ds$$

Hence, for a path nowhere finitely distant from the first,

$$\delta V = - \int (v \delta \alpha + v \delta \beta + v \delta \gamma)$$

But

$$v = \frac{ds}{da} = \frac{ds}{dy} = \frac{ds}{dz} \\ + \frac{ds}{dx} = \frac{ds}{dy} = \frac{ds}{dz} \\ + \frac{ds}{dx} = \frac{ds}{dy} = \frac{ds}{dz}$$

the first three terms depending on the translation of the element ds , the others on its change of direction, and all the differential coefficients being partial. The homogeneity of v gives

$$\frac{dv}{da} + \frac{dv}{dy} + \frac{dv}{dz} = v$$

Also

$$d^2x = d^2y = d^2z = ds \frac{d\alpha}{ds} + ds \frac{d\beta}{ds} + ds \frac{d\gamma}{ds}$$

with two similar equations in y and z .

By the help of these, and a partial integration of the factors $d\alpha, d\beta, d\gamma$, we have

$$\delta V = \frac{dv}{da} \delta a + \frac{dv}{dy} \delta y + \frac{dv}{dz} \delta z \\ + \left[\frac{dv}{d\alpha} \delta \alpha + \frac{dv}{d\beta} \delta \beta + \frac{dv}{d\gamma} \delta \gamma \right],$$

where the integrated part is to be taken between proper limits.

If the initial and final points of the path be fixed, $\delta a, \delta y, \delta z$, vanish in the integrated part, and the stationary condition shows that we must have

$$\frac{dv}{d\alpha} \delta \alpha + \frac{dv}{d\beta} \delta \beta + \frac{dv}{d\gamma} \delta \gamma = 0,$$

with other two similar conditions, only two of the three being independent because of the necessary relation

$$\alpha^2 + \beta^2 + \gamma^2 = 1.$$

These may be regarded as the differential equations of the ray, or path of the corpuscle.

But the essence of Hamilton's method of *varying action* depends upon a change of the terminal point of the ray, and leads at once to the three equations

$$\frac{\delta V}{\delta a} \delta a, \quad \frac{\delta V}{\delta y} \delta y, \quad \frac{\delta V}{\delta z} \delta z,$$

which follow directly from the general value of δV above, by taking account of the vanishing of the unintegrated part in consequence of the stationary condition. We may now write δ for δ everywhere in these expressions

In any isotropic body, homogeneous or not, it is clear that

$$dV = v(dx + ydy + zdz),$$
 and then we have, to determine V , the partial differential equation

$$\left(\frac{dV}{dx}\right)^2 + \left(\frac{dV}{dy}\right)^2 + \left(\frac{dV}{dz}\right)^2 = v^2$$

The treatment of this equation is precisely the same as that of the corresponding one which will presently be derived from the undulatory view of the question

We will now illustrate the application of Hamilton's method to the undulatory theory, in which the *line* of passage from one point of the path to another is the characteristic which fulfils the stationary condition. For the sake of limitation, we will confine ourselves to its application to single refraction in a non-homogeneous medium. In such a medium the velocity of light, at any point, is the same whatever be the direction of the ray. Hence it depends only upon the coordinates of the point, and upon some characteristic (say the wave-length) of the light considered.

If τ be this time of passage, ds an element of the path, and v the velocity of light in that element, we must have

$$\tau = \int \frac{ds}{v},$$

a quantity fulfilling the stationary condition. This gives

$$\delta\tau = \int \frac{dv}{v} - \int \frac{d\tau dv}{v^2}$$

Now, by what has just been said, if λ be the wave-length, we have an equation expressing the data of the problem,

$$v = f(\lambda, x, y, z),$$

where the form of f depends on the arrangement of the parts of the medium. Hence

$$\delta\tau = \int \frac{d\lambda ds + d\lambda dy + d\lambda dz}{vds} - \int \frac{d\lambda}{v^2} \left(\frac{dv}{d\lambda} \lambda + \frac{dv}{dx} x + \frac{dv}{dy} y + \frac{dv}{dz} z \right) - \delta \left[\frac{1}{v} \left(\frac{dx}{ds} \lambda + \frac{dy}{ds} \lambda + \frac{dz}{ds} \lambda \right) \right] - \delta \left[\frac{1}{v} \left(\frac{dx}{ds} \lambda + \frac{dy}{ds} \lambda + \frac{dz}{ds} \lambda \right) \right]$$

The unwritten part consists of an integral which, by the stationary condition, vanishes if the ray be of a definite wave-length and the terminal points through which it passes be given, i.e., if δx , δy , δz , be each equal to 0.

The rest of the expression depends on the terminal points of the ray, and on the wave-length, only. It gives the equations

$$\frac{\delta\tau}{\delta\lambda} = \frac{1}{v} \frac{dv}{d\lambda}, \quad \frac{\delta\tau}{\delta x} = \frac{1}{v} \frac{dv}{dx}, \quad \frac{\delta\tau}{\delta y} = \frac{1}{v} \frac{dv}{dy}, \quad \frac{\delta\tau}{\delta z} = \frac{1}{v} \frac{dv}{dz},$$

and

$$\frac{\delta\tau}{\delta\lambda} = - \int \frac{1}{v^2} \frac{dv}{d\lambda} ds$$

Squaring and adding the last three, we have

$$\left(\frac{\delta\tau}{\delta\lambda}\right)^2 + \left(\frac{\delta\tau}{\delta x}\right)^2 + \left(\frac{\delta\tau}{\delta y}\right)^2 + \left(\frac{\delta\tau}{\delta z}\right)^2 = \frac{1}{v^2}.$$

It is easily shown, by a process similar to that used for *raying action* (see MEMORANDOS), that, if we can find a complete integral of this equation, containing therefore two arbitrary constants, in the form

$$\tau = F(x, y, z, \lambda, a, b),$$

then

$$\frac{\delta\tau}{\delta a} = 2a, \quad \frac{\delta\tau}{\delta b} = 2b$$

are the equations of two series of surfaces whose intersections give the paths of the rays. $2a$ and $2b$ here are the arbitrary constants (These four constants are necessary, and sufficient, for the purpose of making the two intersecting surfaces pass each through any two given points.)

Maxwell's Ray-eye problem. As an illustration, let us suppose the light to be homogeneous, and the medium to be arranged in concentric spherical shells such that the velocity at a distance r from their centre is expressed by

$$v = \frac{b^2 + c^2}{c},$$

where b and c are absolute constants. It is easy to see that, on account of the symmetry, the path of every ray is in a plane through the centre of the spheres. We may therefore restrict our work to the plane of x, y passing through that centre.

The equation is then

$$\left(\frac{dr}{ds}\right)^2 + \left(\frac{dr}{dy}\right)^2 = \frac{c^2}{(b^2 + r^2)^2};$$

or, by change to polar coordinates,

$$\left(\frac{dr}{dr}\right)^2 + \frac{1}{r^2} \left(\frac{dr}{d\theta}\right)^2 = \frac{c^2}{(b^2 + r^2)^2}.$$

What we require is a sufficiently general solution. Assume, therefore,

$$\frac{dr}{d\theta} = a,$$

and we have,

$$\frac{dr}{ds} = \sqrt{\frac{r^2}{(b^2 + r^2)^2} - \frac{a^2}{r^2}}.$$

From these

$$\tau = a\theta + \int dr \sqrt{\frac{r^2}{(b^2 + r^2)^2} - \frac{a^2}{r^2}}.$$

The equation of the path is therefore

$$2a = \frac{dr}{d\theta} = b - c \int \frac{dr}{\sqrt{(b^2 + r^2)^2 - \frac{a^2}{r^2}}},$$

$$= b - c \cos^{-1} \frac{b^2 - r^2}{a^2 - 4b^2 r^2},$$

$$r = \sqrt{\frac{a^2}{a^2 - 4b^2} \cos^2(\theta - 2a)}.$$

or

$$\frac{b^2 - r^2}{r} = \sqrt{\frac{c^2}{a^2} - 4b^2} \cos(\theta - 2a).$$

This is the equation of a series of circles, whose one common characteristic is that the rectangle under the segments of any chord which passes through the origin is b^2 .

Hence every ray in any diaphragm plane describes a circle, and pairs of conjugate foci are situated on a line through the centre, the rectangle under their distances from the centre being b^2 . The property holds therefore for all rays in the medium. This very singular ideal arrangement was suggested to Clerk Maxwell by the eye of a fish. He has given an investigation of it, by a totally different analysis, in the *Cambridge and Dublin Mathematical Journal*, vol. ix. As an illustration of those effects of want of homogeneity to which (as already stated) all the complex phenomena of *mirage*, *haze*, are due, it may be well to consider this simple case more closely. We will therefore consider how images are seen in such a medium. To get rid of the infinity which would arise from finite change of density if an eye was supposed to be plunged in the medium, we will suppose it to be cut across by a crevasse whose surface is everywhere nearly at right angles to the rays by which the image is to be seen,—the eye being then placed (in air) close to such a cutting surface. O the centre of the spherical layers of equal refractive index. Tam every ray from A describes a

circle which passes through A' , where $AOA' = b^2$ is a straight line, and

$$AO \cdot OA' = b^2$$

Annulli construction gives B' from B .

To an eye placed at B_2 (a little crevasse as before explained), and looking towards the object, it will be seen erect,— A being seen in the direction of a tangent to the circle through AE_1A' , and similarly for B . Here the rays have not passed through their conjugate focus. But if the eye be now turned away from the object, it (or rather its image) will be seen, A' in the direction opposite to that in which A was seen, B' in the opposite direction to B . The image will now be an *inverted* one, but it will easily be seen to possess a strange peculiarity. For what is now seen will be the *back* of the object, the side farthest from the eye. The reader may easily trace for himself the course of the rays which would fall on the eye in any other assigned position. Vision in such cases would usually be of a peculiar character from another point of view, viz. the amount of divergence in the plane of the figure will in general differ from that perpendicular to its plane, and therefore the rays would have different divergence for the height and for the breadth of the image. These would therefore appear at different distances from the spectator. This, however, could be cured by a proper cylindrical lens. It is clear from this example (which has been chosen for its special simplicity) that want of

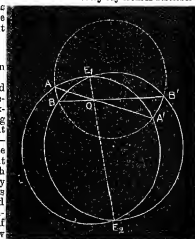


Fig. 25.

homogeneity in a refracting medium is capable of producing phenomena of the most extraordinary character.

Mirage.

It is difficult to ascertain exactly what is the condition of the atmosphere when multiple images, mirage, &c. are seen; and it is obvious from the remarks and illustrations already given that many very different arrangements will produce sensibly the same result to a spectator in a given position. Comparison of the appearances seen simultaneously by a great number of scattered observers is the only way in which we can expect to obtain definite information on such a point. But the following investigation suggests the general nature of the explanation.

If we suppose the refractive index of the air to depend only upon the vertical height above the earth's surface, rays will all travel in vertical planes, and Hamilton's equation (neglecting the curvature of the earth's surface) takes the very simple form

$$\left(\frac{dr}{dz}\right)^2 + \left(\frac{dr}{dy}\right)^2 = f(y),$$

x being measured horizontally, and the refractive index being proportional to $\sqrt{f(y)}$.

This equation gives, as before,

$$r = az + \int dz \sqrt{f(y) - a^2},$$

and the equation of the path of a ray is

$$\frac{dr}{da} = z - a \int \frac{dy}{\sqrt{f(y) - a^2}}.$$

Here, on the corpuscular theory, a is the horizontal velocity of the light, and $\sqrt{f(y)} = a^2$ the vertical velocity. If the form of f and the value of a be such that we can have $f(y) - a^2 = 0$, it is clear that at $y = y_0$ the ray is for a moment horizontal. The form of the equation of the ray shows that it has a vertex at this point, and that it is symmetrical about a vertical axis passing through the vertex. If ξ, η be the coordinates of the vertex for a ray passing through the point $0, \delta$, we have the relation

$$1 = \sqrt{f(\eta)} \int_0^\delta \frac{dy}{\sqrt{f(y) - f(\eta)}}.$$

This is the equation of the locus of the vertices of all rays which, starting from a given point, return again to the same level. To find, then, the various rays by which a distant object near the horizon can be seen, all that we have to do is to draw the curve of vertices which passes through the eye of the spectator, and to find the points in which it is intersected by a vertical line situated midway between the object and the eye. Each of these points is the vertex of a ray by which the object can be seen. When the curve of vertices leans forward towards the eye at one of these points, two conjugate rays cross one another, and an inverted image is seen; when it leans from the eye, they do not cross, and the image is erect.

Now, when the curve of vertices is traced, from the above formula, for an arrangement of the air such that the refractive index falls off through a horizontal stratum of air from a greater value below the stratum to a smaller value above it, it is found that the curve of vertices in the stratum can in general be cut by a vertical line in one point only. But if the refractive index have a nearly stationary value at the upper boundary of the stratum the curve of vertices can be cut twice, or not at all, by a vertical line. When there is no intersection we have only the direct image; but when there are two intersections a distant ship will be seen as usual through the lower uniform air, while there will be seen above it an inverted image, and then a direct image, both due to the stratum. This is a form of mirage very commonly seen at sea. When there is no stationary value of the index at the upper boundary, the upper erect image is not given by the stratum. This arrangement, however, turned upside down, explains the ordinary mirage of the desert—where we see objects directly through the nearly uniform air at some distance above the sand, but also an inverted image (suggesting reflexion from a pool or lake) formed by the reflexion in the hot layer of air near the sand.

Scattering and absorption.

Absorption, Fluorescence.—We must now take up the third and fourth of the categories under which light incident on the bounding surface of two media may fall—*scattering* and *absorption*. We take them together, because in the great majority of bodies, as we have already seen, scattering takes place not merely at the surface but within some distance below the surface, which in general is small, but in some cases considerable. And when the scattering takes place, even in part only, below the surface, the scattered light is usually modified by absorption.

¹ See especially Vince, in the Bakerian Lecture, Phil. Trans., 1796.

An excellent instance of this scattering from below the surface is afforded by a mass of thin films or small particles of transparent bodies, such as glass, water, or ice. Thus pounded glass, froth or foam, snow, clouds, &c., appear brilliantly white in sunlight, and are, in consequence, opaque when in layers of sufficient thickness. Here the light is obviously scattered by reflexion. What passes through one film, crystal, or particle is, in part, reflected from the next, and so on.

Even when the froth consists of bubbles of a highly coloured liquid, such as porter for instance, it usually shows but slight traces of colour, for the great majority of the scattered rays have passed through very small thicknesses only of the liquid. In the same way, very finely pounded blue or red glass (unless it be exceedingly deeply coloured when in mass) appears nearly white. But when a mass of water is full of air bubbles, as, for instance, is the case in the neighbourhood of a breaker, the light of the reflected from the surfaces of these bubbles suffers a double absorption by the water before it reaches the eye. This is one of the causes of the exquisite colours of the sea. Near shore, or in shoal water, another cause sometimes comes into play, viz., fine solid particles suspended in the water. When such particles, whether in air or in water, are exceedingly small, they may produce colours due to their minuteness alone, and not by their own colour nor to the absorptive properties of the medium. This, however, is a question of physical optics.

In general, even the most highly coloured opaque or translucent solids, such as painted wood or stained paper, are visible by scattered light whatever portion of the spectrum falls on them. This is very well seen with highly coloured paper-hangings, when illuminated by homogeneous light, such as that of a sodium flame (a Bunsen flame, into which is thrust a platinum wire dipped in strong brine). The red, orange, and yellow parts usually appear very bright under such treatment, the blue parts appearing but slightly illuminated. The colour of all is, of course, that of the incident light. It appears, therefore, that some of the light is scattered from the surface. It is by this, for instance, that the blue parts are feebly visible. But that which is scattered from the portions coloured red, orange, &c., must come mainly from under the surface.

An excellent proof of this is furnished by mixing, in proper proportions, a yellow and a blue powder, or yellow and blue paints. It is commonly imagined that the green colour which is thus produced is a mixture of blue and yellow. Far from it! When a disk divided into alternate sectors, coloured with the same blue and yellow pigments, is made to rotate rapidly in its own plane, it of course produces on the eye the true result of a mixture of these blue and yellow colours. This depends for its exact tint on the pigments employed, and on the angles of the sectors, but is usually a faint pink or a muddy purple, utterly different from the green produced by mixing the powders or the paints. Helmholtz was the first to point out the true source of the green. It is the *one colour* which is not freely absorbed either by the yellow or by the blue pigment. For the scattered light by which the mixture is seen comes chiefly from below the surface, and has thus suffered absorption by each of the component powders. The yellow powder removes the greater part of the blue, indigo, and violet rays; the blue, the greater part of the reds, oranges, and yellows. Thus the light which finally escapes is mainly green.

For the accurate study of the absorptive power of a solid Exact or liquid medium, it is necessary to compare the spectrum of white light which has passed through a plate or layer of it with a normal spectrum. This is easily effected by placing the absorbing medium (if a fluid, it must be in a

Whiteness of froth, snow, clouds, &c.

sea.

Mixture of pigments.

colours.

study of absorption.

glass (rough with parallel sides) in front of the narrow slit through which the light passes, and in such a position that one half of the slit only is thus covered. We have then side by side, under precisely similar circumstances, two spectra to be compared (one altered by absorption, the other not); and very minute differences between them can thus be detected. When the medium produces a general weakening of the whole spectrum, as well as particular local absorptions, the white light passing through the other half of the slit may be weakened to any desired extent by reflection at the proper incidence from a plate of glass, before it falls on the slit.

To give a satisfactory representation of the phenomena of absorption spectra by the help of a woodcut is not easy. The highest artistic skill could not adequately represent the ordinary solar spectrum by the use of the finest pigments. All optical colour phenomena must be seen, they cannot be reproduced by painting. In such circumstances the simplest method of indicating the locality and amount of the absorption is the best. As we have already seen that we cannot by the eye judge of the relative intensities of lights which differ much in colour, we shall represent the normal spectrum (for our present purpose) as equally bright throughout, and indicate the absorption at different parts by shading of various degrees of depth. A few of the Fraunhofer lines are introduced to indicate (in the absence of colour) the parts of the spectrum which are attacked by the various absorbers. These lines are, of course, in the same absolute positions in all the various spectra, for the spectra are all supposed to be given by the same prism. The line B is in the red, D in the orange, E and F in the green, and G in the indigo. They correspond, as we have already said, to perfectly definite kinds of homogeneous light, and therefore adequately represent the distribution of colours in the spectrum, however much rationally of dispersion may be shown by the material of the prism.

In fig. 26 *a* represents the spectrum of light which has passed through diluted blood; *b* shows the spectrum when the blood has been acted on by a reducing agent, and *c* the spectrum when the blood has been altered by acidulation with acetic or tartaric acid. These figures are taken from an important paper by Stokes (*Proceedings of the Royal Society*, 1864).

Fig. 27 shows in a rude way the absorption by cobalt

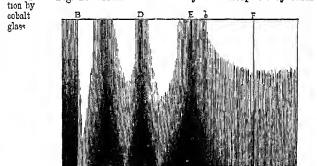


Fig. 27

glass cut in wedge form, and corrected by an equal prism of clear glass.

The commonly received method of calculating the absorption by layers of gradually increasing thickness is to

suppose that, if a layer of unit thickness weakens in any ratio the intensity of any particular homogeneous ray, another unit layer will further weaken in the same ratio that which reaches it, and so on. Thus the amount which passes through a number of layers diminishes in geometrical progression, while the number of layers increases in arithmetical progression. This is certainly true (neglecting the amount reflected), unless the intensity of the light have an effect on the percentage transmitted. And fig. 27 shows, in a very striking manner, the difference between similar terms of different geometric series as the common ratio becomes less and less. This ratio is not much less than 1 for certain red and blue rays, is smaller for yellow, and is very small for the rest of the red, for orange, and for green. The latter colours are therefore rapidly got rid of with increasing thickness, then the yellow becomes too feeble to be seen, while, even after the blue becomes almost insensible, the specially favoured red rays are still transmitted in sufficient quantity to be observed.

If x be the fraction of any species of homogeneous light which is transmitted by a layer of unit thickness, that transmitted by a layer of thickness n is x^n . The following little table will greatly assist the reader in understanding the relative rapidity of extinction of different rays passing through various thicknesses of an absorbing medium. It is a table of double entry, the first column giving various values of x , and the upper row various values of n , while the value of x^n is in the same column as that of x and in the same row as that of n .

1	1	0.99	0.9	0.6	0.1
2	1	0.98	0.81	0.25	0.01
5	1	0.951	0.59	0.08	0.0001
10	1	0.904	0.348	0.0059	
100	1	0.360	0.00008		

Thus a ray which loses 1 per cent. in unit thickness still reaches more than 99 per cent. after passing through ten units. But a ray which loses 10 per cent. in the first unit (and which, therefore, will thus far appear scarcely more weakened than the first) is reduced to 35 per cent. by passage through ten units. After passing through a hundred units the first ray has lost only 65 per cent., the second is practically vanishing.

In thin plates cobalt glass is blue, because the particular red which it does not absorb freely forms only a small fraction of the whole transmitted rays; while in thick masses it is nearly red, for then little but this favoured red is transmitted. For a similar reason Condyl's fluid (permanganate of potash) changes its tint in a very singular manner (even when preserved from the action of the air) by gradual dilution with water.

The imperfection of the accommodation of the eye is readily proved by looking through a plate of cobalt glass at a small hole in the window-shutter of a dark room. The hole at first appears red with a blue space round it; but, by an effort of the muscles of the eye, we can see the hole blue, and then there is a red space surrounding it. Rays of so widely different refractive index cannot be seen in focus simultaneously.

Very curious effects are produced when we examine a landscape through such a glass. Foliage of certain kinds scatters scarcely any blue rays, and therefore appears reddish. Bluish greens, again, which scatter very little red, appear blue. The effects may be exaggerated in a very striking degree by combining the absorptions of two or more media, so as to allow of the free transmission of a few, far detached, portions of the spectrum.

Brewster made the very singular discovery that a solution of oxalate of chromium and potash produces one solitary, narrow, absorption band, almost resembling one of the broader lines in the solar spectrum.

Closely connected with intense local absorption in certain parts of the spectrum is the phenomenon of *abnormal dispersion*, one of the most singular discoveries of modern times. It seems to have been first observed by Fox

Talbot; and he discovered its real nature. But the first published notice of such phenomena is due to Le Roux. Christensen and others have since greatly extended our knowledge of the subject, and Helmholtz and Ketteler have given theoretical explanations of it. Fox Talbot's experiment, though the earliest on record, is one of the easiest to perform, and we therefore quote his own account. The experiment was made about 1840, and the following account is from the *Proc. Roy. Soc. Edin.*, 1870-71.

Talbot's
experi-
ment.

"I prepared some square pieces of window glass, about an inch square. Taking one of these, I placed upon it a drop of a strong solution of some salt of chromium, which, if I remember rightly, was the double oxalate of chromium and potash, but it may have been that substance more or less modified. By placing a second square of glass on the first, the drop was spread out in a thin film, but it was prevented from becoming too thin by four pellets of wax placed at the corners of the square, which likewise served to hold the two pieces of glass together. The glasses were then laid aside for some hours until crystals formed in the liquid. These were necessarily thin, since their thickness was limited by the interval between the glasses. Of course the central part of each crystal, except the smallest one, was bounded by parallel planes, but the extremities were bevelled at various angles, forming so many little prisms, the smallest or them floating in the liquid. When a distant candle was viewed through these glasses, having the little prisms interposed, a great number of spectra became visible, caused by the inclined edges. Most of these were no doubt very imperfect, but by trying the glass at various points, some very distinct spectra were met with, and these could with some trouble be isolated by covering the glass with a card pierced with a pin-hole. It was then seen that each prism (or oblique edge of crystal) produced two spectra oppositely polarized and widely separated. One of these spectra was normal; there was nothing particular about it. The colours of the other were very anomalous, and, after many experiments, I came to the conclusion that they could only be explained by the supposition that the spectrum, after proceeding for a certain distance, stopped short and returned upon itself."

Colours
vapour.

Le Roux in 1860¹ discovered that vapour of iodine, which allows only red and blue rays to pass, refracts the red more than the blue. He, like Talbot, did not at first venture to publish his result, and it appeared only in 1863. Among the many convincing proofs of its accuracy he shows that the dispersion by an iodine-vapour prism can be nearly achromatized by a glass prism which gives refraction in the same direction. He also states that the dispersion in iodine-vapour is less as the temperature is higher.

Fuchsma.

Christensen's² earliest determinations were made in 1870 upon an alcoholic solution of fuchsine (one of the powerful aniline colours). This solution gives a dark absorption band in the green; and it was found that the refractive index rises (as in normal bodies) for rays from the red to the yellow. But all the rest of the transmitted light, consisting of the so-called "more refrangible" rays, is less refracted than the red. Kundt and others shortly afterwards greatly extended these observations.

The explanation of this phenomenon, which has been advanced by Helmholtz,³ depends upon an assumption as to the nature of the mutual action between the luminiferous ether and the particles of the absorbing medium, coupled with a further assumption connecting the absorption itself with a species of friction among the parts of each absorbing particle.

In 1879 De Klerker⁴ made a very curious observation, which shows that the whole subject is still obscure. He employed two hollow prisms of equal angle, turned opposite ways, and filled with alcohol. Through such a combination light passes (as we have seen) without refraction or dispersion. When a few drops of the fuchsine solution were added to the contents of one of the prisms, the yellow, orange, and red rays (in the order named) began to separate themselves from the others. This process could be carried on until the solution was so strong that it transmitted no visible light. All this time the blue and violet

rays remained apparently unrefracted—the yellow, orange, and red showing continually increasing refraction. The conclusion from this, on either theory of light, is that the addition of fuchsine to alcohol alters the velocity of propagation of the (so-called) less refrangible rays, but not perceptibly that of the more refrangible.

Fluorescence.—The singular surface appearances presented Fluorescence. by "canary" glass, by some specimens of flint spar, and by certain liquids, such as a solution of sulphate of quinine acidulated with sulphuric acid, had been the source of much speculation long before their true nature was traced by Stokes in 1852.⁵ By a series of well-contrived experiments, one or two of which will presently be described, he put it beyond doubt that the cause of these phenomena lies in a change of refrangibility of the light which has been absorbed by the upper layers of the medium, and is then given off again. In every case the fluorescent light appears to belong to a less refrangible part of the spectrum light, than does the incident light which gave rise to it, thus affording an instance of dissipation, or degradation of energy.

The yellowish-green surface-colour of canary glass (coloured with oxide of uranium) is well known, as the substance is, mainly on account of this property, very commonly used for ornaments. If we admit a ray of sunlight (or light from the electric lamp) into a dark room, through a cobalt glass so dark that the feeble violet-coloured light it transmits is scarcely visible, we find that the canary glass shows its yellow-green colour vividly when placed in the track of the ray. Striking as this experiment is, it is not quite conclusive as to the true cause of the appearance. But if we take another piece of glass, slightly tinged of a brownish-yellow (by oxide of gold), we find that it is quite transparent to the brilliant light from the canary glass; if, however, we place it in the track of the violet rays before they fall on the uranium glass, it prevents the production of the phenomenon altogether. That is, rays which cannot pass through the glass coloured with gold are rendered capable of freely passing through it after incidence on the canary glass. That the phenomenon is due to rays which are stopped by the uranium glass itself is proved by the fact that a second piece of the glass, placed in the track of the rays which have passed through the first, does not show the phenomenon. Unless, indeed, the source of light be very bright, the appearance is confined to a mere surface-layer of the first piece of canary glass. The phenomenon is very well shown by an aqueous infusion of horse-chestnut bark. Some specimens of paraffin oil exhibit it most brilliantly.

To find the rays which are most effective in producing the fluorescence of any substance, we have only to place it in a pure spectrum of sunlight (or, preferably, of the electric light),—prisms and lenses of quartz being used for producing the spectrum, because that material is found to be far less opaque than glass is to the violet and ultra-violet rays. When this is done with uranium glass we find scarcely a trace of effect until the substance reaches the blue rays, and the effect persists through all the higher colours, and even very considerably beyond the bounds of the visible spectrum. Stokes in fact used it as a means of studying the otherwise invisible, but far extending, spectrum of the ultra-violet rays of the electric spark.

The mechanism of the process by which these extraordinary results are produced is still somewhat obscure, and we cannot attempt to explain it here.

The duration of fluorescence is so very short that it is Photo- only by specially devised methods that we can make certain, though it persists for any measurable time after the exciting source.

¹ *Comptes Rendus*, iv, 1862.

² *Phil. Mag.*, xlv, 1874.

³ *Phil. Mag.*, xlv, 1874.

⁴ *Comptes Rendus*, 1879.

⁵ *Phil. Trans.*, "On the Change of Refrangibility of Light."

light is cut off from the fluorescent body. Becquerel's ingenious *phosphoscope* was invented for the purpose of inquiries of this kind. It consists essentially of a shallow drum, in whose ends two eccentric holes, exactly opposite to one another, are cut. Inside it are fixed two equal metal disks, attached perpendicularly to an axis, and divided into the same number of sectors, the alternate sectors of each being cut out. One of these disks is close to one end of the drum, the other to the opposite end, and the sectors are so arranged that, when the disks are made to rotate, the hole in one end is open while that in the other is closed, and *vice versa*. If the eye be placed near one hole, and a ray of sunlight be admitted by the other, it is obvious that while the sun shines on an object inside the drum the aperture next the eye is closed, and *vice versa*. If the disks be made to revolve with great velocity by means of a train of toothed wheels, the object will be presented to the eye almost instantly after it has been exposed to sunlight; and these presentations succeed one another so rapidly as to produce a sense of continued vision. By means of this apparatus we can test with considerable accuracy the duration of the phenomenon after the light has been cut off. For such a purpose we require merely to know the number of sectors in the disks and the rate at which they are turned. To guard against deception by the persistence of impressions on the retina, the eye should not be directed fixedly on the object, but should be kept travelling slowly round the position in which it is seen to lie.

Uranium glass shows, with rapid turning, nearly as vivid an effect as when exposed to continuous light, but fades rapidly when the speed of the rotation falls off. A pinkish kind of ruby, exposed to concentrated sunlight in the phosphoscope, is seen to glow with a bright red like a piece of live coal. With very rapid turning, feeble fluorescence can be detected in a great many substances in which the ordinary methods will not show it. This is due in great measure to the fact that the phosphoscope entirely does away with the scattered light, which in the ordinary mode of examining these substances overpowers their feeble fluorescence.

Phosphorescence.

What is correctly termed phosphorescence has nothing to do with phosphorus (whose luminosity in the dark is due to slow oxidation), but it is merely a species of fluorescence which lasts for a much longer time after the excitation has ceased than does that just described. Pliny speaks of various gems which shine with a light of their own, and Albertus Magnus knew that the diamond becomes phosphorescent when moderately heated. But the first discovery of phosphorescent substances, such as are now so common, belongs to the early part of the 17th century. During that century the Bologna stone (sulphide of barium) and Homberg's phosphorus (chloride of calcium) were discovered. Canton's phosphorus (sulphide of calcium) dates from 1768. To the substances mentioned may now be added sulphide of strontium. Any of these sulphides, which must be carefully preserved from the air in sealed glass tubes, appears brilliantly luminous when carried from sunlight into a dark room, and for a long time after presents the general aspect of a hot body cooling. The rays which excite their luminosity are (as with the generality of fluorescent bodies) those of higher refrangibilities; but the colours of the phosphorescent light are of the most varied kind, even in specimens of almost precisely the same chemical composition, but prepared at different times. The causes of this strange diversity are as yet quite unguessed at; but the property has been taken advantage of for the production of what are called *luminous paints*. The behaviour of these substances is one of the most singular phenomena in optics. How they manage to store up so large a supply of energy during a short exposure to bright

Luminous paint.

light, and to dole it out continuously for so long a time and mainly in the form of light, is exceedingly puzzling,—especially as no other physical or chemical change has yet been found to accompany the process. Another curious fact connected with their behaviour was discovered by Becquerel. He found that the less refrangible rays have in some cases the power of arresting the emission of light from these bodies when they have been previously excited by higher rays.

The chemical effects of light will be treated under PHOTOGRAPHY, so far as they are connected with decomposition. Its effects in causing combination, as of hydrogen and chlorine, have already been treated under CHEMISTRY.

UNDULATORY THEORY OF LIGHT.

The explanation of the fundamental laws of Geometrical Optics by the wave-theory requires some preliminary remarks. As the subject will be more fully discussed in a special article, we confine ourselves to what is strictly necessary for the immediate purposes of the present article.

(a) The essential characteristic of wave-motion is that a Wave-disturbance of some kind is handed on from one portion of motion, a solid or fluid mass to another. In certain cases only, this disturbance is unaltered in amount and in kind as it proceeds.

(b) So far as light is concerned, the velocity with which Velocity each particular species of disturbance passes in any direction of propa- gation. is the same for all directions. When the medium is not homogeneous, the velocity may vary from point to point. If the medium be not isotropic, the velocity may depend upon the direction of propagation. Examples of each of these peculiarities will be met with presently.

(c) When two or more separate disturbances simultaneously affect the same portion of a medium, the effect may be very complex. But in the case of light, it has been found that a geometrical (or rather *kinematical*) superposition or composition agrees, at least to the degree of accuracy of the experiments, with all the observed facts. This would be the case, as a dynamical result, if the distortions due to wave-motion were always, even for the most powerful light, exceedingly small. On this is based the whole doctrine of *interference*, Young's grandest contribution to the wave-theory (1801).

(d) The disturbance at any point of a medium, at any *Hy-* instant, is that due to the superposition of all the distur- bances which reached it at that instant from the various sur- roundings parts of the medium. This is (in a somewhat generalized form) what is commonly known as Huygens's principle, first enunciated in 1678.

(e) The front of a wave is defined at any instant as the Wave- continuous locus of all portions of the medium which, at front that instant, are equally and similarly distorted. The word *continuous* is inserted because, in oscillatory wave-motion, such as that of light, a large number of successive waves are exactly equal and similar to one another. Thus we have a *series* of wave-fronts following one another, which are not to be considered as parts of one wave-front. The distance between two successive fronts in which the distortions are similar, measured in the direction in which the light is travelling, is called the *wave-length*.

(f) The colour of homogeneous light depends entirely on Colour the period of a wave, i.e., on the time of passage from one wave-front to the next. This is obviously the same thing as the time of a complete vibration of any one particle of the medium—whatever be the velocity of light in the medium, or the consequent wave-length.

These being premised, let us take the propagation of homogeneous light from a luminous point in a homo-

Wave-
motion,
in homi-
geneous
isotropic
medium

geneous isotropic medium. Here we have simply a succession of concentric spherical wave-fronts, their radii differing by one or more whole wave-lengths. The disturbance in any portion of one of these fronts is propagated radially. But we may consider it from a different point of view, as hinted in (*d*) above. Simple as this particular case is, the reader will probably find that it will greatly assist him in understanding the more complex ones which follow.

Every disturbed portion of the medium may be looked upon as a centre of disturbance from which a new set of spherical waves is constantly spreading. Take then, as common radius, the space described by a disturbance in any very short interval, and, with centres at every point of any one wave-front, describe a series of spheres. The ultimate intersections of these spheres will lie on a surface which is the *envelop* of them all. In the case considered, it is obviously a sphere whose radius exceeds that of the wave-front from which we started by the common radius of the set of spheres. This is shown in a central section in fig 28 below, which suffices to prove that we arrive by this mode of construction at the result which we know in this simple case to be the correct one. It will be seen that the centres of the construction-spheres lie on a certain part of one wave-front, while their ultimate intersections lie on the *corresponding* part of the future wave-front. This holds for spheres of all radii, and for continually increasing radii shows that a plane wave moves perpendicularly to its front. This is so important a part of Huygens's work that we give it in his own words (*Traité de la Lumière*, 1690, pp. 18-20) —

"Pour venir aux propriétés de la lumière, nous suppose premièrement que chaque partie d'onde doit s'étendre en sorte, que les extrémités soient toujours comprises entre les mêmes lignes droites tracées du point lumineux. Ainsi la partie de l'onde *HO*, ayant le point lumineux *A* pour centre, s'étendra en l'arc *CE*, terminé par les droites *AB*, *AD*, *AE*. Car here que les ondes particulières produites par les particules qui composent l'espace *C&E*, se repandent aussitôt de cet espace, toutesfois elles ne concourent point en même instant, à composer ensemble une onde qui termine le mouvement, que précisément dans la circonférence *CE*, qui est leur tangente commune.

"Et d'icy l'on voit la raison pourquoi la lumière, à mesure que ses rayons ne soient réfléchis ou rompus, ne se repand que par des lignes droites, en sorte qu'elle ne balaye aucun objet que quand le chemin depuis sa source jusqu'à cet objet est ouvert suivant de telles lignes. Car si, par exemple, il y avoit une ouverture *BC*, bouchée par des corps opaques *BH*, *GI*, l'onde de lumière qui sort du point *A* sera toujours terminée par les droites *AC*, *AE*, comme il vient d'être démontré. Les parties des ondes particulières, qui s'étendent hors de l'espace *ACE*, étant trop faibles pour y produire de la lumière.

"Or quelques petites que nous fassions l'ouverture *BC*, la raison est toujours la même pour y faire passer la lumière entre des lignes droites, parce que cette ouverture est toujours assez grande pour contenir un grand nombre de particules de la matière éthérée, qui sont d'une petitesse inconcevable, de sorte qu'il parait que chaque petite partie d'onde s'avance nécessairement suivant la ligne droite qui vient du point luisant. Et c'est ainsi que l'on peut prendre des rayons de lumière comme si c'étoient des lignes droites.

"Il paraît en reste, parce qu'il est remarqué touchant la faiblesse des ondes particulières, qu'il n'est pas nécessaire que toutes les particules de l'éther soient égales entre elles, quoique l'égalité soit plus propre à la propagation du mouvement. Car il est très-que l'irrégularité d'un qu'une particule, en poussant une autre plus grande, fasse effort pour reculer avec une partie de son mouvement, mais il ne s'ensuivra de cela que quelques ondes particulières se retirent vers le point lumineux, incapables de faire de la lumière. & non pas d'onde composée de plusieurs, comme estoit *CE*.

"Une autre, et des plus merveilleuses propriétés de la lumière est que, quand il en vient de divers costes, en même d'opposés, elles

font leur effort l'une à travers l'autre sans aucun empêchement. D'où vient aussi que par une même ouverture plusieurs spectateurs peuvent voir tout à la fois des objets différens, et que deux y enoient se voyent en même instant les yeux l'un de l'autre. (Si survient ce qui a été expliqué de l'action de la lumière, et comment ses ondes ne se défont point, ny ne s'interrompent les unes les autres quand elles se croisent, ces effets que je viens de dire sont assez à concevoir. Qui ne le sont nullement à mon avis selon l'opinion de Des-Cartes, qui fait consister la lumière dans une pression continuelle, qui ne fait que tendre au mouvement. Car cette pression ne pouvant agir tout à la fois des deux costes opposés, comme des corps qui n'ont aucune inclination à s'approcher, il est impossible de comprendre ce que je viens de dire de deux personnes qui se voyent les yeux mutuellement, en comment deux même peuvent se pénétrer l'un l'autre."

We will now, for the purposes of this elementary article, assume that something similar holds in all cases, and will not trouble ourselves with the fact that our construction, if fully carried out, would indicate a retrograding wave as well as a progressive one. The obvious fact that a *solitary wave* can be propagated in water, or along a stretched string, may assist the reader in taking the bold step which we have proposed to him. And we will also assume that this mode of representation leads to correct results even when we do not choose a wave-front as the locus of the centres of disturbance,—that in fact we may choose for our purpose *any* surface through which the rays pass, provided always that the radii of the spheres are so chosen that the length of each ray from some definite wave-front to the centre of the sphere, together with the radii of that sphere, always corresponds to a path described in a given time.

We are now prepared to explain the reflexion of light, and we need do so for a plane reflecting surface alone, because the length of a wave, as we shall soon see, is an almost vanishing quantity in comparison with the radius of curvature of any artificial mirror, be it even the smallest visible drop of mercury.

Let a plane wave-front be approaching a plane mirror, and at any instant let fig. 29 represent a section by a plane perpendicular to each, cutting the wave-front in *AB* and the mirror in *AC*. From what has been already said, the motion of every part of *AB* is perpendicular to that line, and in the plane of the figure. During the time that the disturbance at *B* takes to reach *C*, the disturbance which had reached *A* will have (in part, for there is usually a refracted part also) spread back into the medium in the form of a spherical wave whose radius, *AD*, is equal to *BC*. Its section is of course

a circle. That from any other point *P* will have reached *Q*, and then (in part) diverged into a spherical wave whose centre is *Q* and radius $QT(-QT) = BQ - PQ$. Obviously all the circles which can be thus drawn ultimately intersect in the straight line *CD*. This is a section of the reflected wave-front. A plane wave, therefore, remains a plane wave after reflexion, each part of it obviously moves in the plane of incidence, and the similarity of the triangles *ABC* and *CDA* proves the equality of the angles of incidence and reflexion, for the ray is everywhere perpendicular to the wave-front. It is to be particularly noted that this is independent of the velocity of the light, so that all rays are reflected alike. In this, as in the preceding and the immediately following instances, the diagram has been taken (with but slight change) from Huygens.

This being true of any plane wave-front, large or small in area, is necessarily also true of any wave-front of finite

Unobscured
plane
reflexion



Fig. 28

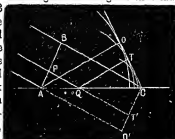


Fig. 29

curvature. Thus, if a set of rays be drawn perpendicular to any wave-front, they will after refraction be perpendicular to a new wave-front; and the lengths of all the rays, from wave-front to wave-front, will be equal.

This is merely another way of stating that if a set of rays can be cut at right angles by a surface (of finite curvature) they will always be capable of being cut at right angles by such a surface, even after any number of reflexions at surfaces of finite curvature, provided they move in a homogeneous isotropic medium.

This proposition will be seen to be capable of extension to reflection, provided always that both media are homogeneous and isotropic. For a plane wave, falling on a plane reflecting surface, our construction (fig 30) is as follows—

Let AB be, as before, a plane wave-front in the first medium, and AC the plane surface of the second medium. As before, let BC be perpendicular to AB. Also let CD be drawn parallel to BA. With centre A and radius AD equal to the space described in the second medium while EC is described in the first, let a sphere be described. The disturbance at A will have diverged in this sphere, while that at B has just reached C. The disturbance at any other point, as P, will have passed to Q, and then have diverged into a sphere of radius QT. Such that

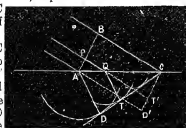


Fig 30

Obviously all spheres so drawn ultimately intersect along CD, which is therefore the front of the refracted wave. The angles of incidence and refraction, being the inclinations of the incident and refracted rays to the normal, are the inclinations BAC and DCA of the incident and refracted wave-fronts to the refracting surface. Their sines are evidently in the ratio of BC to AD, i.e., they are directly as the velocities of propagation in the two media.

Hence the law of refraction also follows from this hypothesis. But there will now be separation of the various homogeneous rays, because the ratio of their velocities in the two media is not generally constant.

Besides, it is clear from the investigation above that, in the refracting medium, the rays are still perpendicular to the wave-front. Thus the proposition lately given may now be extended in the following form—

If a series of rays travelling in homogeneous isotropic media be at any place normal to a wave-front, they will possess the same property after any number of reflexions and refractions. And it is clear from the investigations already given that the time employed by light in passing from one of these wave-fronts to another is the same for every ray of the series.

We now see how crucial a test of theory is furnished by the simple refraction of light. On the corpuscular theory the velocity of light in water is to its velocity in air as 3 : 4 nearly; on the undulatory theory these velocities are as 3 : 4, since, as we have seen, the refractive index of water is about $\frac{4}{3}$. But Foucault's experimental method showed at once that the velocity is less in water than in air. This finally disposed of the corpuscular theory. Though it had been conclusively disproved long before, by certain interference experiments whose nature will presently be described, the argument from this was somewhat indirect and not well suited to convince the large non-mathematical class among optical students and experimenters. The true author of the undulatory theory is

undoubtedly Huygens. Christaldi, Hooke, and others had expressed more or less obscure notions on the subject, but Huygens in 1678 first gave it in a definite form, based to a great extent upon measurements of his own. It was read to the French Academy, but not published till 1800, when it appeared with the title *Traité de la Lumière*. Huygens gives the explanation of the double refraction of Iceland spar, which had been described by Bartholinus in 1670. Unfortunately the remarkable step taken by Newton in explaining the law of refraction on the corpuscular theory—the earliest solution of a problem connected with molecular forces—had for some time been before the scientific world. The authority of Newton was paramount in such matters, and the work of Huygens produced no effect at the time. Even the genius of Young, who at the commencement of the present century recalled attention to this all-but forgotten theory, and enriched it by the addition of the principle of interference, as well as by many important applications, failed to secure its recognition. It was not till 1815 and subsequent years that, in the hands of Fresnel, the undulatory theory finally triumphed, and, even then, the battle was won against determined resistance on the part of the upholders of the corpuscular theory. Witness what Laplace¹ said, in 1817, in the following excerpt from a letter to Young—

"J'ai reçu la lettre que vous m'avez fait l'honneur d. m'écrire, et dans laquelle vous cherchez à établir que, suivant le système des ondulations de la lumière, les sens d'incidence et de réflexion sont en rapport constant, lorsqu'elle passe d'un milieu dans un autre. Quelque ingénieur que soit ce raisonnement, je n'ai pu le regarder que comme un aporie, et non comme une démonstration géométrique. Je persiste à croire que le problème de la propagation des ondes, lorsqu'elles traversent différents milieux, n'a jamais été résolu, et qu'il n'a pu l'être que par les seules méthodes de l'analyse. Des expériences qui ont été faites, et qui ont donné des résultats qui paraissent combats et rejetés par les plus grand nombre des physiciens jusqu'à ce que Newton ait fait voir que ces suppositions résultent de l'action du milieu réfringent sur la lumière, alors on en a eu une explication mathématique du phénomène dans le système de l'émission de la lumière. Ce système qui donne encore l'explication la plus simple du phénomène de l'absorption, que n'explique point le système des ondes lumineuses. Mais les suppositions de Descartes, comme plusieurs aperçus de Kepler sur le système du monde, ont été vérifiées par l'analyse. Mais le monde de la découverte d'une vérité appartient tout entier à celui qui la démontre. Je conviens que de nouveaux phénomènes de la lumière sont jusqu'à présent très difficiles à expliquer; mais en les étudiant avec un grand soin, pour découvrir les lois dont ils dépendent, on parviendra peut-être un jour à reconnaître dans les molécules lumineuses des propriétés nouvelles qui donneront une explication mathématique de ces phénomènes. Remonter des phénomènes aux lois et des lois aux causes, est, comme vous le savez, la vraie marche des sciences naturelles."

Poggendorff remarks that there is no other instance, in the whole history of modern physics, in which the truth was so long kept down by authority. Poggendorff further remarks that of the six chief phenomena of light known in Huygens's time he fully explained three—reflection, refraction, and the double refraction of Iceland spar—at least so far as concerns the direction of the reflected or refracted rays. Phenomena such as diffraction, and the colours of thin plates, required the principle of interference for their explanation, which was first given by Young, and dispersion (not yet quite satisfactorily disposed of) was first accounted for in comparatively recent times by Cauchy. Huygens himself was the discoverer of polarization, but he could not account for it. Even Young also, because like Huygens he supposed the undulations to be in the direction of the ray, failed to account for it, and it was not explained till Fresnel reintroduced with the

¹ Young's Works, ed. by Peacock, vol. i. p. 371. It is matter for curious remark that Laplace refers to Descartes only, and not to Huygens.

most brilliant success a guess of Hooke's (of date 1672), that the vibrations of light in an isotropic medium are perpendicular to the direction of the ray.

Classes of waves.

Taking the undulatory theory as the only one left possible by the experiments of Foucault, we will now consider the explanation it offers of various phenomena. It will be remembered that we have as yet made no assumption whatever as to the precise nature of a wave, and it will be found that a large class of important phenomena can be explained by it without our making any such assumption, but that other classes of phenomena compel us to adopt certain limitations of the very general hypothesis with which we started. As long as we deal with the first class of phenomena, we may take for granted those properties which are common to all ordinary forms of wave motion, such as those in water or air. In ordinary water-waves the motion of a particle is partly to and fro in the direction in which a wave is travelling, partly up and down and therefore perpendicular to that direction. This is obvious to every one who watches a floating cork. In sound-waves, whether in air or in water, the displacement of each particle of the medium is wholly in the direction in which the wave is travelling. Directly connected with this there is another distinction between these classes of waves. In ordinary water-waves the water-elements change only their *form* as the wave passes, in sound-waves there is change of *volume* also. A third distinction, also directly connected with the first, is that sound-waves in water travel at a much greater rate than the swiftest, i.e., the longest, of surface waves.

Interference.

But, in either case, when two similar and equal series of waves arrive at a common point they *interfere*, as it is called, with one another, so that the actual disturbance of the medium at any instant is the resultant of the disturbances which it would have suffered at that instant from the two series separately. Thus if crests, and therefore troughs, arrive simultaneously from the two series, the result is a doubled amount of disturbance. If, on the contrary, a crest of the first series arrive along with a trough of the second, the next trough of the first series will arrive along with the next crest of the second, and so on. One series is then said to be half a wave-length behind the other. In this case, the portion of the medium considered will remain undisturbed. Thus, at the port of

Tide of Batsha.

Batsha in Tong-king, the ocean tide-wave arrives by two different channels, one part being nearly six hours, or half a wave-length, behind the other. As a result, there is scarcely any noticeable tide at Batsha itself, though at places not very far from it the rise and fall are considerable. This was known to Newton, and is noticed by him in the *Principia*, in 24. See also *Phil. Trans.*, vol. xiv. p. 677, for the observed facts and Halley's comments. This also (see ACQUEROS) two sounds of the same wave-length and of equal intensity produce silence if they reach the external ear with an interval of half a wave-length, or any odd multiple of half a wave-length.

Young's discovery.

It is not remarkable that Young's Bakerian Lecture (1801), in which the principle of interference is for the first time described and applied, should consist in great part of extracts from the *Principia*. For there are many passages in Newton's works which might have been written by an upholder of the wave theory. Unaccountably, however, Newton in the context almost always brings in a reference to the "rays of light," as something different from the vibrations of the ether, yet capable of being acted on by them so as to be put into "fits of easy reflexion or of easy transmission." These allusions are the most obscure parts of all Newton's scientific writings; and it is very difficult to form a precise conception of what he meant to express in them.

The following passage, extracted from Young's temperate

reply (*Works*, vol. i. p. 302) to the violent but ignorant assault on him by Lord Brougham in the *Edinburgh Review*, is chosen as showing his own estimate of his own work and of its relation to what was already known —

"It was in May 1801 that I discovered, by reflecting on the beautiful experiments of Newton, a law which appears to me to account for a greater variety of interesting phenomena than any other optical principle that has yet been made known. I shall endeavour to explain this law by a comparison —

"Suppose a number of equal waves of water to move upon the surface of a stagnant lake, with a constant velocity, and to enter a narrow channel leading out of the lake. Suppose then another similar cause to have excited another equal series of waves, which arrive at the same channel, with the same velocity, and at the same time with the first. Neither series of waves will destroy the other, but their effects will be combined: if they enter the channel in such a manner that the elevations of one series coincide with those of the other, they must together produce a series of greater joint elevations, but if the elevations of one series are so situated as to correspond to the depressions of the other, they must equally fill up those depressions, and the surface of the water must remain smooth, at least I can discover no alternative, either from theory or from experiment."

"Now I maintain that similar effects take place whenever two portions of light are thus mixed, and thus I call the general law of the interference of light. I have shown that this law agrees, most accurately, with the measures recorded in Newton's *Optics*, relative to the colours of transparent substances, observed under circumstances which had never before been subjected to calculation, and with a great diversity of other experiments never before explained. This I assert is a most powerful argument in favour of the theory which I had before received: there was nothing that could have led to it in my notion with whom I am acquainted, except some imperfect hints in those unchangeable but neglected notes of nascent inventions, the works of the great Dr Robert Hooke, which had never occurred to me at the time that I discovered the law, and except the Newtonian explanation of the combinations of tides in the port of Batsha."

Young's first application of the principle of interference was made to the colours of *stratified surfaces*, the next to *fringes* the colours of *thin plates*. These, however, are not so *immediately* intelligible as the application to an experiment devised by Fresnel several years later. We therefore commence with Fresnel's experiment, which gives the most simple arrangement yet contrived, but it must be understood that the explanation is really due to Young. BOD (fig 31) is an isosceles prism of glass, with the angle at C very little less than two right angles. A luminous point is



Fig 31

placed at O, in the plane through the obtuse edge of the prism and perpendicular to its base. If homogeneous light be used, the light which passes through the prism will consist of two parts, diverging as if from points O_1 and O_2 , symmetrically situated on opposite sides of the line CO. Suppose a sheet of paper to be placed at A with its plane perpendicular to the line OCA, and let us consider what illumination will be produced at different parts of this paper. As O_1 and O_2 are images of O, crests of waves must be supposed to start from them simultaneously, in homogeneous light. Hence they will arrive simultaneously at A, which is equidistant from them, and there they will reinforce one another. Thus there will be a bright band on the paper parallel to the edges of the prism. If P₁ be chosen so that the difference between P₁O₁ and P₁O₂ is half a wave-length (i.e., half the distance between two successive crests), the two streams of light will constantly meet in such relative conditions as to destroy one another. Hence there will be a line of darkness on the paper, through P₁, parallel to the edges of the prism. At P₂, where O₁P₂ exceeds O₂P₂ by a whole wave-length, we have another

bright band, and at P_2 where O_2P_2 exceeds O_1P_1 by a wavelength and a half, another dark band, and so on. Hence, as everything is symmetrical about the bright band through A, the screen will be illuminated by a series of bright and dark bands, gradually shading into one another. If the paper screen be moved parallel to itself to or from the prism, the locus of all the successive positions of any one band will (by the nature of the curve) obviously be an hyperbola whose foci are O_1 and O_2 . Thus the interval between any two bands will increase in a more rapid ratio than does the distance of the screen from the source of light. But the intensity of the bright bands diminishes rapidly as the screen moves further off, so that, in order to measure their distance from A, it is better to substitute the eye (furnished with a convex lens) for the screen. If we thus measure the distances AP, between A and the nearest bright band, measure also AO, and calculate (from the known material and form of the prism, and the distance OO) the distance O_2O_1 , it is obvious that we can deduce from them the lengths of O_1P_1 and O_2P_2 . Their difference is the length of a wave of the homogeneous light experimented with. Though this is not the method actually employed for the purpose (as it admits of little precision), it has been thus fully explained here because it shows in a very simple way the possibility of measuring a wave-length.

The difference between O_1P_1 and O_2P_2 becomes greater as AP is greater. Thus it is clear that the bands are more widely separated the longer the wave-length of the homogeneous light employed. Hence when we use white light, and thus have systems of bands of every visible wave-length superposed, the band A will be red at its edges, the next bright bands will be blue at their inner edges and red at their outer edges. But, after a few bands are passed, the bright bands due to one kind of light will gradually fill up the dark bands due to another, so that, while we may count hundreds of successive bright and dark bars when homogeneous light is used, with white light the bars become gradually less and less defined as they are farther from A, and finally merge into an almost uniform white illumination of the screen.

In this example, and in all others of a similar character which will be introduced into this elementary article, the solution is only approximate. The utmost resources of mathematics are in most cases required for the purpose of complete solution.

We are now in a position to prove that light moves slower in glass than in air, by the process which was merely indicated while we were discussing the velocity of light. For, if we could slightly lengthen the paths of the rays which come from O_2 , leaving those from O_1 unaltered, the system of bands would obviously be shifted in the direction from A to P in the figure. This happens if a very thin film of glass be interposed in the path of the rays which appear to come from O_2 . The best mode of making the experiment is to put a piece of very uniform plate glass, cut into two parts, between the prism and the screen, so that rays from O_1 pass through one part and those from O_2 through the other. So long as these pieces are parallel, no shifting takes place. But if one be slightly turned, so as to give the rays a longer path through it, the system of bands is at once displaced to the side at which it is situated.

Also, we can now see how it is possible to discover whether light has its velocity affected by that of the medium in which it is traveling. We know that sound travels faster with the wind, and slower against it, than it does in still air. We may, therefore, suppose a disposition of the interference apparatus such that the two rays which interfere have each passed through a long tube full of water. A rapid current may be established, in either

direction, in one or other of the tubes, or in opposite directions in the two, and the shifting of the interference-bands will at once indicate the nature of the effect. We cannot describe the details of the process. The result, however, is analogous to that of wind on sound, but of course very much smaller, and it seems that the actual change of the velocity of light is less than the velocity of the current. See ENRIK.

Let us next consider the effect of a grating, a series of inter-fine parallel wires placed at small equal intervals, or a piece of glass or of speculum metal on which a series of equidistant parallel lines have been ruled by a diamond point. We take only the case in which plane waves of homogeneous light are incident in a direction perpendicular to the plane of the grating, and when the bars and openings of the grating are all equal in breadth.

Consider the effect on an eye or screen at a considerable distance, in the direction BE (fig. 32). If there were no grating, practically no light would reach the eye from the aperture AD unless ABE were very nearly a right angle



Fig. 32

This is, of course, the statement of Huygens already quoted. But Young's principle enables us to say why this is the case. Let us divide AD into a series of equal parts by lines perpendicular to BE, and distant from one another by half a wave-length of the homogeneous light employed. The portions coming to the eye from any two adjacent parts AB, BC will be practically of the same intensity, and will exactly neutralize one another's effects on the eye. For if we take points a and b similarly situated with regard to A and B respectively, the distances of a and b from the eye differ by half a wave-length, and rays from a neutralize those from b. This is true wherever a be taken between A and B. Hence, under the conditions assumed, no light reaches the eye.

Now suppose the alternate parts AB, CD, &c. to be opaque. Similar reasoning will show that the remaining rays conspire to strengthen one another. Thus, when homogeneous light from a distant point falls perpendicularly on a grating in which the breadth of the bars is equal to that of the interstices, it will be seen brightly in a direction inclined at an angle θ (ABE) to the plane of the grating,—the angle θ being such that

$$AC \cos \theta = \text{wave-length}$$

Similar reasoning shows that the light is reinforced whenever θ is such that

$$AC \cos \theta$$

is an integral multiple of the wave-length. The appearance presented when a long narrow slit is the luminous object, and the bars of the grating are placed parallel to it, is therefore (with homogeneous light) a central image with others equidistant from it on each side—their angular distances from it being the values of the angle corresponding to the sizes

$$\frac{\lambda}{a}, \frac{2\lambda}{a}, \frac{3\lambda}{a}, \text{ \&c.}$$

Here λ is the wave-length, and a is the sum of the breadths of a bar and an interstice. It is found in practice, and it is also deducible from the complete

MEASUREMENT
OF WAVE-
LENGTHS

EFFECT OF
WHITE
LIGHT

ADDITIONAL
PROOF
THAT
LIGHT
MOVES
SLOWER
IN GLASS
THAN IN
AIR

theory, that the *ratio* of the breadths of the bar and interstice has but little effect on the result, unless it be either very large or very small. Hence if λ be expressed as a fraction of an inch, and n be the number of lines per inch in the grating, the angular deviations of the bright bands have the sines

$$n\lambda, 2n\lambda, 3n\lambda, \text{ &c.}$$

The mean wave-length of visible rays in air is about $\frac{1}{10000}$ of an inch. Thus a grating with 5000 equidistant lines per inch will give with such light an angular deviation of about 6° for the first bright diffraction line.

If we notice that the sine of the deviation is proportional to the wave-length, it will be obvious that when white light is used the result will be a series of spectra on each side of the central white image, their more refrangible ends being turned towards that image. When the grating is a very regular one, and the appearances are examined by means of a telescope adjusted for parallel rays, the spectra formed in this way show the Fraunhofer lines with as great perfection as do the best prisms. And they have one special advantage, which prisms do not possess. The relative angular separation of the various colours depends solely on their wave-lengths, and thus the spectra formed by different gratings are practically similar to one another. There is, in fact, almost no *irrationality* in this kind of dispersion. In glass prisms and especially in those of flint glass, the more refrangible part of the spectrum is much dilated, while the less refrangible part is compressed.

The counting of the number of lines per inch in a grating is not difficult, nor is the accurate measurement of the angle of deviation of any particular Fraunhofer line. Hence, by the help of the very simple formula given above, the wave-lengths of light corresponding to the various Fraunhofer lines have been determined with very great accuracy from the diffraction spectra of gratings. The following are, according to Angstrom's, a few of the chief values. λ is expressed in ten-millionths of a millimetre.²

A	Atmosphere	7604
B	Atmosphere	6867
C	Hydrogen	6562
D (double)	Sodium	5895
E	Calcium and Iron	5269
F	Hydrogen	4861
G	Iron	4307
H (double)	Calcium and Iron	3968
		3933

For the sake of a discussion to be entered on later, we have appended the refractive index from air into water for each of these rays, as given by Fraunhofer himself.³

If now we suppose AB, CD, &c., to be transparent, while BC, &c., become opaque, it is obvious that the new grating will be the *complement* of the old one, and will give precisely the same appearances at points outside the course of the direct beam. For when there is no grating there is practically no illumination at such points. This statement of course is equally true of any grating, whatever be the ratio of the breadths of the bars to those of the interstices.

Another very curious result of the theory of interference, fully verified by experiment, is furnished by the fact that the *central spot* of the shadow of a small circular disk, cast by rays diverging from a distant point in its axis, is as brightly illuminated as if the disk had not been interposed.

The final example of interference which we can give here is noteworthy on account of a peculiarity which it

presents. Let us consider the case of homogeneous light reflected by a thin plate or film of a transparent material.

Let AB (fig. 33) be the direction of the incident ray, BE the direction in which part of it is reflected to an eye E at a considerable distance: and let DE be the direction in which another part escapes after refraction into the plate at D and partial reflexion at the second surface of the plate at C. Then if Dd be drawn perpendicular to BE, the retardation of the wave in DE as compared with that in DE will be $(2\mu BC - Ed)\lambda$ wave-lengths, where μ is the refractive index to the plate.

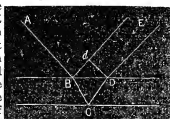


Fig. 33

It e' be the angle of refraction, and t the thickness of the plate, it is easily seen that

$$DC \cos e' = t,$$

$$BD = 2BC \sin e' = 2t \tan e'$$

Hence

$$2\mu BC - Dd = 2\mu t \cos e'$$

whenever, for a given thickness of plate, a' is such that

$$2\mu t \cos e'$$

is an integral multiple of λ , the two rays should reinforce one another at E. The same will happen for a given angle of incidence when the thickness of the plate is such that

$$2\mu t \cos e'$$

is an integral multiple of λ . When, on either account $2\mu t \cos e'$ is an odd integral multiple of $\lambda/2$, the rays at E will weaken (perhaps destroy) one another.

Hence, in homogeneous light, a thin plate, tuned about, alternately reflects and does not reflect to an eye in a given position. And a fixed plate of non-uniform thickness reflects light from some parts and not from others. When white light is used there will in general be colours seen which vary with the angle of incidence, and also with the thickness. If the plate is infinitely thin it would appear that there should be infinitely slight retardation only, and the plate should thus be bright in homogeneous light (and of course white in white light) at all incidences.

In general this is not the case. Thus when a soap bubble, or a vertical soap-film, is screened from currents of air, and allowed to drain, the uppermost (i.e., the thinnest) part becomes perfectly black. It can, in fact, be seen only by the feeble light scattered by little drops of oil or particles of soap or dust on its surface. Here, again, Young's sagaciously supplied the germ at least of the explanation. It is given in the following extract from his *Theory of Light and Colours*, the Bakuian Lecture for 1801 already referred to:—

"PROPORTION IV.—If then an undulation arrives at a Surface less of which is the Limit of Mediums of different Densties, a partial halt Effluvia takes place, proportional to the Difference of the wave-lengths."

"This may be illustrated, if not demonstrated, by the analogy of elastic bodies of different sizes. If a smaller elastic body strikes against a larger one, it is well known that the smaller is reflected more or less powerfully, according to the difference of their magnitudes: thus, there is always a reflexion when the rays of light pass from a rarer to a denser stratum of ether, and frequently an echo when a sound strikes against a cloud. A greater body striking a smaller one propels it, without losing all its motion; thus, the particles of a denser stratum of ether do not impart the whole of their motion to a rarer, but, in their effort to proceed, they are recoiled by the attraction of the reflecting substance, with equal force, and thus a reflexion is always secondarily produced, when the rays of light pass from a denser to a rarer stratum." But it is not absolutely necessary to suppose an attraction in the latter case, since the effort to proceed would be propagated backwards without

² *Spectro Scopus*, 1869.

³ As there are nearly 25 millimetres in an inch, these numbers each multiplied by 4 give the wave-lengths approximately in thousand-millionths of an inch.

⁴ *Gilbert's Annals*, li, 1817.

Light
interference
of thin
films

Wave-lengths
for
different
homogeneous
rays

Trans-
parency
of gratings

Shadow
of cen-
tral disk

Colours
of thin
plates

new

length

it, and the undulation would be reversed, a rarefaction returning in place of a condensation; and thus will perhaps be found most consistent with the phenomena."

This idea, of a rarefaction returning by reflexion when a condensation is incident, is equivalent to a loss or gain of half a wave-length when light in a denser body is reflected at the surface of a rarer body. Whether, then, the plate is denser or rarer than the medium surrounding it, one or other of the two interfering rays loses half an undulation more than the other in the mere act of reflexion. This completely removes the difficulty. But Young went farther, and pointed out that if a thin plate be interposed between two media, one rarer, the other denser than the plate, this half wave-length effect should disappear. He verified this conjecture by direct experiment, founded on a modification of a process due to Newton.

Newton's rings. Newton had, long before, devised and carefully employed an excessively ingenious (because extremely simple and effective) method of studying the colours of thin plates. It consisted merely in laying a lens of long focus on a flat plate of glass. The film of air or other fluid between the spherical surface and its tangent plane has a thickness which is directly proportional to the square of the distance from the point of contact. When such an arrangement is looked at in homogeneous light, the lens having been pressed into contact with the flat plate, there is seen a central black spot, surrounded by successive bright and dark rings, whose number appears to be practically unlimited. The radii of the successive bright rings were found by Newton to be as the square roots of the odd numbers 1, 3, 5, &c. Hence the thicknesses of the film of air are directly as these numbers. When rays of higher refrangibility are used the rings diminish in diameter. Hence when white light is employed we have a superposition of coloured rings of all sizes, but it is no longer possible to trace more than four or five alternations of *bright* and *dark* rings—the colours being then more and more compound. This series of coloured rings is named after Newton, and the successive colours, gradually more and more composite, form Newton's *scale of colours*. Thus we read, in books more than thirty years old, of a red or blue of the *third order*, meaning those colours as seen in the third bright ring round the central dark spot.

Many of the most vivid colours of natural and artificial bodies are due to one or other of the forms of interference we have roughly explained. Thus *Borac's buttons* (once employed for ornament as they produce an effect very similar to that of diamonds) were simply polished metal plates stamped by a die of hardened steel, on whose surface a pattern had been engraved consisting of small areas ruled in different directions with close equidistant parallel grooves. That the colours of a pearl and of mother-of-pearl are due to a similar surface corrugation was proved by Brewster, who took impressions from such substances in black wax, and found that it was thus rendered capable of giving the same play of colours. The scales from the wings of butterflies owe their bright colours to a delicate ribbed structure. On the other hand, the thin transparent wings of house-fly, earwig, &c., owe their colour to their thinness. The same is true of the temper colour of steel, Nobil's rings, &c. Very beautiful examples of thin plates scaled off from decayed glass (found in Roman excavations) have been figured, with their play of colours, by Brewster.¹

Here we can only say a word or two about the probable relation between the wave-length of homogeneous light and its refractive index for any isotropic medium. The existence of dispersion was attributed by Cauchy to the fact that even the most homogeneous media, such as water,

have grained or heterogeneous structure of dimensions not incomparably smaller than the average length of a wave of light. This grained structure has been recently proved to exist, by several perfectly independent processes arising from totally unconnected branches of physics; and its dimensions have been assigned, at least in a roughly approximate manner. See ATOM, and CONSTITUTION OF MATTER.

It appears from the theory of disturbances in such a medium that the velocity of a ray depends upon its wavelength in a manner which is expressed by a series of even inverse powers of that wavelength. Hence we have a relation such as

$$\mu = a + \frac{\beta}{\lambda^2} + \frac{\gamma}{\lambda^4} + \dots$$

in which, from our present ignorance of the precise connexion between matter and ether, we must be content to find the multipliers of the various terms by direct measurement. If we neglect all but the first two terms, we may determine α and β from the known wave-lengths of two of Fraunhofer's lines, and their refractive indices for a particular medium. We can then test the accuracy of the formula by its agreement with the corresponding numbers in the same medium for others of the fixed lines. Thus, taking the data for water given above, we have, from the numbers for the two hydrogen lines (C and F, the values

$$\alpha = 1.3243,$$

Calculating from these, and the wave-length of H₁ we have for its refractive index 1.3447, instead of 1.3442 as determined by Fraunhofer. So far as we may trust this theory, which certainly accords fairly with the experimental data for substances of moderate dispersive powers, though by no means well with those for substances of high dispersive power such as oil of cassia, the value of the quantity n is the refractive index for the *longest possible waves*; *i. e.* it is that of the inferior limit of the spectrum.

DOUBLE REFRACTION.—We now come to phenomena which cannot be even roughly explained by processes based on the vague analogies of sound and water waves which have hitherto sufficed for our elementary treatment of the subject.

These phenomena were first observed in Iceland spar. Iceland spar was described in a general way by Bartholinus, who showed that one of the two rays into which a single incident ray is divided by this substance follows the ordinary law of refraction. Huygens, who studied the subject only eight years later, verified the greater part of the results of Bartholinus, and added many new ones. From his point of view it was of course obvious that the ordinary ray is propagated by spherical waves, i. e., its velocity is the same in all directions inside the crystal. To explain the extraordinary ray, he assumed that it was propagated in waves of the form of an ellipsoid of revolution, the simplest assumption he could make. To test the accuracy he first noticed that a rhombohedral crystal of Iceland spar behaves in precisely the same way whichever pair of parallel faces light passes through. Hence he accurately concluded that the axes of the ellipsoids of revolution (if such were the form of the waves for the extraordinary ray) must be symmetrically situated with regard to each of these planes. The only such lines in a rhombohedron are parallel to that which joins those corners which are formed by the meeting of three equal plane angles. In the case of Iceland spar these equal angles are obtuse. Huygens then verified, by experiments well contrived, though carried out by a very rough mode of measurement, the general agreement of his hypothesis with the fact; and he further tested it by comparing its indications as to the position of the two spaces for any position of the crystal

with the results of direct observation. There can be no question that the whole investigation was, for the age in which it was made, of an exceedingly high order. But it must not be left unsaid that far more accurate measurements than those of Huygens were necessary before it could be asserted that the form of the extraordinary wave is an ellipsoid of revolution, and not merely a surface closely resembling such an ellipsoid. These improved measurements were made 1803 by Wollaston, and they have recently been repeated with far more perfect optical means by Stokes, Mascart, and Glaszbrook. The result has been the complete verification of Huygens's conjecture. The generating ellipse of the extraordinary waves is found to have its minor axis, which is that of revolution, equal to the diameter of the corresponding sphere for the ordinary ray. Its major axis is to the minor nearly in the ratio $1.654:1.483$.

We are now in a position to trace the paths of the two rays into which a ray falling in any direction on a surface of the crystal is divided by refraction.

Refraction by Iceland spar.

Let fig. 34 represent a plane wave front AB (in an) falling on the surface AC of a piece of Iceland spar cut in any way. The figure is a section perpendicular to the surface, and parallel to the incident ray. The wave-front AB cuts the surface of the spar in a line (not shown) at right angles to the plane of the paper. Draw from A the axis Aa (not necessarily in the plane of the paper) and the sphere and ellipsoid of revolution which have Aa for a common axis. Then, if C be taken such that BC is to Aa as the velocity of light in air is to that of the ordinary ray in

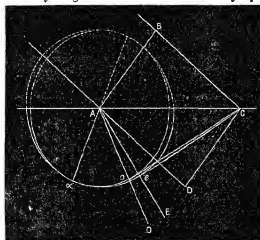


Fig. 34

the crystal, the wave-front of the ordinary ray is found by drawing a tangent plane to the sphere, passing through C and perpendicular to the plane of the paper. This touches the sphere in a point o (in the plane of the paper) and AoO is the ordinary ray¹. To find the direction of the extraordinary ray, a plane perpendicular to the paper, and passing through C, must be drawn so as to touch the ellipsoid. Let c be the point of contact, which will in general not be in the plane of the paper unless Aa is in or perpendicular to that plane, then AaB is the extraordinary ray.

Thus, in general, the extraordinary ray is not in the plane of incidence. Also the ratio of the sines of the angles of incidence and refraction is generally different for different directions of incidence, in the case of the extraordinary ray.

In an elementary article we cannot attempt more fully to study these phenomena, so we merely state that all the observed appearances, so far as the directions of the

¹ This is merely a repetition of the construction we have already given for singly refracting bodies.

refracted rays are concerned, are explained by supposing the wave-surface in the crystal to be made up of the sphere and the ellipsoid of revolution above described. Thus, when both eyes are used, the two images of a plane object seen through a crystal of Iceland spar appear in general to be situated at different distances above the plane. One of them maintains its apparent position as the crystal is made to rotate about a perpendicular to the two faces employed; the other's position varies as the crystal is turned.

But we have now to inquire *why* the incident ray is divided into two, and why one of them follows the ordinary law of refraction. Here another experimental result of Poisson's comes to our assistance. We paraphrase the author's description:—

"I will, before concluding, mention another remarkable phenomenon which I discovered after the above was written. For, given a diamond I have not yet been able to find the cause of it, I do not dwell on that account to refrain from pointing it out, in order that every one may have an opportunity of seeking to explain it. It appears that it will be necessary to make hypotheses additional to those already given,—though these will lose none of their probability, confirmed as they have been by so many tests. The phenomenon is that, taking two fragments of the crystal (Iceland spar) and laying them on one another, or even holding them apart, if all the faces of the one be parallel to those of the other, a ray of light divided into two by the first fragment will not be further subdivided by the second. The ordinary ray from the first will be refracted ordinarily by the second, the extraordinary ray extraordinarily. And the same thing happens not only in this arrangement but in all others in which the principal sections² of the two fragments are in the same plane, whether the surfaces turned towards one another be parallel or not. It is, in fact, marvellous that these rays, falling on the second fragment, do not divide like the ray incident on the first. One would say that the ordinary ray from the first fragment had lost what is necessary for the production of extraordinary refraction, and the extraordinary ray that which is necessary for ordinary refraction, but there is something else which upsets this view. For when one places the fragments so that their principal sections are straight angles, whether the opposed surfaces be parallel or not, the ordinary ray from the first suffers only extraordinary refraction by the second, and *vice versa*.

"But in all the infinite number of positions other than those named, both rays from the first fragment are divided into two by the second. Thus the single incident ray is divided into four, sometimes equally sometimes unequally bright, according to the varying relative position of the crystals. But all together do not seem to have more light than has the single incident ray.

"When we consider that, the two rays given by the first crystal remaining the same, it depends upon the position of the second crystal whether they shall be divided into two or not, while the incident ray is always divided, it appears that we must conclude that the waves of light which have traversed the first crystal have acquired a form or disposition which in some positions enables them to excite the two kinds of matter which give rise to the two kinds of refraction, in other positions to excite only one of them. But I have not yet been able to find any satisfactory explanation of this."

So far Huygens. His statements are perfectly in accordance with fact, and they were reproduced by Newton³ in very nearly the same form. Newton adds,—"The un-Newton's usual refraction is, therefore, performed by an original property of the rays. And it remains to be enquired, whether the rays have not more original properties than are yet discovered. Have not the rays of light several sides, ended with several original properties?"

It is very curious to notice how near each of these great men came to the true explanation, and yet how long time elapsed before that explanation was found. The date of Huygens's work is 1690, that of Newton's 1704. It was not till 1810 that farther information on the subject was obtained. Then one brilliant observation opened the way for a host of discoveries in a new and immense field of optics.

² Defined as passing through the shorter diagonal of one of the rhombic faces of the crystal, and through the edge formed by the two adjacent faces.

³ *Optics*, Queries 25, 26.

Polarization by reflection.

In the last-mentioned year Malus, while engaged on the theory of double refraction, casually examined through a doubly refracting prism of quartz the sunlight reflected from the windows of the Luxembourg palace. He was surprised to find that the two rays alternately disappeared as the prism was rotated through successive right angles,—in other words, that the reflected light had acquired properties exactly corresponding to those of the rays transmitted through Iceland spar. Even Malus was so imbued with the corpuscular theory of light that he named this phenomenon *polarisation*, holding it as inexplicable on the wave theory, and as requiring a species of polarity (akin to the magnetic) in the light-corpuscles—a close reproduction of one of Newton's guesses.

Transverse vibrations.

But after a short time Hooke's old guess was independently reproduced, and in the hands of Young and others, but most especially of Fresnel, the consequences of the assumption, that the vibrations of the luminiferous medium take place *perpendicularly* to the direction of the ray, were the almost complete explanation of the cause of double refraction, and the discovery (often the prediction) of a long series of the most gorgeous phenomena known to science.

The real difficulty in the way of this conception probably lay in the fact that most of the familiar forms of wave-motion—such as sound-waves in air or in water, and ordinary water waves—are not of this character. In sound-waves the vibrations are wholly in the direction of the ray, while in surface-waves in water they are partly parallel to and partly perpendicular to the direction in which the wave is travelling. That a body may transmit waves in which the vibration is perpendicular to the direction of a ray, it must have the properties of an elastic solid rather than of a fluid of any kind. And our experience of the almost entire absence of resistance to the planetary motion seems, at first sight at least, altogether incompatible with the idea that the planets move in a jelly-like solid, filling all space through which light can be propagated.

Analogies.

Without going into difficult dynamical details, we may obtain a notion of the nature of the motion now to be considered, by observing the propagation of a wave when a long stretched wire or string is struck or plucked near one end. Here the line of motion of each part of the wire is almost exactly perpendicular to the direction of the wire, i.e. to the line along which the wave travels. (When the string is extensible there may be another wave, due to extension; but this, which is analogous to sound, has its vibrations *along* the string, and it usually travels at a very different rate from the other, so that the two are not in any way associated.)

Interference of polarized rays.

Now it is clear that waves of this wholly transverse character can have, in Newton's language, *sides*. And it is also clear that they cannot interfere so as mutually to destroy one another unless their corresponding sides are parallel to one another; nor can they interfere at all if their sides are perpendicular to one another. Hence a very severe test of the theory will be furnished by examining various cases of interference of polarized light, which ought to present in general marked differences from those of ordinary light. It was by experiments of this kind that Fresnel and Arago first firmly established the bases of the theory of polarization. The important fact discovered by Malus was soon generalized into the following statement:—

Polarizing angle.

Light reflected from the surface of substances so different as water, glass, polished wood, &c., at a certain definite angle, which depends on the nature of the substance, is found to possess all the properties of one of the rays transmitted through Iceland spar. If the plane of re-

flexion is parallel to the axis of the spar, the properties of the reflected light are those of the *ordinary* ray; if perpendicular to it, those of the *extraordinary* ray.

It was reserved for Brewster to discover, as the result of an extraordinary series of experimental measurements, the very simple law which follows:—

The tangent of the polarizing angle is equal to the Brewster law refractive index of the reflecting substance.

This may be put in another form, in which its connexion with theory is a little more evident:—

When the reflected ray is completely polarized, it is perpendicular to the refracted ray.

Bearing in mind Huygens's observations on light which has passed through two crystals of Iceland spar, we can now see that a ray of light polarized by reflexion is in general divided into two by a crystal of Iceland spar. But there is only one ray when the principal plane of the crystal is parallel to the plane of reflexion, and none when these planes are perpendicular to one another.

We may now much simplify matters by suppressing the Iceland spar, and using two reflecting plates of glass, so placed that a ray meets each of them in succession at the polarizing angle. It is then found that when the planes of reflexion are parallel the ray is reflected (almost without loss) from the second plate, but when they are perpendicular to one another there is complete extinction.

In intermediate positions the intensity was found by Arago to be as the square of the cosine of the inclination of these planes.

This very simple experiment, which any one may easily make for himself, by putting two pieces of glass at the proper angle in the ends of two wooden tubes which fit into one another, enables us to form a general notion of the modification which is called polarization. The "sides" of the reflected ray are obviously in, and perpendicular to, the plane of incidence; for a ray can be reflected over and over again if the successive planes of incidence are parallel, but is stopped at once if one of them be perpendicular to the others.

Here, however, two new difficulties come in at once:—

(1) Are the vibrations of the reflected ray, in perpendicular to, the plane of reflexion? (2) As ordinary sun or lamp light, reflected at the proper angle from a polarizing surface, shows no variation of intensity when the azimuth of the plane of reflexion is changed, what can be then the direction of its vibrations? These questions have not yet been answered in a thoroughly satisfactory manner.

Many important phenomena are explained in terms quite independent of the proper answer to (1), and, in other words, which do depend on the answer, the theoretical differences between the results of the two hypotheses are so small as to have hitherto remained undetected. In an important test, suggested by Stokes, the experimental results have been at variance in a way not yet explained. It is quite possible that, as is required by Clerk Maxwell's *electromagnetic theory* of light (see *ETHER*), there may be simultaneous displacements, but of different characters, in each of these planes, and then the question would be reduced to—Which of these displacements is the luminous one? But on this theory, both are probably essential to vision.

As to the second question, it may be said—*first*, that, Nature so far as the test of double refraction can inform us, is of completely polarized ray whose plane of polarization is made to rotate rapidly produces precisely the same effects as a ray of ordinary light; and, *secondly*, that, so great is the number of vibrations even of red light in one second, it would be impossible to make the plane of polarization rotate fast enough to affect the circumstances of any of the phenomena of interference, even when they take place between two portions of the same ray, one of which is retarded

thousands of wave-lengths more than the other. But, *thirdly*, the fact that, when homogeneous light is used, Newton's rings have been counted up to the 7000th shows that, whatever be the actual nature of the vibrations of unpolarized light, they must for at least 7000 waves in succession be almost precisely similar to one another. Then, for other 7000 waves or so, we may have a totally different type of vibration. But, *fourthly*, in the course of $\frac{1}{4}$ th of a second, at the very utmost, the vibrations must have been almost uniformly distributed over all directions perpendicular to the ray. Again, however, *fifthly*, another quite different view may be suggested. All common light has its origin from a practically infinite number of sources, consisting of the vibrating particles of the luminous body. The contributions from each of these sources (so far as one definite wave-length is concerned) may be said probably are at any one point as different in direction of vibration as they certainly must be in phase.¹ From this point of view, which we cannot develop here, the uniformity of optical phenomena becomes quite analogous to the statistical species of uniformity which is now found to account for the behaviour of the practically infinite group of particles forming a cubic inch of gas. The reader need only think of the fact that, so numerous are those particles, it is practically (though not theoretically) impossible that even a cubic millimetre of air should, even for $\frac{1}{1000}$ th of a second, contain oxygen particles alone.

Reflexion not at the polarizing angle

Polarization by ordinary refraction

When light is reflected at an incidence either less or greater than the polarizing angle, it behaves as if part of it was only polarized and the rest ordinary light, and it is said to be *partially polarized*. Tested by a crystal of Iceland spar, it gives two images in all positions of the crystal; but their brightness is unequal except in the special positions where they would be of equal brightness were the ray wholly polarized.

From the fourth of the remarks made above regarding common light, and the facts of double refraction, it follows at once that, when light is to any extent polarized by reflexion, there must be an exactly equal amount of polarization must be perpendicular to that of refraction. This was established by experiment soon after Malus's discovery. But as the reflected ray from glass, water, &c., is in general much weaker than the refracted ray, the percentage of polarized light is generally much greater in the former. It was found, however, by experiment that refraction at a second glass plate parallel to the first increases the proportion of polarized to common light in the transmitted ray, and thus that light may be almost completely polarized, by transmission, at the proper angle, through a number of parallel plates. The experimental data of this subject were very carefully obtained by Brewster. He has found, for instance, how the angle of incidence for the most complete polarization varies with the number of plates. The plane of polarization of such a bundle is *perpendicular* to the plane of refraction.

This, however useful on many occasions, is at best a rough arrangement for producing polarized light. By far the most perfect polarizer for a broad beam of light is a crystal of Iceland spar, sufficiently thick to allow of the complete separation of the two rays. But such specimens are rare and costly, so that the polarizer in practical use is now what is called *Nicol's prism*, invented in 1828 (*Jamieson's Journal*, p. 85). By cutting a rhomb of Iceland spar in two, and cementing the pieces together with Canada balsam (after carefully polishing the cut faces),

Nicol's prism.

¹ A curious exception occurs in the case of light reflected from a body which polarizes by absorption. See REFRACTION.

Nicol produced an arrangement in which one only of the two rays is transmitted, the other being totally reflected at the surface of the balsam. The reason is simply that the refractive index of Canada balsam is intermediate to those of the ordinary and extraordinary rays in the spar. The ordinary ray, falling very obliquely on a medium of a smaller refractive index, is totally reflected, the extraordinary ray, falling on a medium of greater, but very little greater, refractive power, is almost wholly transmitted. The only defect of the Nicol's prism is that, to secure the total reflexion, its length must be considerably greater than its breadth; and thus it necessarily limits the divergence of the beam it allows to pass.

Certain doubly refracting crystals exert considerable Polar. absorption on one of the two rays they produce, and can therefore, when in plates of sufficient thickness, be by absorption employed as polarizers. This is the case with some specimens of tourmaline when cut into plates parallel to the axis of the crystal. It is also found in the flat crystals of several artificial salts, such as, for instance, iodo-sulphate of quinine.

Let us now suppose that by one or other of these pieces Two of apparatus, say a Nicol's prism, light has been polarized. Nicol's. If we examine this ray by means of a second Nicol, placed in a similar position to the first, it passes practically unaltered. As the second Nicol is made to rotate, more and more of the light is stopped, till the rotation amounts to a right angle. Two well-constructed Nicols, placed in this position, are practically opaque to the strongest sunlight. During the next quadrant of rotation the transmitted ray gradually increases in brightness, until at 180° of rotation it passes practically unaltered. Precisely the same phenomena occur in the same order during the next half of a complete rotation. The reader will observe that this is merely Huygens's original statement, limited to one of the four rays which are produced by passing common light successively through two crystals of Iceland spar.

Whatever be the true mechanism of polarized light, Symmetry of polarized light. there can be no doubt that its vibrations are *symmetrical* with respect to the ray, and also with respect to the plane of polarization. Hence we may, for many important purposes, symbolize them by simple harmonic vibrations taking place either in or perpendicular to the plane of polarization. But, if they be supposed to take place simultaneously in these two planes, their quality or nature must be essentially different in the two, else the symmetry above referred to would be violated. Hence it will be sufficient for the present to assume that they take place perpendicular to the plane of polarization. The nature of the resulting effects, so far as the eye is concerned, will not be different for the different hypotheses. Also, as no instance has yet been observed, even with the most intense beams of light, in which the joint effects observed are not those due to simple superposition, we may assume that the elastic force of the luminiferous medium, called into play by a displacement, is directly proportional to the displacement, and therefore that the vibrations for each wave-length follow the *simple harmonic law*, that of the cycloidal pendulum.

The subject of the composition of simple harmonic motions of equal period falls to be discussed as an important branch of *kinematics* (see MECHANICS). We will therefore here assume the following results,—referring to the above-quoted article for their proof—

1. Two simple harmonic motions of the same period, in *Proper- lines perpendicular to one another, give, in general, elliptic motion, which may be in the positive or negative direction of rotation.* simple harmonic motion

2. The ellipse becomes a straight line, and the resultant motion therefore simple harmonic, when the phases of the

components are the same, or differ by an integral multiple of π .

3. It becomes a circle when the amplitudes of the components are equal, and then phases differ by an odd multiple of $\frac{1}{2}\pi$. The motion takes place in one direction (say right-handedly) in the circle when this multiplier is 1, 5, 9, 13, &c., and in the opposite (left-handed) when it is 3, 7, 11, 15, &c. . .

Effect of a plate of doubly refracting material

Homogeneous light

Now, suppose a plane polarized ray to fall on a plate of a doubly-refracting crystal (a thin plate of mica or selenite, for instance). Within the plate it will in general be divided into two, which are polarized in planes at right angles to one another. The directions of vibration in these rays are determined by the physical properties of the material. Let them be represented by the lines O*x*, O*y* in fig. 35. Then, if O*A* represents the semiamplitude of vibration in the incident ray, it may be looked on by (2)

above as the resultant of two simple harmonic motions of the same period, whose semiamplitudes are OM and ON, and which are in the same phase. Each of these will pass through the plate of crystal unchanged. But one will, in general, travel faster than the other, for the essential cause of double refraction is the difference of velocities of the two rays. The portions of the two rays which simultaneously escape from the crystal, and which travel together outside it, will therefore differ in phase. Hence, to find the nature of the transmitted light, we must recombine the vibrations in OM, ON, taking account of this difference of phase. By (1) above the result will be in general elliptic motion. The ellipse will necessarily be one of the infinite number which can be inscribed in the rectangle AA'BB', whose construction is obvious. We have then, in general, what is called *elliptically polarized light*. This degenerates (by (2) above) into plane polarized light, whose vibrations are along OA or OA' according as the difference of phase is 0, 2π , 4π , &c. or π , 3π , 5π , &c. And it will become *circularly polarized light* if OM=ON (i.e., if $\angle AOB = \frac{1}{2}\pi$) and the difference of phase be an odd multiple of $\frac{1}{2}\pi$. By (3) above this will be right or left handed, according to the value of the odd multiplier.

Elliptically and circularly polarized light.

This conclusion from the assumption above made is fully borne out by experiment. When a plate of mica, of such a thickness as to retard one of the two rays a quarter of a wave-length more than the other, is interposed between two Nicols, we observe the following phenomena:—

If the Nicols were originally placed so as to extinguish the light, the introduction of the mica plate in general partially restores it. Now, let the mica plate be made to rotate in its own plane. The light vanishes for successive positions, differing by a quadrant of rotation, i.e. whenever the directions of vibration in the crystal coincide with the principal planes of the Nicols. In each of these positions the light from the first Nicol passes unchanged through the mica, and is therefore entirely stopped by the second Nicol. Half-way between these positions the light transmitted through the system is at its brightest, and in these cases it is not altered in brightness by rotating the second Nicol. It is then circularly polarized, and in whatever direction the second Nicol is placed the component of the circular motion which is ready to pass through it is of the same amplitude. Here, then, is a case in which a Nicol (the second) cannot enable us to distinguish between common light and light very seriously modified.

In what precedes, we have assumed that *homogeneous white light* was used. In general, a doubly-refracting plate light produces a difference of phase in its two rays which will depend on their wave-length; and thus when white light is used we have a display of colour, sometimes extremely gorgeous, and we may distinguish light thus circularly polarized from common light by slight changes of colour and intensity as the second Nicol is turned.

Hitherto we have spoken of the polarizing angle for light reflected in air from bodies such as glass, water, &c., which have a higher refractive index than air, and we have seen that an equal amount of light is polarized in the refracted beam. But what if there be no refracted beam? This is the case of total reflexion inside the denser body. Fresnel discovered that in this case the two kinds of polarized light (in planes at right angles to one another) co-exist in the totally reflected ray, but that they differ in phase, and therefore in general recombine into elliptically polarized light. Guided by peculiar theoretical considerations, he was led to construct a piece of glass (*Fresnel's rhomb*), inside which light is twice totally reflected at a certain angle with the result that, if it be originally polarized in a plane inclined at 45° to the plane of reflexion, the emergent light is circularly polarized.

Reflexion from the surface of metals, and of very highly refractive substances such as diamond, generally gives at all incidences elliptically polarized light. Attempts have been made to determine from such effects the refractive indices of metals and other opaque substances. These are all based upon theory, and cannot as yet command much confidence. With certain doubly-refracting substances the light reflected at a definite angle is differently polarized, and sometimes even differently coloured, for different azimuths of the plane of incidence.

When a thin plate of doubly-refracting crystal, which rings gives a bright colour when placed between two Nicols, is and slightly inclined to the ray, the colour changes as the difference of phase of the two refracted rays is increased. If, now, we take a plate of Iceland spar cut perpendicularly to the axis, no colour will be produced by parallel rays passing through it perpendicularly, because both rays have a common velocity parallel to the axis, but, if divergent light be used, there is a gorgeous display of circular coloured rings surrounding the axis, which depends upon the increasing retardation of the ordinary ray behind the extraordinary as their inclination to the axis increases. When the principal planes of the Nicols are at right angles, this system of rings is intersected by two black diameters, in these planes respectively. When the second Nicol is turned through a right angle, we have exactly the complement of the former appearance, i.e., a figure such that, if superposed on the former, it would give an uniform field of white light.

It is to be noticed that none of these phenomena can be observed without the use of the second Nicol. This arises from the fact that, where the vibrations in any direction interfere so as to destroy one another, those in the direction perpendicular to the former interfere so as to strengthen one another. The second Nicol enables us to select one of these portions, and examine it independently of the other.

The only double refraction we have considered particularly is that of Iceland spar, where everything is symmetrical about the axis of the crystal. Such crystals, and they include as a rule all those of the second and third systems in *CRYSTALLOGRAPHY* (q.v.), are called *uniaxial*. Crystals of the first system are not doubly refractive. But it was one of the most valuable of Brewster's discoveries that the great majority of non-isotropic substances are doubly refracting, and in general are *biaxial*, i.e., have two

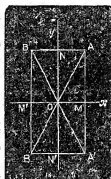


Fig. 35

Fresnel's
waves.Conic
refrac-
tion.Double
refrac-
tion
dup-
to stress

equally important axes inclined to each other at angles of all values from 0° to 90° . The form of the *wave-surface* in such bodies was, at least very approximately, assigned by Fresnel. This forms one of the most brilliant of his many grand discoveries, and it led to Hamilton's prediction of the existence of the two species of *conical refraction*, which was experimentally verified by Lloyd.

Fresnel also made the striking discovery that glass and other simply refracting bodies are rendered doubly refracting when in a state of strain. To this Brewster added the observation that the requisite strain might be produced by unequal heating instead of by mechanical stress, and also that unannealed glass is usually doubly refractive. Clerk Maxwell in 1873 (*Proc. Roy. Soc.*) showed that shearing stress in viscous liquids, such as Canada balsam, renders them temporarily doubly-refractive. This subject has been elaborately investigated by Kundt (*Pogg. Ann.*, 1879).

The details of these subjects, with those of the polarization of light reflected from small particles, the *rotatory polarization* produced by quartz, sugar, transparent bodies under the influence of magnetism, &c., must be deferred to OPTICS (PHYSICAL).

There is, however, one elementary point which must not be omitted here, as it is intimately connected with the wave-theory,—that is, the alteration which light undergoes in consequence of the relative motion of the source and spectator in the line of vision.

Doppler's
principle.

When a steamer is moving in a direction perpendicular to the crests of the waves, she will encounter more of them in a given time if her course is towards them than if she were at rest, while, if she be moving in the same direction as the waves, fewer of them will overtake her in a given time than if she were at rest. The same thing is true of sound-waves. When an express train passes a level crossing at full speed, the pitch of the steam whistle is higher during

the approach and lower during the recess from the listener at the gate than it would be if the engine were at rest. The successive sound-pulses are emitted at the same intervals as before, but from points successively nearer to or farther from the listener. Hence more or fewer reach his ear in a given time. The principle is precisely the same as that of Rømer's observation of the frequency of eclipse of Jupiter's satellites, which we have already given—the number of light-waves which reach the eye per second is increased if the source is approaching, and diminished if it be receding. We are now dealing with a phenomenon which occurs some 600,000,000,000,000 times per second instead of once every forty-two hours. Now, increased wave-frequency, with unaltered velocity of light, certainly implies shorter wave-length and most probably greater refrangibility, and *vice versa*. There is, undoubtedly, a weak link in this reasoning, due to our ignorance of the true nature of the luminiferous medium and of the species of vibration on which light depends. If we knew something definite about the nature of the ether, and the mechanism of its vibrations, this weakness would be at least in part got rid of. Observation has not yet settled the question of the relative motion of bodies, the ether they contain, and the ether in free space.

This principle has been applied with success by Huggins and others to find the rate at which we are approaching to or receding from different fixed stars, and the rate of motion in solar cyclones; and it may even be applied, as was ingeniously suggested by Fox Talbot (*B. A. Report*, 1871), to determine (from the relative velocities of the components of a double star in the line of sight, measured by its aid) the distance of the star itself from our system.

The reader is advised to consult, in connexion with the whole of the second part of this article, the previous article *ETHER*. (P. a. z.)

LIGHTFOOT, JOSEPH (1802-1875), an eminent rabbinical scholar, was the son of Thomas Lightfoot, vicar of Uttoxeter, Staffordshire, and was born at Stoke-upon-Trent in that county, on March 29, 1802. His school education was received at Morton Green near Congleton, Cheshire, and in June 1817 he entered Christ's College, Cambridge, where he made great progress in Latin and Greek, and was reckoned the best orator among the undergraduates. After taking his bachelor's degree, he became for some time assistant master at Repton in Derbyshire, at the canonical age he received ordination, and shortly afterwards was appointed curate of Norton-under-Hale in Shropshire. There he attracted the notice of Sir Rowland Cotton, an amateur Hebraist of some attainments it would seem, who made him his domestic chaplain at Belleport, and was the first to awaken his taste for rabbinical learning. Shortly after the removal of Sir Rowland with his family to London, Lightfoot followed him thither, but for some unexplained reason soon left the capital again, and, visiting his parents at Uttoxeter, took a solemn leave of them, having resolved "to travel beyond the seas." An unexpected and pressing invitation induced him to change his determination, and to accept a charge at Stone in Staffordshire, where he continued for about two years, and where, on May 21, 1828, he married Joyce, daughter of William Crompton of Stone Park, and widow of George Copwood of Delverne, Staffordshire. From Stone he removed to Hornsey near London, for the sake of the library of St. John College, which he often had occasion to consult; his first published work, entitled *Brubins, or Miscellanies, Christian and Judaical, penned for recreation at vacant hours*, and dedicated to Sir R. Cotton, appeared at London in 1829. During the summer

and autumn of 1830 he lived at Uttoxeter, and in September of that year he was presented by Sir R. Cotton to the rectory of Ashley in Staffordshire, where he continued to discharge his pastoral duties, and to prosecute his rabbinical studies, for the next twelve years. For the more uninterrupted pursuit of the latter he is said to have bought a small piece of land near his personage, and to have built upon it a small house "containing a study and withdrawing room below, and a lodging chamber above." "Here he closely followed his said studies with great delight and unwearied diligence, and did choose to lodge here very often, though it were so near to his family and personage house." In June 1842 he left Ashley for London; the precise occasion of the removal is not known, but probably it arose out of the necessity for personal superintendence of the publication of his next work, *A few and new Observations upon the Book of Genesis: the most of them certain; the rest, probable; all, harmless, strange, and rarely heard of before*, which appeared at London in that year with a dedication to "my dear and loving countrymen of the county of Stafford, and other my friends residing in the city of London." Soon after his arrival in the capital he became minister of St Bartholomew's church, near the Exchange; and in 1843 he was appointed to preach the sermon before the House of Commons on occasion of the public fast of March 29. It was afterwards published under the title of *Elihu Redivivus*, the text being Luke i. 17; in it a parallel is drawn between the Baptist's ministry and the work of reformation which in the preacher's judgment was incumbent on the parliament of his own day. Lightfoot was also one of the original members of the Westminster Assembly, which held its first formal meet-

ing on Saturday, July 1, 1643; his "Journal of the Proceedings of the Assembly of Divines from January 1, 1643 to December 31, 1644," now printed in the thirteenth volume of the 8vo edition of his *Works*, is a valuable historical source for the too brief period to which it relates. He was assiduous in his attendance from the first, and, though frequently standing almost or even quite alone, especially in the Erastian controversy, exercised a material influence on the result of the discussions of the Assembly. In 1643 Lightfoot published *A Handful of Gleanings out of the Book of Exodus*, dedicated to the inhabitants of Bartholomew Exchange, and in the same year he was made master of Catherine Hall by the parliamentary visitors of Cambridge, and also, on the recommendation of the Assembly, was promoted to the rectory of Much Munden in Hertfordshire; both appointments he retained until his death. In 1644 was published in London the first instalment of the laborious but never completed work of which the full title runs *The Harmony of the Four Evangelists among themselves, and with the Old Testament, with an explanation of the chief difficulties both in Language and Sense: Part I. From the beginning of the Gospels to the Baptism of our Saviour*. The second part *From the Baptism of our Saviour to the first Passover* after followed in 1647, and the third *From the first Passover after our Saviour's Baptism to the second* in 1650. On August 26, 1646, he again had the honour of preaching before the House of Commons on the day of their monthly fast; in the discourse, which was afterwards published (*A Fast Sermon*, on Rev. xx. 1, 2), after outcountering as erroneous and false the doctrine of the Millenaries, he goes on to urge upon the parliament various practical suggestions for the repression with a strong hand of current blasphemies ("I do hold it a truer point in divinity that 'erroneous conscientia liganda' than 'ligat'"), for a thorough revision of the authorized version of the Scriptures, for the encouragement of a learned ministry, and for a speedy settlement of the church. "I rejoice to see what you have done in platforming classes and presbyteries, and I verily and cordially believe it is according to the pattern in the mount." In the same year appeared *A Commentary upon*

the Acts of the Apostles, chronological and critical, the Difficulties of the text explained, and the times of the Story cast into annals. From the beginning of the Book to the end of the Twelfth Chapter. With a brief survey of the contemporary Story of the Jews and Romans (down to the third year of Claudius), and in 1647 he published *The Harmony, Chronicle, and Order of the Old Testament*, which was followed in 1655 by *The Harmony, Chronicle, and Order of the New Testament*, inscribed to Cromwell, with an epistle dedicatory to his highness's honourable council. In the last-named year Lightfoot, who in 1652 had commenced doctor of divinity, was chosen vice-chancellor of the university of Cambridge, but continued to reside by preference at Munden, in the rectory of which, as well as in the mastership of Catherine Hall, he was confirmed, through the influence of friends, at the Restoration. The remainder of his life was principally devoted to the production of the work by which his name now chiefly lives, the *Horæ Hebrææ et Talmudicæ*, in which the volume relating to Matthew appeared in 1658, that relating to Mark in 1663, and those relating to 1 Corinthians, John, and Luke, in 1664, 1671, and 1674 respectively. Towards the close of 1675, while travelling from Cambridge to Ely (where he had been collated by Sir Orlando Bridgman to a prebendal stall), he caught a severe cold, upon which, by an indiscretion in diet it is said, fever supervened; falling afterwards into a lethargy which continued for about a fortnight, he died at Ely on December 6, 1675. The *Horæ Hebrææ et Talmudicæ impensæ in Acta Apostolorum et in Ep. S. Pauli ad Romanos* were published posthumously.

The *Works of Lightfoot* were first edited, in 2 vols fol., by Bright and Strype in 1844; the *Opera Omnia, cura Tassinii*, appeared at Rotterdam in 1856 (2 vols fol.), and again, edited by Leiden, at Frankfurt in 1869 (3 vols fol.). A volume, *Remarques* was published at London in 1700. The *Hor. Hebr. et Talm.* were also edited in Latin by Carpov (Leipzig, 1675-76), and again, in English, by Gandell (Oxford, 1859). The most complete edition is that of the *Whole Works*, in 18 vols 8vo, edited by Pitman (London, 1828-30). It includes, besides the works already noticed, numerous sermons, letters, and miscellaneous writings; and also *The Temple, especially as it stood in the Days of our Saviour* (London, 1650).

L I G H T H O U S E

I. LIGHTHOUSE CONSTRUCTION.

THE primary and most important consideration relating to the design and construction of a lighthouse tower which is to be built within the tide mark is the force of the waves which may be expected to assail it, and the directions and heights at which that force will act on the building. The great waves which are found in the open ocean cannot be generated in smaller seas, and, with a due regard to economy in construction, ought not therefore to be provided against. What is wanted is to ascertain in such shorter seas the height of waves in relation to the length of "fetch" in which they are generated, and next to determine their energy when on reaching the shore or a sunken rock, and so ceasing to be waves of oscillation, they enormously increase their destructive force by becoming waves of translation. Full information as to these points and as to the marine dynamometer—an instrument used for ascertaining the force of the waves on an exposed surface—will be found in the article *HARBOURS*, to which the reader is referred. It is enough here to state that the law of increase in the height of waves was found by Mr T. Stevenson to be proportional to the square root of the distance from the windward shore, and that the greatest force recorded on rocks exposed to the ocean was $3\frac{1}{2}$ tons per square foot. The relative forces of summer

and winter gales were found to be as 1 to 3, and the vertical force, after acting on a curved sea wall, was eighty-four times greater than the horizontal force at a height of 23 feet above high water.

The history of the ancient lighthouses is of so scanty a nature that we may pass at once to more modern works, commencing with Winstanley's Eddystone Light.

Winstanley's Eddystone Light.—The Eddystone Rocks, which lie about 14 miles off Plymouth, are fully exposed to the south-western seas. The lighthouse was completed by Winstanley in four seasons. In 1698 it was finished at a height of 80 feet and the light exhibited; but in 1699, in consequence of damage by storms, the tower was increased by an outer ring of masonry 4 feet thick, and made solid from the foundation to nearly 20 feet above the rock. The height was increased to nearly 120 feet, and completed in 1700. During the well-known hurricane of 20th November 1703 the tower was destroyed. In general design as well as in details this work must be placed among the *vetanda* of maritime engineering. For example, in plan it was polygonal instead of circular. In his blind devotion to ornamentation Winstanley profaned throughout the principles of uniformity of outer profile so as to present great obstructions to the action of the waves.

Radyer's Eddystone Tower.—This work was commenced

in 1706 and completed in 1709, in the form of a frustum of a cone 92 feet high. The work consisted principally of timber, the lower part being oak carefully bolted together, and also to the rock. Above the lower structure of oak courses of stone, clamped together and fixed to the timber work and to the rock, were added in order to give weight to the structure. This lighthouse stood for forty-six years, and was destroyed by fire in 1755. In every respect the simplicity of the structure and the judicious character of the details of the design may be regarded as models of engineering. First, it rested upon a stepped level base, was circular in plan, did not wholly depend upon fixtures but upon weight, preserved a uniform external surface devoid of outside projections and ornamentation, and, above all, the engineer did not by splaying out the base needlessly throw away the small diameter which the rock afforded, but with much judgment adopted the conical form.

Smeaton's Eddystone Tower.—This justly celebrated work, which consisted entirely of stone, was commenced in 1750, and the masonry was finished in 1759. Smeaton was the first engineer who adopted a structure of masonry for a sea tower and dovetailed joints for the stones, which averaged a ton in weight. This work cannot be regarded as a safe model for general imitation in exposed situations, and Rudyard's earlier tower was certainly as successful in resisting the forces to which it was exposed. Rudyard unquestionably selected for so small a rock as the Eddystone a preferable form to that adopted by Smeaton. The sharply curved profile in Smeaton's design greatly reduced the diameter of the building at a small height above the rock, and so reduced its strength.



Fig 1

Smeaton's reasoning about the similarity of a tower exposed to the surf and an oak tree resisting the wind was very conclusively shown to be fallacious by the late Mr. Alan Stevenson. The arching of the floors, as shown in fig 1, was also a source of weakness which the introduction of the iron chains, shown black in the diagram, was intended to counteract. Mr. Douglass in 1878 stated that "for several years the safety of the Eddystone had been a matter of anxiety and watchful care to the corporation of the Trinity House, owing to the great tremor of the building with each wave stroke." He also stated that the projecting cornice at the top had been lifted, and that the rock itself had been considerably undermined. A new tower has now (1882) been erected in place of Smeaton's by Mr. Douglass.

Bell Rock Lighthouse Tower.—The Bell Rock, which lies 12 miles off the coast of Forfarshire, is fully exposed to the assaults of the German Ocean. The rock is of considerable extent but of a low level, the tower being covered about 16 feet at high water of spring tides. Mr. R. Stevenson, of Edinburgh, when he first landed on the rock, decided to adopt a stone tower as Smeaton had done at the Eddystone, but he deviated largely from that design in the thickness of the walls,



Fig 2

in raising the tower to 100 feet instead of 68 feet, and the level of the solid to 21 feet above high water instead of 11 feet. Instead of employing arched floors as at the Eddystone, he adopted level stones for the floors which formed part of the outward walls, and were feathered and grooved as in carpentry, besides having dovetailed joggles across the joints where they formed part of the walls. It will be seen on fig. 2 that the floors instead of being sources of weakness, as in Smeaton's tower, were converted into effective bonds tying

the walls together. He also used a temporary beacon or barnack on the rock for the engineer and his workmen to live in while the tower was in progress. The bill introduced into parliament for this work in 1802 was not passed in consequence of financial difficulties. As the Bell Rock was scarcely dry at low water, while the Eddystone was scarcely covered at high water, the commissioners, in order to fortify Mr. Stevenson's views, consulted Mr. Telford, and before going to parliament for the second time they also, on Mr. Stevenson's suggestion, obtained for the scheme the support of Mr. Rennie, with whom he could afterwards advise in case of emergency during the progress of the work. The second bill was passed in 1806, and the works, which were begun in 1807, were finished in 1810, and the light was exhibited in 1811. The total weight of the tower is 2076 tons.

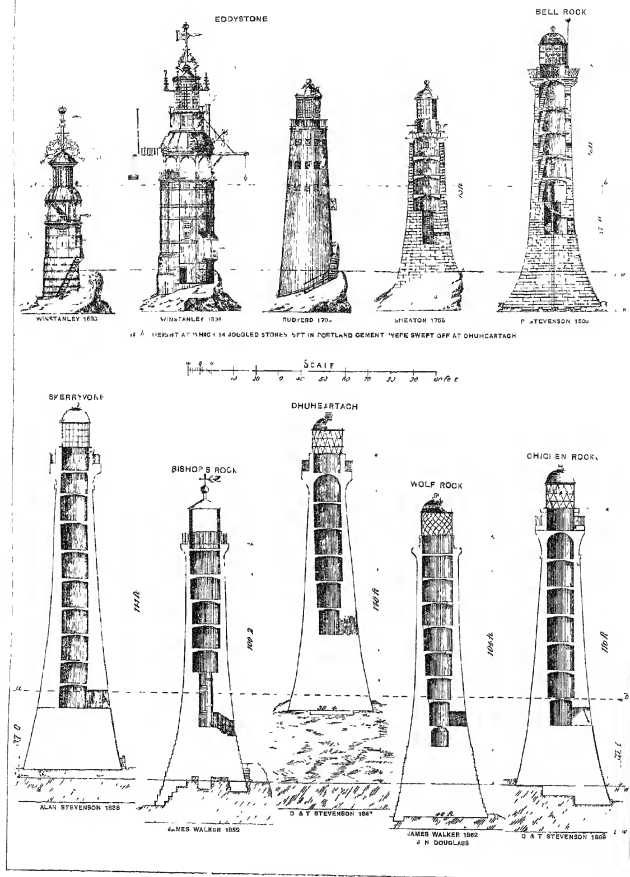
Skerryvore Lighthouse.—The Skerryvore Rocks, 12 miles off the island of Tyree in Argyllshire, which is the nearest land, are wholly open to the Atlantic. The works, designed and carried out by the late Mr. Alan Stevenson, were commenced in 1838 and finished in 1843. The first temporary barnack was destroyed in 1838, and another erected on a more sheltered part of the rock. The tower, which is of a hyperbolic curve, is 138 feet high, 42 diameter at the base, and 16 at the top. Its weight is 4308 tons.

Bishop Rock.—The Bishop Rock, lying off the Scilly Islands, is fully exposed to the Atlantic. It was designed by the late Mr. James Walker, and carried out by Mr. J. N. Dorgless. It is 100 feet above high water, 34 feet in diameter at the base, and 17 at the top. The lowest part of the foundation of tower is covered about 19 feet at high water springs, the solid is 20 feet above high water, where the walls are 9 feet thick, and decrease to 2 feet at the top. Owing to the great tremor in this building, it has lately been found necessary to strengthen it by an internal structure of ironwork.

Wolf Rock.—This much exposed rock is about midway between Scilly and the Lizard Point, and is submerged to the depth of about 2 feet at high water. The first design for a lighthouse was in 1823, by Mr. R. Stevenson, but it was not till 1862 that a lighthouse was commenced under the superintendence of Mr. Douglass, from a design by the late Mr. Walker. It is 116½ feet high, 41 feet 8 inches diameter at the base, decreasing to 17 at the top, and the walls are 7 feet 9½ inches thick, decreasing to 2 feet 3 inches. The shaft is a concave elliptical frustum, and contains 3296 tons. The lower part of the tower has projecting acarcments in order to break up the sea, but, as has been already stated in the case of the Eddystone, such projections are not in accordance with the principle of uniformity of external surface, and are, therefore, more likely to produce disturbance of the masonry than to add to its stability.

Dhu Heartach Rock Lighthouse.—The Dhu Heartach Rock, which is 35 feet above high water, is 14 miles from the island of Mull, which is the nearest shore. The maximum diameter of the tower, which is of parabolic outline, is 36 feet, decreasing to 16 feet; the shaft is solid for 32 feet above the rock, the masonry weighs 3115 tons, of which 1810 are contained in the solid part. The temporary barnack for the workmen was made of malleable iron bars with an iron drum on the top in which the workmen lived. This tower was designed by Messrs D. & T. Stevenson, and occupied six years in erection, the length of the working season being only about two and a half months in each year.

Chickens Rock Lighthouse.—The Chickens Rock lies 1 mile off the Caif of Man. The curve of the tower, which is 123 feet 4 inches high, is hyperbolic, the diameter varying from 12 feet to 16 feet. The tower is submerged 5 feet at



high-water springs. The solid is 32½ feet in height, weighing 2050 tons, the whole weight of the tower being 3557 tons. The walls decrease from 9 feet 3 inches to 2 feet 3 inches in thickness. The work was designed by Messrs D & T Stevenson, and was begun in 1860 and completed in 1874.

Great Basses Lighthouse near Ceylon—Great Basses lighthouse has 6 miles from the nearest land, and was designed by Mr. Deanglass. The tower has a cylindrical base 32 feet in diameter, above which is a tower 67 feet 5 inches high and 93 feet in diameter. The walls vary in thickness from 5 feet to 2 feet. The tower, including the base, contains about 2768 tons, and the work was finished in three years.

There are several other lighthouses in Ireland, India, and America which merit more attention than our space admits of, and we shall therefore conclude with directing the attention of the engineer to the important influence of the configuration of rocks in modifying the breaking of waves. It cannot but excite surprise that some of the structures which were erected on the Eddystone should have withstood the waves so long as they did. This fact seems to lead to the conclusion that the Eddystone Rock, at one time at least, acted to some extent as a shelter to the structures which were built on it. During a summer gale when Dhu Heantach lighthouse was being erected fourteen stones each of 2 tons weight, which had been fixed on the tower by joggles and Portland cement at the level of 37 feet above high water, were torn out and swept off into deep water, as shown on Plate VII. At the Bell Rock stones of 2 tons weight were several times swept away during the construction of the tower, while it is a remarkable fact that no stones were ever moved at the Eddystone. But what is more striking, the thin glass panes of Winstanley's first tower stood successfully through a whole winter's storms at the same level above the water as that at which the fourteen heavy blocks were swept away at Dhu Heantach, while it was found necessary from the experience acquired when constructing the lighthouse to raise the solid base of the tower to nearly the same height above the water as the glass panes in Smeaton's tower, which have hardly ever been broken during the storms of more than a hundred years.

The conclusion then which seems fairly deducible from these facts is that the level of the plane of dangerous impact of the waves above high water depends upon the relation subsisting between their height and the configuration of the rocks above and below high water, as well as perhaps on the configuration of the bottom of the sea near the lighthouse. Thus, while the rock at Dhu Heantach, from its height above high water, forms a great protection against the smaller class of waves, it operates as a dangerous conductor to the largest waves, enabling them to exert a powerful horizontal force at a much higher level than they would had the rock been lower. The lighthouse engineer must therefore beware of taking it for granted that Smeaton's Eddystone tower is a model for general imitation, and must carefully consider as best he can in what way the configuration of the rock may affect the stability of the tower which he has to design. Unfortunately in the present state of our information no specific directions can be laid down for his guidance in this matter, but the following general rules of construction may be given.—

(1) The tower should have a low centre of gravity and sufficient mass to prevent its being upset by the waves. (2) It should be throughout regular in the horizontal plane, and either straight or continuously curved in the vertical plane, so as to present no abrupt change of outline which would check the free ascent of the rising waves, or the free descent of the falling waves, or the free vent of those passing round the tower. All external ornaments in the vertical plane, or polygonal outline in the horizontal plane,

are therefore objectionable. (3) Its height, *ceteris paribus*, should be determined by the distance at which the light requires to be seen by the sailor. The rule for determining this height will be afterwards given. (4) Where the rock is soft, or consists of ledges which are easily torn up, the tower should spring from the foundation-course at a low angle with the surface of the rock, so as to prevent its being broken up by reaction of the waves from the building, or, in other words, the tower must have a curved profile. But special care should be taken to sink the foundation-course below the surface of the rock, as the superimposed weight decreases with the sine of the angle of inclination of the wall. If the rock overhangs, owing to the wearing action of the waves, the tower should, if possible, be built at a distance from the place where this dangerous action is in progress. (5) Where the rock is hard and of ample area, the tower may be of such a curved form as will best suit the economic arrangement of the masonry, so as to avoid an unnecessary thickness of the upper walls. (6) When the rock is hard, but of small dimensions, the diameter above the base should not be suddenly reduced by adopting a curved profile, but a conical outline should be adopted, and if the rock be hard, but of yet smaller dimensions, a cylindrical form of greater height should be adopted so as to thicken the walls, and to increase the weight and therefore increase the friction, which is directly proportional to the weight of the blocks of masonry. In all cases where the rock is small the thickness of the walls should be decreased by steps or saucerments *ceteris paribus*, but never *extremely*. (7) The level of the top of the solid part of the tower, and the thickness of the walls above it, should, in different towers having the same exposure, be determined in each case by the level and configuration of the rock and of the bottom of the sea. (8) The best position for the tower is not necessarily the highest part of the rock. It should, in each case, be selected so as to secure the greatest protection in the direction of the maximum fetch and deepest water near the reef. (9) The tower should not, if possible, be erected across any chasm which divides the rock, or in the direction of any gully which projects into it, especially if it be of converging form, which would concentrate wave action. (10) No permanent fixture of the tower to the rock is required for increasing the stability of the structure. The foundation-course (unless where a curved profile is adopted) becomes, indeed, in the end the most stable of all, because it has the greatest weight above it, to keep it in its place. (11) The stones should, however, be sufficiently connected together and fixed to the rock, in order to prevent their being washed away during the construction of the work, when they have no superimposed weight to keep them in their beds. (12) The tower should rest on a truly level base, or on level steps cut in the rock. (13) The pressure of all the materials within the tower should act vertically, so as not to produce a resolved force acting laterally as an outward thrust. (14) The tower should be of such height and diameter, with walls of such thickness, as to prevent the masonry being disturbed by the impact of the waves. (15) The entrance door should be placed on that side of the tower where the length of fetch is shortest, or where from the configuration of the reef and the depth of water, the force of the waves is least. This was determined at the Bell Rock by the distribution of the *fucos* which grew on the lower parts of the tower during the first winter, the vegetation being least where the waves were heaviest. (16) The materials should be of the highest specific gravity that can be readily obtained, and, in some special cases, lead, or dove-tailed blocks of cast iron set in cement, might perhaps be employed.

Plate VII. shows sections on the same scale of a number of the more remarkable lighthouse towers.

Fig. 3 shows an iron pile light erected at Hameda, in the Bay of Yedo, Japan.

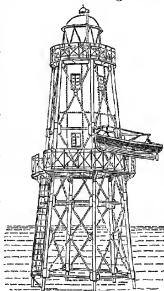


Fig. 3

Modes of Uniting the Stones and Courses of Masonry.—Fig. 4 (p. 618) shows the mode of combining the stones during construction at different lighthouses in the United Kingdom and in America.

II LIGHTHOUSE ILLUMINATION

What is required of every lighthouse apparatus is either the equal distribution of the rays constantly or periodically over the whole horizon, or else their unequal distribution over certain azimuths only.

The first of these two cases, viz., the equal distribution of the light, will be best understood by explaining the different manner in which the rays are operated on by the apparatus for a fixed light and by that for a revolving light. The characteristic of a *fixed* light, which is that of being seen constantly and always of the same power round the whole horizon, might no doubt be perfectly produced by a naked flame without any apparatus, but then all the rays which did not fall on the navigable track of shipping would be lost to the sailor. In order then to intercept and utilize those rays which, instead of falling on this navigable track, would either go upwards to the sky or downwards on the shore close to the lighthouse tower, and on that part of the sea which is very near the shore, we must have recourse to optical agents both for bending down the rays which naturally point too high, and for bending up those which point too low. It thus appears that the apparatus for a fixed light should bend the rays in the vertical plane only, but should not interfere with their natural horizontal divergence in azimuth.

The demands which are made on a light that has to *revolve* are not nearly so great as on one that is fixed, for the revolving light does not, like the fixed, require to illuminate the whole horizon simultaneously, but only each point of it at successive intervals of time. When the dark intervals occur, the rays from the flame which are then pointing in the direction of the dark spaces should therefore have their directions so altered laterally as to pass into the adjoining light spaces and thus to increase the power of the luminous flashes. A revolving light, though supplied by a flame of the same power as a fixed, will thus necessarily be far more intense, as it does not lose its power by diffusing the rays constantly over the whole horizon, but gathers them up into a number of separate bundles or beams of great intensity. The apparatus of a revolving light has consequently more optical work to do than that of a fixed, for the rays must be bent not only in the vertical plane but laterally in the horizontal and in all intermediate planes as well.

In the construction of lighthouse apparatus either metallic or glass agents may be employed, but it has been found by experiments that a great saving of light (about 25 per cent.) is effected when glass only is used. All kinds of apparatus may conveniently be ranged either under the *catoptric system*, where metallic reflexion only is used, the *dioptric* where the material employed is wholly glass producing refraction and total reflexion, or the *catadioptric*, in which both glass and metal are employed.

CATOPTRIC SYSTEM of Illuminating every Azimuth with Light of equal Power either Constantly or Periodically

Passing over the early and rude expedients of such night marks Catoptric as open coal fires or naked candles placed in glazed lanterns, we system shall confine our attention to the gradual development of those optical designs

which are now or were lately adopted for lighthouse apparatus.

Parabolic Reflectors — In 1763, or at latest before 1777, parabolic reflectors were first used for lighthouse illumination by Mr

Hutchinson, dockmaster of Liverpool. In his work on *Practical Seamanship*, published in 1777, he states that the Merser lights were fitted with reflectors (figs 5 and 6) formed of small facets of silvered

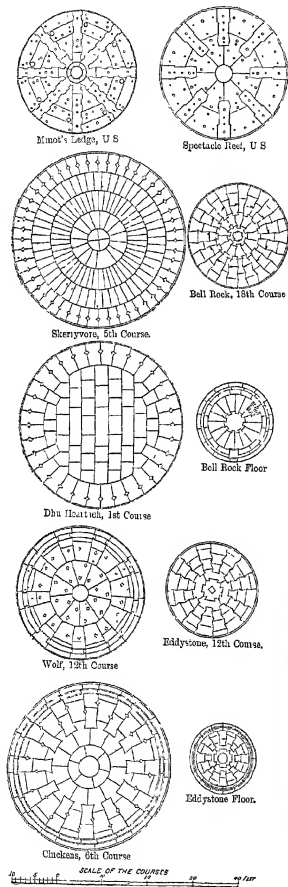


FIG. 4.—Courses of various Lighthouse Towers.

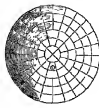


Fig 5



Fig 6.

Parabolic reflectors

glass, and made, as Descartes nearly as they can be to the parabolic curve." This is unquestionably the earliest published notice of the use of parabolic reflectors for lighthouse illumination. Up to 1782 the wicks of the lamps were of a flat form, but in that year Augustin Imhof made wicks and burners of a hollow cylindrical form which admitted a central current of air through the burner, so as to ignite the cone of gas issuing from the wick both within and without. Rumford afterwards split up the cone of gas into several concentric shells.

"It is remarkable," says Mr J. T. Chance in his excellent memoir (*Atlas des Grands Eclairages*, vol. xvi.), "how many inventors have contemplated this respective parts to the multiple burner. — Augustin, the double current, Lange, the impenetrable contraction of the glass chimney; Carrel, the mechanism for an abundant supply of oil, and Count Rumford, the multiple burner, an idea made feasible by these contrivances, and finally realized by Augustin Fresnel."

Optical Properties of the Parabolic Reflector.—In the parabolic reflector all rays diverging strictly from the focus and falling on the paraboloid emerge in one beam of parallel rays. But as an oil light is not a mathematical point, but an object of considerable magnitude, the rays from the outside of the flame being evocal will, after reflection, emerge as a cone whose divergence is directly proportional to the radius of the flange and inversely to the focal distance of the reflector. Its intensity must consequently vary as the squares of the distances from the lighthouse. Optical sympathies does not then prevent that divergence which is due to the flame being of sensible magnitude.

Defects of the Paraboloid.—It will be seen from fig. 7 that the paraboloid mirror is at best but a very imperfect instrument, for even if the reflector was strictly a mathematical point, the cone of rays (shown undotted) escaping past the lips of the mirror must be lost.

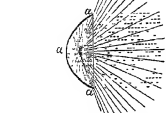


FIG. 7—Vertical Section



FIG. 8—Plan

Mode of Employing Reflectors for Fixed and Revolving Lights.—In order to produce, on the optotype system, a fixed light showing all round the circle, a number of reflectors (a, a, a , fig. 8) are fixed round the outside of a stationary chandelier c . As the ordinary paraboloid has about $1\frac{1}{2}^\circ$ of divergence, twenty-five reflectors were needed to light up continuously (though not equally) the whole horizon. If again the light was to revolve, then a revolving chandelier (figs 9 and 10) was employed having a certain number of flat faces, on each of which was fixed a number of separate lamps and reflectors with their axes parallel to each other. When the chandelier revolved, and one of the flat sides was turned towards the sailor, he would, when at some distance from the shore, receive a flash at once from each of the mirrors which were on that face, but when the face was turned away from him a dark period would intervene until the next face came round again.

Bartholomew's Fixed Sideral, 1810.—In order strictly to equalize a fixed light over the whole horizon, which could not possibly be done with separate reflectors, Malet proposed this ingenious instrument, which is governed by the revolution of the parabolic profile pp' (fig. 11) round its parameter as a vertical axis, instead of round a horizontal axis, as in all former reflectors. The vertices of the parabola are cut off, so as to permit of a common focus for the flame.

The rays will therefore be reflected parallel to the horizontal axis in the vertical plane, while the natural divergence of the light in azimuth will not be interfered with. By this excellent contrivance the light was for the first time spread equally round the horizon in one continuous zone. But even though the reflectors were reduced to a mathematical point, very

many of the rays (shown in hard lines in the elevation, fig. 11) are allowed to escape past the lips of the reflector, and thus less takes place all round the circle.

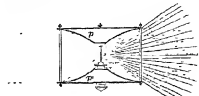


FIG. 11

DIOPTRIC SYSTEM

Beginning in 1822, Augustin Fresnel, the eminent physicist and Dioptric mathematician, entirely revolutionized the previously existing light-system house system by means of his annular lenses, cylindrical reflectors, and totally reflecting prisms. Before describing these and their combinations it is necessary to state that the size of the flame produces divergence with lenses as well as with reflectors. The measure of this divergence for any point of the lens is the angle whose sine is

$$\frac{\text{Radius of flame}}{\text{Distance of point from centre of flame}}$$

Fresnel's Optical Aspects

Annular Lens, 1748-1822.—Buffon in 1748 suggested a new form of Fresnel's lens for burning purposes in order to save the loss of heat by annular absorption of the sun's rays in passing through a thick lens of large lens size whose outer periphery is continuously spheroidal. He proposed to grind out of a solid piece of glass a lens in steps or concentric rings in order to reduce the thickness to a minimum (figs 12 and 13). Condacnet, in his *Eloge de Buffon*, in 1778 (Paris edition, 1804, p. 85) proposed the capital improvement of building up Buffon's stepped lens in separate rings, and pointed out that the cutting of the surface into steps had the effect of converting to a large extent the spherical aberration, or divergence from the parallel, of the rays emitted by any continuously spheroidal lens. Sir D. Brewster, in 1811, also described the same plan. But both these writers suggested thin lenses for burning purposes only, and not for operating on light, while all the surfaces of their lenses were spheroidal. In 1822 Fresnel constructed a built-up lens for lighthouse purposes, in which the centres of curvature of the different rings receded from the axis according to their distance from the centre, so as practically to eliminate spherical aberration, the only spherical surface left being the small central part a (fig. 13). These lenses are used for revolving lights only.

Cylindrical Refractor.—This instrument was introduced by Fresnel Cylindrical for effecting dioptrically by refraction in front of the flame what reflectors

had been done before optically by Malet's reflector by reflection from behind the flame. It consisted of a zone or hoop of glass (figs 14 and 15) generated by the revolution round a vertical axis of the middle section of the annular lens just described, which lens, on the other hand, being generated by the same profile round a horizontal axis parallelled the rays in every plane, whereas the cylindric refractor does so in the vertical plane only.

Totally Reflecting Prisms.—Fresnel next conceived the admirable improvement of employing the principle of "total" or internal reflection by glass prisms. The rays Pa (fig. 16) falling on a prismatical ring, ABC , is refracted and bent in the direction aB , and falling on the side AG , at an angle of incidence greater than the critical, is totally reflected in the direction Ra , and, impinging on the side BC at c , it undergoes a second refraction, and emerges horizontally. The highest ray Pa after refraction by AB and reflection by AG must (in order to avoid superfluous glass) pass

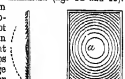


FIG. 12—Elevation



FIG. 13—Plan



FIG. 14—Elevation

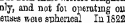


FIG. 15—Plan

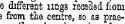


FIG. 16—Vertical Section

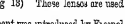


FIG. 17—Plan

along AB, and after a second refraction at B emerge horizontally. The lowest ray EB after refraction by AB must, for like reason, pass along BC, and after reflection by AC and a second refraction by BC either ray incident on the prisms between A and B, after one reflection and two refractions, emitted horizontally.

Straight Refracting Prism—

Fresnel's straight refracting prism which refracts the rays that fall on it, but in one place only, requires no further explanation, as it is simply a straight prism of the same horizontal cross section as one of the prisms of his cylindrical refractor, so as when placed in front of his fixed apparatus to produce a beam of parallel rays like a lens.

Great Circular Lamp—We will now go on to describe the manner in which Fresnel united the four new optical agents which he originated, by first referring to his central burner system. In all lighthouses prior to 1822 the mode of getting up the required power was by employing a sufficient number of separate reflectors, each of which (unless we except Bonaparte's reflector) required its own separate lamp. Instead of numerous independent lamps and reflectors, Fresnel used a single lamp which had four concentric wicks, and was fed with oil by a pump worked by clock work. Surrounding this lamp was a stationary cylindrical reflector for a fixed light, and annular lenses revolving outside of it for a revolving light.

Fresnel's Combination of his Optical Agents

Catadioptric Fixed Light—This apparatus (figs 17 and 18), in which a central burner is used, consists of a dioptric cylindrical refractor with zones of silvered mirrors above and below similar in profile to Bonaparte's reflector. By the adoption of the

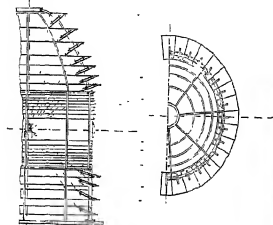


Fig. 17—Section

Fig. 18—Plan

reflector the whole of the wasteful divergence which occurs in Bonaparte's reflector is prevented. We have here a geometrically perfect combination, but it is not so physically, because metallic reflection is used. This physical defect Fresnel obviated in his next design.

Dioptric Fixed Light—First Application of Total Reflection to Fixed Lights—In this apparatus Fresnel substituted his totally

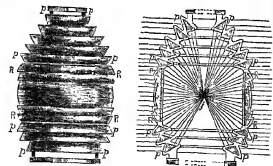


Fig. 19—Elevation

Fig. 20—Vertical Section

reflecting prism *p* and lens *r* for Bonaparte's reflector, and thus distributed the whole light equally over the horizon by means of dioptric agents alone. This was the first application of total

reflection to lighthouse apparatus, and this beautiful instrument continues to tell now in universal use. Figs 19 and 20 represent an elevation and section of this apparatus.

Fresnel's Revolving Light—In this form of revolving light (fig. Revoly 21) the central burner is surrounded by annular lenses *L*, and ing light,

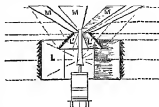


Fig. 21—Vertical Section

on account of the employment of metallic reflection, and because two agents are employed for all except the central portion of the rays. *Fixed Light varied by Flashes*—This distinction (figs 22 and 23) Fresnel produced by placing his straight refracting prisms *p* on a revolving frame outside of his fixed light apparatus, so that when the upright prisms come in line with the observer the light is increased to the power of the revolving light, a broad flash *as* in the annular lens being placed in place of a narrow strip of rays as in the unsilvered fixed light.

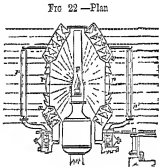


Fig. 22—Plan

Fig. 23—Vertical Section

Alan Stevenson's Improvements

Mr Stevenson was the first to introduce the dioptric system into Alan Butan, and in doing so he made the following improvements. *Stevenson's Refractor of a Truly Cylindrical Form*—Owing to difficulties soon's in construction, Fresnel adopted a polygonal instead of a cylindrical preform for his refractor, but Mr Stevenson succeeded in getting Messrs. Messrs. Cookson of Newcastle to construct a flat order refractor of a truly cylindrical form.

2. Helical Glass Joints for Fixed Lights—Mr Stevenson further improved the apparatus by constructing the refractor in a rhomboidal method of rectangular pieces (figs 24 and 25), thus producing helical joints and preventing serious obscuration of the light in any azimuth.

3. Helical Metallic Framework—The internal metallic frame work for supporting the upper cupola of prisms was also, for the same reason, made by him of a helical form.

4. Diagonal Framed Lantern—The astragals or sash bars of the lantern were likewise made diagonal and constructed of brass instead of iron in order to reduce their sectional area. A small harbor light with inclined astragals was made in 1836 by Mr E. Sang. Mr Stevenson also prepared a design in 1846 for Start Point, Orkney, in which he extended the helical arrangement to the astragals, but it was never carried out. Mr Douglas independently designed and afterwards carried into practice this form of lantern.

Alan Stevenson's Improved Revolving Light for Skerryvore—In 1835 Mr Stevenson, in a report to the Northern Lighthouse Board, proposed to add fixed reflecting prisms *p* (fig. 26) below the lenses of Fresnel's revolving light, and he communicated this proposal to M. L. Fresnel, who approved of his suggestion, and

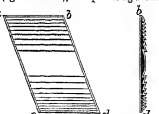


Fig. 24—Elevation

Fig. 25—Vertical Section

assisted in carrying out the design in 1849. This combination added, however, but little to the power of the flash, and produced both a periodically flashing and constantly fixed light, but it must be remembered that the prism for fixed lights was the only kind of reflecting prism then known. The combination of trapezoidal lenses and mirrors was also, for the same reason, still used. The prisms for Stearns were the first that were made of the large size (first order), and were constructed by M. Solin at Paris under the superintendence of Leonor Fresnel, the successor of his brother Augustin, then deceased.

Besides the designs which have been described for improving Fresnel's revolving light, there were many others, among which may be mentioned those of Leonor Fresnel, Sir David Brewster, W. H. Barlow, F. R. S., A. Gordon, Lepaute, Lescoum, Reynaud, and Taboret, but in all these, as well as in those which have been described, the rays were either not parallelized in every plane or else unnecessary agents were resorted to for that purpose.

T. Stearns's Holohedral System

It was not till 1849-50 that the problem was first solved of condensing the whole sphere of rays diverging from a flame into a single beam of parallel rays without any unnecessary reflections or refractions.

Catadioptric Holohedra.—In Figs 27 and 28 part of the anterior hemisphere of rays is intercepted and at once parallelized by the

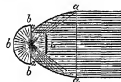


Fig. 27—Vertical Section



Fig. 28—Front Elevation.

lens L, whose principal focus (f , for parallel rays) is in the centre of the flame, while the remainder is intercepted and made parallel by the paraboloid a , and thus the double agents in Fresnel's design are dispensed with. The rays of the posterior hemisphere are reflected by the spherical mirror d back again through the focus, whence passing onwards one portion of them falls on the lens and the rest on the paraboloid, so as finally to emerge in union with and parallel to the front rays. This was the first instrument which intercepted and parallelized all the rays proceeding from a focal point by the minimum number of agents. It is therefore geometrically perfect, and was called by Mr. Stearns a holohedra, but it is not physically so, for it employs installa reflexion, and with an ordinary oil flame and burner some of the rays reflected by the spherical mirror would fall upon the burner and be lost. This instrument was first employed at the North Harbour of Portland in 1849.

Holohedral Catadioptric Apparatus Revolving round a Central Flame.—If in place of Fresnel's compound arrangement of trapezoidal lenses and plane mirrors there are substituted mirrors B, B' (fig. 29) generated by the revolution of a parabolic profile round a horizontal axis, all the light will be at once sent out in parallel beams by them and the lenses L, and the apparatus is therefore geometrically perfect, but metallic instead of glass agents are still employed.

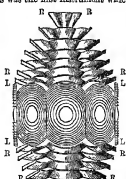


Fig. 29.—Vertical Section

T. Stearns's Holohedral Dioptric Agents

The agents for revolving the holohedra purely dioptric fall next to be described.

Holohedral Prisms, 1850.—If prisms are generated by the revolution of sections of Fresnel's prisms round a horizontal instead of a vertical axis, as shown in fig. 30, rays incident upon them will be made parallel in every plane instead of in the vertical plane only as in Fresnel's prisms.

In 1850 it was stated that A. Fresnel, in 1828, tried prisms of this kind on lamp-posts for the quays of a canal in Paris, but their use was discontinued. They were not so arranged as to be applicable to lighthouses, and no account of them was published.

Double Reflecting Prisms giving Two Internal Reflections instead of One, 1850.—The object of these prisms is to reflect the rays back through the focus. The rays from f (fig. 31) pass normally through



Fig. 31—Vertical Section

the surface bc and fall upon the surfaces ab , ac , by which they are totally reflected and sent back to the flame.

Optical Combinations of Dioptric Holohedral Agents

Dioptric Holohedra with Dioptric Spherical Mirror.—If rings of Dioptric holohedral prisms p , p (fig. 32), combined with a central refracting holohedral lens L, subtending together 180° , be placed before a flame, the whole width of the front half of the diverging sphere of rays will be at once mirror condensed by refraction and total reflexion into one beam of parallel rays. Next, if there be placed behind the flame a dome of glass a formed of zones generated by the revolution of the cross-section of the double reflecting prisms round a horizontal axis, the back hemisphere of rays will, after the double reflexion, be returned by it through the flame so as to diverge along with the front rays; for this dome is a perfect mirror, not only for the faint light that is superfluously reflected by the first concave surface, but also for the main portion of the rays which enter the substance of the glass and are three totally reflected. Thus the whole light is parallelized entirely by glass agents. This combination should therefore produce the light of maximum intensity, being both geometrically and physically perfect when the radius is a luminous point. Still, some of the rays reflected by the upper and lower parts of the mirror will not clear the burner of an oil light, but falling on it will be lost.

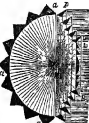


Fig. 32—Vertical Section

Dioptric Holohedral Revolving Light.—Application of Total Revolving Reflexion to Revolving Lighthouses, 1850.—If sections of the front half of light

the dioptric holohedra be arranged as a polygonal cage round a large central flame and made to circulate round that flame, a revolving light with its periodic flashes will be produced (fig. 33), which is characteristically geometrically and physically perfect, and the double agents used in Fresnel's revolving light are thus wholly dispensed with. Mr. J. T. Chance says, "on the whole the modern plan (holohedral) must give light five or six times more intense than that of the former (Fresnel's) arrangement." The greater simplicity and compactness of this light may be seen in comparing figs. 21 or 23 with fig. 33.

The holohedral revolving light is now the only one that is employed for all new lights. It was first introduced in 1850 on the small scale by Messrs. Stevenson at Harburgh Rock, Singapore, and on the larger scale at North Ronaldshay in Orkney, the prisms of which were most successfully made in 1851 by Letourneau of Paris.

Fig. 33—Elevation

Fixed
light
with
dishes

Holophotal Fixed Light erected by Flinders—Flinders' double agents (figs. 21, 22) are here also dispensed with by the single agency of panels of fixed light apparatus p', p' (fig. 34) and cylindrical reflectors L, L , alternating with panels of holophotal apparatus p, p, L, L , both of which revolve together round the central burner.

Back
pans

Back Pans—It will be noticed that, while perfection was attained by single agency in Flinders' fixed apparatus and also in the holophotal revolving apparatus, a physical defect still attached to every form of holophotal which compressed the light into a single beam where the rays require to be sent back through the flame. The defect is not a geometrical one, and would be non-existent were the luminant a mathematical point. In order to remedy this objection, Mr. T. Stevenson and Mr. Diebler designed what they termed "back" pans, capable of directing the rays through an angle of 180° , so that the engine becomes virtually independent of the optical angle.

Professor Swan of St. Andrews also independently proposed the same kind of pans, accompanied by general formulae for its construction. The ray ab (fig. 35) is refracted at b , totally re-

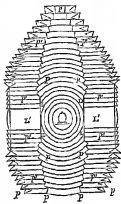


FIG. 34.—Vertical Section



FIG. 35.

fracted at c , and again refracted at d , so as to pass out parallel to the horizontal axis. These pans may be formed by the revolution of the generating section round either a vertical or horizontal axis, or they may be made straight as shown in elevation and section in the diagram.

The "back pans" which were first used in Islay, Argyllshire, were made by Messrs. Chance in accordance with Professor Swan's formula.

Perfect
form of
holo-
photo

Perfect Form of Dioptric Holophote for an Oil Flame—By combining the back pans p, p , (fig. 36) just described with a semi-holophote abc subtending 180° and a portion of the dioptric spherical mirror, no light is lost on the burner, and all the rays are parallelized, so that this apparatus, being all of glass, is both geometrically and physically perfect.

Chance's
improvement

J. T. Chance's Improvement of 1862—Mr. Chance says, "The plan of generating zones round the vertical axis (instead of the horizontal) was introduced by the author, who adopted it in the first

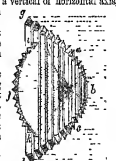


FIG. 36.—Vertical Section

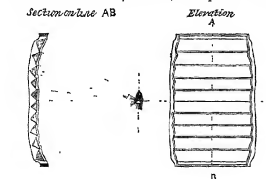


FIG. 37

complete catoptrical mirror which was made and was shown in the exhibition of 1862 by the Commissioners of Northern Lighthouses,

for whom it was constructed, in order to further the re-erecting of what Mr. T. Stevenson had ingeniously suggested about twelve years previously. During the progress of this instrument the idea occurred to the author of separating the zones (fig. 37) and also dividing them into segments like the ordinary reflecting zones of a dioptric light, by this means it became practicable to increase considerably the radius of the mirror and thereby to render it applicable to the largest sea light without overlapping the limits of the angular breadths of the zones, and yet without being compelled to resort to glass of high refractive power."

Mr. Stevenson states (*Mar. Eng.*, vol. xxvi.) that he originally intended to generate the pans round a vertical axis, but adopted the horizontal as more practicable where fine glass which was taken out of the melting pot on the end of a rod had to be employed for the most important and smaller central parts of the apparatus, which at that date were the only ones that could be constructed.

Professor Swan's Designs—Among several ingenious arrangements and new forms of agents proposed by Professor Swan¹ is design

the mode of sending rays from pans through inter-shoes left between other pans placed in front, and also a form of agent which he termed the thesoptric pans, in which the rays would undergo two reflections and three refractions. In fig. 38 a are the front and b the thesoptric pans. The two upper and lower pans a are constructed of flat glass of high refractive power. It will be observed from the drawing that this ingenious arrangement is nevertheless open to objection, for cones of light of 80° in front and of 60° at the back are lost through the substrations.



FIG. 38.—Vertical Section

T. Stevenson's Aximuthal CONDENSING SYSTEM for Distributing the Light Unequally in Different Directions either Continuously or Periodically

PICURUS to 1850 all apparatus was designed to emit light of Condens equal power in every azimuth either constantly or periodically, so that when applied to illuminate sea extending farther in some system directions than in others, such, for example, as long narrow sounds, the power was either needlessly great in some azimuths or not nearly strong enough in others. The only exception was where a tower was placed on a long straight coast, when a spherical mirror was fixed behind the flame to prevent the light passing landward. The light that would have been lost on the land was, in this way, sent seawards, but no attempt was ever made to condense the light over a given arc or to allocate this auxiliary light in proportion to the varying lengths of the different ranges and the amplitudes of the arcs over which it had to be sent, nor where a light had to show all round the horizon, to weaken its intensity in one arc and with the rays so abstracted to strengthen some other arc which from its range being longer ought to be of greater power. As the optical agents which we have described were insufficient for this purpose, it became necessary to devise new agents possessing special optical properties, for distributing the rays not equally but equitably. Some of the more important of these agents and their combinations will be described, but before doing so it is necessary to make some preliminary explanations.

The form of the emergent light from condensing apparatus is neither a solid beam of parallel rays like that from an annular lens nor yet a zone of rays diverging naturally in azimuth all round like that from an ordinary fixed apparatus, but is intermediate between these, being a solid angle or wedge of light strengthened by these rays which would naturally diverge in other directions, but which are diverted and spread over the given sector as shown perspectively in plan in fig. 39, in which L represents the position of the lighthouse, LD'

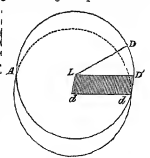


FIG. 39

¹ "Professor Swan's Designs," *Trans. Roy. Soc. of Arts*, 1867-68.

the range, or distance it sea from which the light can be seen, and **DEVELOP** the solid horizontal angle that is to be illuminated and into which all the light DAD' which would naturally diverge over the rest of the circle must be compressed, and over which it must be uniformly spread.

Fixed condensing prisms

Requirements for Fixed Condensing Lights—1. Where a light has to be seen constantly over only one arc of the horizon, the apparatus must compress all the rays within that one arc whatever its amplitude may be, and spread them uniformly over it.

2. Where the whole horizon has to be constantly illuminated, but the light has to be seen at greater distances over some parts of the sea than over others, so much light must be abstracted as can be spared from the shorter ranges and directed to the longer so as to allocate the rays in the compound ratio of the number of degrees and the squares of the distances from which the light has to be seen in each arc, and the light thus diverted from one arc to strengthen another must be spread uniformly over the one that has to be strengthened. By this mode of abstraction and addition there is produced a constant equitable distribution over the whole horizon of all the rays from any single flame. Where the whole horizon has to be lighted, and where more than one arc has to be strengthened, the rays which would be lost on the land or can be spared in some other direction must be directed to and spread uniformly over these arcs in proportion to their amplitudes and ranges.

Revolving condensing lights

Requirements for Revolving Condensing Lights—1. Where a light has to give its flashes periodically over only one arc of the horizon, all the rays must be collected and sent out periodically in solid beams of equal power over that arc.

2. Where the whole horizon has to be periodically illuminated, but where its flashes have to be seen at greater distances over some parts of the sea than over others, the apparatus must be made (as in number 2 of the fixed condensing light) to vary proportionally the power of the flashes whenever they begin to pass over those parts of the sea where the ranges are of different lengths so as to produce an equitable periodic distribution of all the rays.

3. Where the whole horizon has not to be lighted, and where more than one arc has to be strengthened, the rays which would be lost on the land or can be spared in some other direction must be directed to and spread uniformly over these arcs so as to strengthen the flashes in proportion to their amplitudes and ranges.

If a be the number of degrees in an arc to be illuminated, and d the distance in miles to be traversed by the light, then, neglecting atmospheric absorption, the quantity of light to be allocated to that arc will be proportional to ad^2 , but if we take account of atmospheric absorption, supposing g to be the quantity out of a unit of transmitted light which escapes absorption after passing through a mile of air, then the whole light needed by the arc to be illuminated will be proportional to $a \cdot ad^2 \cdot g^d$. Supposing now that L is the whole 360° of available light from the apparatus, the quantity to be apportioned to the given arc will be $mL/2\pi a$, where $2\pi a$ denotes the sum of the several numbers m computed for the respective arcs of the horizon.

The Principal Optical Condensing Agents

Condensing straight prisms

Condensing Straight Prisms—These, either by reflection or refraction at both, cause a ray fr (fig. 40) proceeding in any compass

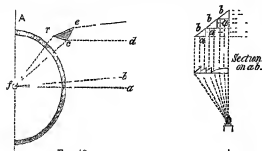


Fig. 40

bearing from a fixed light apparatus AA to emerge in the direction, eg , parallel to the corresponding ray fb , which proceeds in the same compass bearing from another part of the apparatus and so of any other ray fr which is sent parallel to the ray fb .

Right-angled prisms

Right-Angled Expanding Prisms—These (fig. 41) are right-angled vertically, while ac plane two of them C_1O_1 are semi-cylinders, and the third C_2 a semi-cone. A semi-cylindrical beam of parallel rays passing vertically upwards and falling normally on the bases a of the prisms enter the glass, are reflected

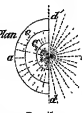


Fig. 41

by the sides b , and pass out horizontally and normally to the other sides, but, as the prisms are bent through a circular segment dad' in plane, the emergent rays will be spread over the same angle in azimuth, and this will be true of any angle in azimuth subtended by the prisms. As those in the diagram subtend 180°, the light will in this case be spread over half the horizon dad' .

Turn Prisms—These are for carrying out Professor Swan's mode of causing light coming from prisms behind to pass through spaces left for the purpose between others in front. The turn prisms (fig. 42) are formed by cutting out the apex (shown black on diagram) of a straight prism so as to leave a sufficient space between it and the next prism for the passage of rays coming from behind. The length of glass traversed by the rays is lessened by this arrangement, and the size of the apparatus and lantern can at the same time be very greatly reduced.



Fig. 42

Diffracted Lens—Horizontal divergence may be obtained by any Difference amount by varying the radius of curvature of the inner tall lens and refractor.



Fig. 43

Fig. 44



Fig. 45

Diffracted Refractor—This is the application to the cylindrical refractor of the same principle which has been described above to the ordinary annular lens.

Condensing Catoptric Spherical Mirror—If a large arc of a Spherical mirror be cut opposite to a short range of sea, and a mirror smaller arc be cut in the mirror opposite to the longer range which has to be strengthened, then the light passing through the larger arc is received on an elliptic reflector placed behind, so as, with the help of an additional reflector and lens, to cause the larger cone of rays to be compressed into the smaller arc which has to be strengthened.

Spherical Mirror of Unusual Size—This mirror is set out in height in such a way that its different heights represent inversely the different distances of the neighbouring land from the light-house, so as to reflect less light in the shorter and more in the longer ranges.

Application to Fixed Condensing Apparatus

Fixed Condensing Light for a Single Sector, 135°—The heliophote light in plp (fig. 46) throws its whole light on straight condensing prisms ac , each of which distributes the rays over the required sector.

Condensing Apparatus for Steamers' Side Lights—By means of this apparatus of the condensing prisms (figs. 47 and 48) all the light can be distributed with strict equality over 115° 30', which is the arc prescribed for steamers by the Board of Trade. Several of the Transatlantic and other steamers have adopted the kind of apparatus, which is hung on gunbells and placed in iron towers, having an entry from below the deck, which can be made use of in bad weather.

Condensing Quadrant—The fixed apparatus 304 , with spherical condenser behind, throws its rays directly through the angle of 90° quadrant afg , while the supplementary rays falling on the straight condensing prisms p, p', p' (fig. 49) are sent out parallel to the corresponding rays in the unobstructed central quadrant of the main apparatus. The whole light will therefore be condensed equally over 90°.

Fig. 46—Vertical Section.

Condensing Optical—The central fixed apparatus 46 (figs. 50, 51) with spherical mirror *ad* throws its rays directly over the angle of 45° *ppq*, while the supplemental rays fall upon the straight condensing

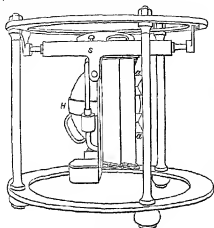


FIG. 47.—Side Elevation

ing prisms *p*, each of which spreads the incident rays parallel to the corresponding rays in the central angle *ppq*. In this way the whole of the front hemisphere of rays is parallelized in the vertical

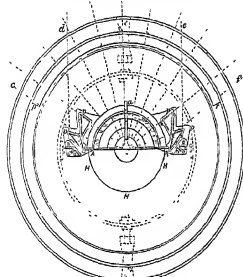


FIG. 48.—Horizontal Section

plane and spread equally over the 45° in azimuth. The hemisphere of back rays is condensed into the same arc seawards by the dioptric spherical mirror, which returns the rays incident upon it through

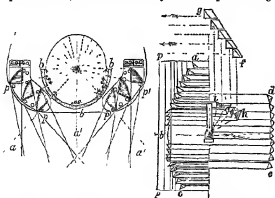


FIG. 49.—Horizontal Section

the flame, where mingling with the front rays they are finally distributed over the arc of 45°. The light passing above the spherical mirror is parallelized by a half holophote *ab* (fig. 50), and sent

FIG. 50.—Vertical Elevation

vertically upwards, when, falling on the expanding prisms *of*, it also is finally spread over the isosceles arc. Thus the whole light is condensed and distributed with strict equality over the 45° by means of six different optical agents. Two apparatus of this kind form the leading lights to the River Tay.

Condensing Optical—Fig. 52 shows part of the Lamplish light in the Firth of Clyde. Its action will be easily understood by the numbers shown on the diagram.

Fixed Condensing Lights for more than one Sector of Unequal Range.—Fig. 53 is a chart of the Sound of Glenelg, in which the Isle Oranay light has to be seen generally at a distance of 3 or 4 miles across the Sound, but in the direction

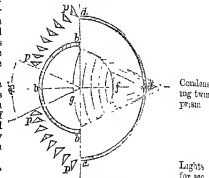


FIG. 51.—Horizontal Section

Condensing twin prisms

Light for sectors of unequal range

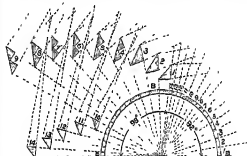


FIG. 52.—Horizontal Section

another up the sound between C and D an angle of 10° has to be seen about 7 miles. Fig. 54 shows in plan the apparatus, which was for certain local seasons not constructed according to the



FIG. 53

formula, but 168° of the spare light which would otherwise have fallen upon the land were allocated down Sleat Sound and 139° down the Sound of Glenelg. That for Sleat Sound was given

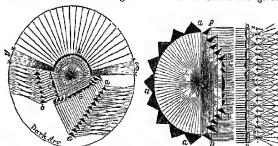


FIG. 54.—Horizontal Section

FIG. 55.—Vertical Section

directly by the main apparatus through the arc *h*, and that to Glenelg through the arc *g*, but these arcs were respectively strengthened by portions of the holophotes B and C, the light from which was condensed respectively over the arc *h* by each of the straight prisms *a* and over the arc *g* by each of the prisms *b*. The condensed light at Isle Oranay, which is of the fourth order, appears to be equal to that of a first order, so that with a

lamp consuming annually only 170 gallons of oil a light is obtained in the only direction in which great power is required equal in effect to a lamp consuming 800 gallons per annum.

Fixed Condensing Lights of Unequal Range which constantly illuminate the whole horizon.—For this purpose the condensing apparatus of mirror or spherical mirror of unequal area will be found applicable.

Revolving or Intermittent Lights for Condensing the Rays into one Sector.—The heliophote in fig. 55 shows its rays on straight condensing prisms P, each of which spreads the light over the required sector, while making M to revolve horizontally on pivots cut off the light either slowly or suddenly so as to produce a revolving or an intermittent light, both of which condense all the rays uniformly over the one sector.

Application of Condensing Prisms to Revolving Lights of Unequal Range, which do not illuminate the whole horizon.

Repeating Light.—Plane mirrors M (fig. 56) revolve on an endless screw placed outside of the apparatus and alter the direction of the flashes after they pass into the dark arc on the landward side so as to cause the lenses L, L to repeat their flashes over the seaward arc which requires strengthening. The condensing spherical mirror and mirror of unequal area will also be found applicable in cases where the flashes do not require to sweep over the whole horizon.

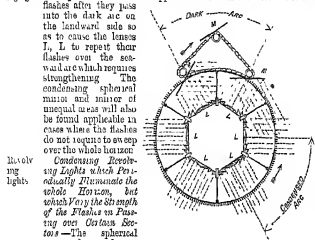


FIG. 56.—Horizontal Section

Condensing Intermittent Lights.—Figs. 57 and 58 show straight refracting or reflecting prisms, which revolve and intercept as they pass round certain of the rays from a central fixed light apparatus so as to produce perfect darkness over the sectors which they subvert at the time, while they spread the rays which they intercept uniformly over and thus strengthen the intermediate sectors which are illuminated directly by the central apparatus.



FIG. 57.—Horizontal Section



FIG. 58.—Elevation

The peculiar property of this arrangement is that the power is increased in proportion to the duration of the intervening periods of darkness. Thus, neglecting the loss by absorption, &c., the power is doubled when the periods of light and darkness are equal, tripled when the dark periods are twice as long as the light, and so on in proportion, while in every case the rays are spread uniformly over each illuminated sector.

Revolving Condensing Light with Differential Reflector.—Figs. 59 and 60 show the new apparatus of Mill of Galloway in which the differential reflector, by the compound horizontal and vertical section of which angle agent the whole condensing intermittent effect is produced, so that condensing prisms are done

away with opposite the central, which is the most important, part of the apparatus. The centre of the inner curve of the refractor is at O in fig. 60. Through there is no relative motion in this apparatus, every part of which revolves together, the parts may be arranged so that the condensing only move. This apparatus was constructed in the most satisfactory manner by Messrs. Baillet & Penet, Paris.

Alteration of Fixed to Intermittent Apparatus.—Any existing fixed light can at once be made intermittent so as to show either equal or unequal periods, by simply causing condensing prisms to circulate round it, while the power will be increased in proportion to the ratio of the duration of light to dark periods.

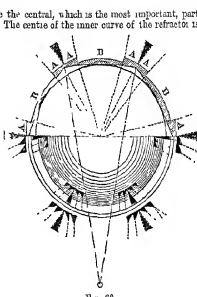


FIG. 60

Change of fixed to intermittent apparatus

Beacons and Buoys

Beacons in exposed situations are constructed sometimes of Beacon stones, and cement concrete or cement-rubble, but generally of cast-iron columns let into heavy base plates which are fixed to the rock by strong Lewis bolts. The small class iron beacons are generally of malleable iron and the larger of cast-iron, but steel or bronze might with advantage be used in very exposed places. Fig. 61 shows a first order cast-iron beacon as used in Scotland.

T. Stevenson's Apparent Light.—This kind of light is specially useful at places where there is a sunk rock with little sea-room round it, and at the piersheads of harbours which must be closely hugged by vessels seeking entrance. It consists of certain forms of optical apparatus for reflecting and redistributing at a beacon placed on a submerged rock parallel rays which proceed from a lamp and apparatus placed on the land. An optical deception is thus produced, as the sailor initially supposes that there is a lamp burning on the beacon itself. The first light of this kind, which has been in use since 1861, was placed in a beacon on a sunk reef in Sornoway Bay, and is shown pictorially in fig. 62. This light is 530 feet distant from the lighthouses where the lamp is placed. Others have since been established at Grampouth, which is 235 feet from the light, and at lesser distances at the harbours of Ayr and Abroath, at Odessa in the Black Sea, and at Gatcombe Head, Queensland.

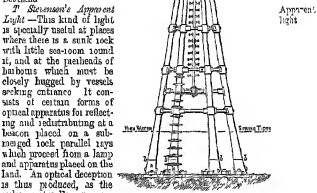


FIG. 61

Beacon Lights.—Lamps without glass chimneys, as used in the Beacon early experiments with paraffin, and as used with gas in Parker's lights buoy, having iron tubes placed at certain distances above the flames, and supplied with very large external of crystal oil, have been kept continuously burning in Scotland for about a month without turning. These lamps are for rocks at sea which can only be reached when the weather is moderate.

Illumination of Beacons by Gas to Produce a Fixed Light.—A light near Port-Glasgow has been illuminated by gas since 1861. The tower is about 300 feet from the shore, and the supply and pressure of gas are regulated by self-acting arrangements on the shore.

Pat. 15. *Proctor's Gas Illuminated Buoy for Producing a Fixed Light*—This buoy is gas and water tight, and is charged to a pressure

around the whistle. It is said that an undulation of even 12 inches is sufficient to sound the whistle.

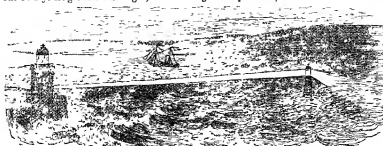


Fig. 62

of ten atmospheres. The buoy is filled with gas sufficient to burn night and day for three or four months, the burning pressure is kept constant by Proctor's regulator. These buoys promise to be of great service, and have now been in use for more than a year at several places both in England and Scotland.

Automatic Meter for Producing Intermittent Lights by the Flow of the Tide—In order to distinguish one buoy or beacon from another, Mr. T. Stevenson has proposed to make the flow of the gas itself produce automatic intermittent action without using clockwork. The full flame continues to burn until the action of the meter reduces the supply, but leaves a small jet still burning in the sockets of the burner till the full flame is again produced. This meter has been tried successfully on shore for twenty-eight hours consecutively.

Uniform System of Beacons and Buoys—The first proposal for a system of dealing systematically with the colours of beacons and buoys was in 1828, when Mr. R. Stevenson proposed for the navigation of the

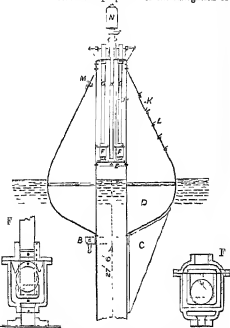


Fig. 63—Combs's Automatic Buoy. A, cylinder, 27 ft. 6 in. long; B, moving shaft; C, boiler; D, buoy; E, diaphragm; F, ball valves; G, an inlet tube; H, an (compressed) outlet tube to whistle; I, compressed inlet to buoy; K, manhole; L, steps; N, whistle.

river Forth that red buoys should be taken on the starboard and black on the port side in going up the river. This system has since been adopted generally in the United Kingdom. In 1857 Admiral E. J. Belford suggested a uniform system for all the coasts of the country, which was carried out in Scotland by Mr. A. Cunningham. A different uniform system has been adopted in England by the Trinity House. In 1859 Mr. J. F. Campbell suggested what is undoubtedly the best system, that a buoy shall indicate by its shape and colour the compass direction in which a vessel should sail after seeing the buoy.

Combs's Automatic Buoy—This useful form of buoy (fig. 63) first used in America, has a cylindrical tube A projecting below the level of the water, on the upper part of which cylinder there is a whistle N and also two inlet valves F, F, so that the rising and falling of the buoy draws in and expels the air alternately which

Tolling of Bells by the Hydrostatic Telling of the Force of the Tide—In 1810 Mr. R. Stevenson designed apparatus for tolling with a bell on the Gun Rock lighthouse, which was to have been effected by a float when ascending with the pressure of the flowing tide, when descending with the fall of the ebb tide and by means of a peculiar arrangement of weights for keeping the bell in action during the time of slack water.

ILLUMINANTS

After a good ordinary single-wick oil lamp, Fresnel still adhering to Argand's principle of the double or current intro-

duced two, three, and four concentric wick burners, Mr. Alan Stevenson the five, and Mr. Douglas the six wick burners. These burners are suitable for the consumption of animal and vegetable oils, which

were in use at the various lighthouse services of the world till within the last few years. These oils are, however, superseded by hydrocarbons, which at one-half the cost give an increased luminous intensity for an equal consumption, but they require a larger supply of air for their combustion, and consequently an improved form of burner. Mr. Main in 1856 devised a single-wick burner for this purpose which gave good results, but many and all attempts to construct a multiple-wick mineral oil burner failed till 1868, when Captain Doty's famous device.

By a happy choice of proportions in the various parts of his burner (fig. 64), and by the addition of an exterior cylinder surrounding the outer wick, and a central disk, both placed in such a manner as to throw a current of air into the flame at the right place, Captain Doty succeeded in producing single and multiple-wick hydrocarbon burners, which carry a flame of great luminous intensity and regularity. The following table gives the details of these burners, and also the candle power and consumption, as determined by Dr. Stevenson Macadam.

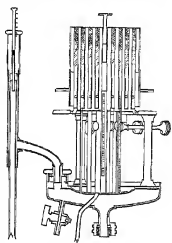


Fig. 64

No. of Wicks	Main Diameter of Outer Wick, in inches	Height of wick part of Flame, exclusive of Trill, in inches	Candle Power in Spec. Oil, each consuming 120 grs. Spirit per Hour	Value of Light from Consumption of 1 gallon of Oil in 24 hours
1	0.2	1	28.62	27.29
2	1.75	1.5	63.75	27.29
3	2.5	2	90.72	27.29
4	3.2	2	107.62	27.29

Mr. J. K. Douglas has also introduced a mineral oil burner, which, however, Doty claims as similar in principle to his. By igniting only half the number of wicks (the outer in a six-wick for instance) the use of the burner can be diminished by one-half. This is Mr. Douglas's lamp of single and double power for use in clear and foggy weather respectively.

The mineral oil employed most extensively in light-houses (illumination is Scotch paraffin). The specific gravity, which is a test of the relative values of the oil, should be from 0.8 to 0.82 at 60° Fahr., and the flashing point at temperature at which it begins to evolve inflammable vapour should not be lower than 125° nor higher than 185° Fahr. The Board of Northern Lighthouses was the first light-house authority in Britain that adopted paraffin and Doty burners, and by doing so an annual saving of between £4500 and £5000 in the maintenance of the lights on the Scotch coast was effected.

Single-wick burners are supplied with oil from the cistern by the capillary action of the wick alone. But in the case of multiple-wick burners other methods must be employed to secure a sufficient supply. If the cistern be placed above the level of the top of the burner, the flow of the oil to the wick ends is effected by the direct

action of gravity, regulated by a contrivance which maintains a constant head. If, however, the lantern be placed below this level, either a mechanical pump is employed, in which the oil is forced into the burner by pumps worked by clockwork, or a moderator lamp, in which this is effected by the pressure created by a weighted piston descending in a cylinder forming the lantern.

Cocle-Gas—Coal-gas was first used as a lighthouse illuminant at Salvoe, near Trieste, in 1817. For many years it has been used in the harbour lights of Great Britain when in the neighbourhood of gas-works. Mr J R Wigham has designed a compound or cocle burner consisting of a group of twenty-eight vertical tubes, each carrying an ordinary double-bell-tower burner, and the ignited gases issuing from all these jets unite into one large flame. Additional groups of twenty jets each can readily be arranged around the first, which forms a central nucleus, and in this way, depending on the state of the atmosphere, the power of the burner can be made at will 25, 45, 65, 85, or 105 jets. Fig 65 shows the arrangement



Fig 65



Fig 66

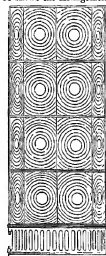


Fig 67

for 25 jets, and fig 68 one for 105 jets. In his triaxial or quadriform systems Mr Wigham places two, three, or four of the burners already described vertically one above the other (fig 67), with lenses opposite to each. The following table gives the candle powers, &c., of Mr Wigham's burners.

Number of Jets	Consumption of Gasol litres per Hour	Candle Power in Spinal Candles, consuming 100 gas per Hour
25	14.4	420.6
45	23.2	523.0
65	34.9	716.0
85	54.0	1100.0
105	80.0	1512.0

The diameter of the 105-jet burner is 12 inches

Faraday and Holmes's Magneto-Electric Light—In 1858 Professor Holmes made the first magneto-electric machine for lighthouses, which was tried by the Trinity House in 1857, and the electric light was first shown to the mariner in 1855. The Trinity House subsequently introduced it at Dungeness in 1859, and at Souter Point in 1871. The optical apparatus for these lights was designed by Mr J T Chance. In 1869 Holmes constructed for the Trinity House a dynamo-electric machine (in which no permanent magnet is used), giving a light of about 5800 candles. The magneto electric light of Holmes is exhibited from a third order dioptric apparatus at the South Foreland light has been estimated at 150,000 candles, or twenty times that of the old first order dioptric flash white light. The following table shows the results which have been obtained by Dr Tyndall and Mr Douglass by the magneto-electric and dynamo-electric machines, tried at the South Foreland, 1876-77—

Name of Machines	Cost.	Light in candle power	Light produced per HP as stated in Candles	Max Mean	Order of Merit	
Holmes's Magneto-Electric	£50	22	400	476	6	
Albion	404	2	400	541	5	
Giuseppe Dynamo-Electric (No 1)	320	42	430	1,257	7	
Do do (No 2)	250	571	420	1,277	8	
Swanwick's	200	8	430	1,212	9	
Do do (small No 5)	100	100	32	550	1,022	2
Do do (small No 6)	100	2	550	1,080	1	
Two Holmes's Magneto-Electric	1,100	60	490	479	428	3
Two dynamo Electric	640	10	420	1,061	651	4
Two Swanwick's (small Nos 5 and 6)	200	60	550	2,141	1,201	1

It may be kept in view that in the electric as well as in every other light the following requirements must be fulfilled—(1) it shall be constantly in sight during those periods of time at which it is advertised to the mariner as being visible, (2) it shall be seen as far as possible in a thick and hazy atmosphere, (3) it shall constantly maintain on the distinctive character of the station where it is employed so as not to be mistaken for another light, and (4), when revolving, its flashes shall remain long enough in view to let the sailor take the compass bearing of the light. The electric light practically fulfils all these conditions, and, when we consider its transcendent intensity, and the smallness of the luminous incandescence which enables the engineer to adapt it to any required conditions far more strictly than oil light, we may certainly conclude that the electric is the best though the most costly of all illuminants.

The only question which has not yet been decided is whether an electric light of equal initial power will penetrate a hazy atmosphere as far as an oil light. Experiments made at Edinburgh in 1866 seemed to show that the highly distinctive flash of the electric light when acted on by optical apparatus is perhaps not so much due to a greater amount of light as to the more complete parallelism of the rays arising from the smallness of the radiant. The apparatus of a small size which was first used both in England and France recently produced a useful vertical divergence, and has therefore been now justly discarded.

Allard's Statistics of Lighthouse Apparatus.

The following useful formulae are taken from M Allard's very valuable *Mémoire sur l'Éclairage et la Puissance des Phares*, Paris, 1876 statistics *Conservation of Oil in Relation to Diameter of Burner*—If c denote the consumption of mineral oil in grammes per hour, d the diameter of the burner in centimetres, then

$$c = 4.9d^{2.25}$$

Luminous Intensity—A Cocle burner consuming 40 grammes of colza oil per hour being taken as unit, if I denote the intensity for mineral oil in a burner of diameter d in centimetres, then

$$I = 0.22d^2$$

Luminous Intensity of Apparatus—Loss due to Reflection, Absorption, and Flaring of Apparatus—The loss due to reflection on entering and leaving the glass may be valued at 650, 652, 658, 676, 720, 730, for angles of incidence respectively of 0°, 15°, 30°, 45°, 60°, 75°. In totally reflecting mirrors the luminous ray suffers three deviations instead of two, therefore the above values should be multiplied by 3.

The loss by absorption in the glass, although properly given by an exponential formula, may, with sufficient accuracy, be taken as 68 per centum of the glass traversed.

The loss due to the horizontal joints of the lenses, and to the intervals between the reflecting rings, varies from 62 to 68, or from 0.7 to 0.4, in passing from the first to the fifth order.

Coefficients—These are the ratios in which the intensity of the lamp is increased by the apparatus. Where m is the coefficient, f the focal distance, d the diameter, and h the height of flame in a fixed light apparatus, they can, if expressed in centimetres, be calculated from the formula—

$$m = \sqrt{\left(\frac{f}{d}\right)^2 + 1} \quad \text{or} \quad m = 2.12 \left(\frac{f}{h}\right)^{1.15}$$

Annular Lens—The intensity of an annular lens is obtained by multiplying that of the corresponding fixed light by $\frac{1}{2}$, where ϕ is the angle subtended by the annular lens, and h the horizontal semi divergence. The intensity of light from an ordinary fixed light apparatus is increased 28 per cent. by the use of the dioptric spherical mirror.

Distinctions of Lights

The most important characteristic distinctions of lights are the following—(1) The *fixed light*. Two of these are sometimes shown tiers at different heights from the same tower. (2) The *revolving light*, which at equal and comparatively long periods comes slowly and gradually into full power, and then as gradually disappears. (3) The *flashing light*, which at short periods (such as a few seconds) comes very quickly, though gradually, into full power, and as quickly and gradually fades away, was first introduced by the late Mr Robert Stevenson in 1825. (4) The *coloured light*, which is obtained by using coloured media, and was first employed by Hills of Bradingham. (5) The *intermittent light*, introduced by the late Mr R Stevenson in 1830, which bursts instantaneously into full power, and after remaining as a fixed light for a certain length of time is as suddenly eclipsed and succeeded by a dark period. When the periods are very short the intermittent is used.

¹ This result as to total resistance is not in accordance with the experiments of Professor Potter, which, however, were made with a very finely polished glass made for optical purposes.

called an occulting light. (3) *The intermittent light of unequal periods*, first proposed by Mr R. I. Stevenson in 1871, showing from the same apparatus different durations of the dark periods with equal periods of light, such as fixed for 2' eclipsed 5', fixed 2' eclipsed for 2', and then, as at first, fixed for 2'. (7) *Group flashing light*. This distinction consists in giving a series of groups of two or more flashes separated by short eclipses, the groups being separated from one another by a longer eclipse. The Mr Wigham of Dublin first proposed this distinction, and applied it to a dioptric revolving apparatus illuminated by gas, the effect being produced by raising and lowering the gas. Mr Wilson of Troon had done in 1847. Dr Hopkinson produced the same effect optically and for the luminous by the arrangement of the ordinary revolving apparatus. (8) *Fixed lights illuminating the whole horizon*, but showing revolving or intermittent characteristics over small areas. These can be produced by masks arranged like romanian house blinds placed opposite the arc where the characteristic is to be different from the main light. This arrangement and No. 9 were lately proposed by Mr T. Stevenson. (9) *Intermittent flashing light*. This is produced by condensing prisms revolving round a fixed light apparatus. The flashing light continues giving its rapidly recurring flashes for a certain period, which is succeeded by a dark period. The light which is not returned during the dark periods is condensed by the prisms so as to strengthen the light periods.

Uniform System of Characteristic.—Various modes of distinguishing lights have been at different times proposed, such as Babbage's, which represented the stations by numbers, and Sir V. Thomson's by the Morse alphabet, or dots and dashes, but the following results seem to show that the present system is satisfactory, while it is free from many objections to which the other modes are liable. The Board of Trade records of shipwrecks show that during the space of twenty years (1857 to 1876) 2716 vessels were wrecked by stranding on the coasts and shoals of Scotland and the Isle of Man, and that of all these there were only twenty-four, and the great majority of them were small vessels, in which it was *even alleged* that the cause was a failure in identifying the distinctive characteristic of some one of the Northern lighthouses, and in one-third of those cases the sailors were foreigners, and made such glaring mistakes as taking a fixed for a revolving light. It is scarcely more probable that in many of these cases they did not confound the characteristics at all, but really did not know what they were. But, waving all these considerations, there were after all only about 1 per cent. of all the wrecks which were alleged to have been caused by mistaking one light for another.

Power of Coloured Lights.—Experiments, and particularly those of M. Beryand, have shown that red of the same initial power as white penetrates a fog to a greater distance than the white, owing to the red rays not being so much dispersed by refraction. Experiments made at Edinburgh in 1868 show that a light should, before passing through red glass, have four and a half times the initial power of a white light. The same results have since been obtained by M. Allard of Paris.

An objection to all coloured lights is the fact that some persons are unable to detect any difference between certain colours. According to the experiments of Professor Halmgren on sixty to seventy thousand persons in Europe and America, about 4.5 per cent. are congenitally colour-blind, and the commonest form of this defect is inability to distinguish between red and green, which are the only tones employed for lighthouse distinctions. This objection, however, must gradually lose its weight, as the Board of Trade have now adopted the "colours test" as part of their examinations for certificates in navigation.

Distribu-
tion of
light.

Distribution of Lights on a Coast.—Mr Alan Stevenson gives the following as a few of the chief considerations which should guide us in the selection of sites and characteristic appearances of the lighthouses to be placed on a line of coast.

"1. The most prominent points of a line of coast, or those first made on over-sea voyages, should be first lighted, and the most powerful lights should be adapted to them, so that they may be discovered by the mariner as soon as possible before they reaching land."

"2. So far as is consistent with due attention to distinction, revolving lights of some description, which are necessarily more powerful than fixed lights, should be employed at the outposts on a line of coast."

"3. Lights of precisely identical character and appearance should not, if possible, occur within a less distance than 100 miles of each other on the same line of coast which is made by over-sea vessels."

"4. In all cases the distinction of colour should never be adopted except from absolute necessity."

"5. Fixed lights and others of less power may be more readily adapted in narrow cases, because the range of the lights in such situations is generally less than that of open sea-lights."

"6. In narrow cases also the distance between lights of the same appearance may often be safely reduced within much lower limits than is desirable for the greater sea-lights. Thus there are many instances in which the distance separating lights of the same

character need not exceed 60 miles, and peculiar cases occur in which even a much less separation between similar lights may be sufficient."

"7. Lights intended to guard vessels from reefs, shoals, or other dangers should, in every case where it is practicable, be placed seaward of the danger itself, so it is desirable that easen be enabled to make the lights with confidence."

"8. Views of economy in the first cost of a lighthouse should never be permitted to interfere with placing it in the best possible position, and, when funds are deficient, it will generally be found that the wise course is to delay the work until a sum shall have been obtained sufficient for the erection of the lighthouse on the best site."

"9. The elevation of the lantern above the sea should not, if possible, for sea-lights, exceed 200 feet, and about 150 feet is sufficient, under almost any circumstances, to give the range which is required. Lights placed on high headlands are subject to be frequently wrapped in fog, and are often thereby rendered useless, at times when lights on a lower level might be perfectly efficient. But this rule must not, and indeed cannot, be strictly followed, especially on the British coast, where there are so many projecting cliffs, which, while they subject the lights placed on them to occasional obstruction by fog, would also entirely and permanently hide from view lights placed on the lower land adjoining them."

"10. The best position for a sea-light ought rarely to be neglected for the sake of the more immediate benefit of some neighbouring port, however important or influential; and the interests of navigation, as well as the true welfare of the port itself, will generally be much better served by placing the sea-light where it ought to be, and adding, on a smaller scale, such subsidiary lights as the channel leading to the entrance of the port may require."

"11. It may be held as a general maxim that the fewer lights that can be employed in the illumination of a coast the better, not only on the score of economy, but also of real efficiency. Every light needlessly erected may, in certain circumstances, become a source of confusion to the mariner, and in the event of another light being required in the neighbourhood, it becomes a deduction from the means of distinguishing it from the lights which existed previous to its establishment."

"12. Distinctions of lights, founded upon the minute estimation of intervals of time between flashes, and especially on the measurement of the duration of light and dark periods, are less satisfactory to the great majority of coasting seamen, and are more liable to denigration by atmospheric changes, than those distinctions which are founded on what may more properly be called the characteristic appearance of the lights, in which the times for the recurrence of certain appearances differ so widely from each other as not to require for their detection any very minute observation in a stormy night. Thus, for example, flashing lights of five seconds' interval, and revolving lights of half a minute, one minute, and two minutes, are much more characteristic than those which are distinguished from each other by intervals varying according to a slower series of 8", 10", 20", 40", &c."

"13. Harbour and local lights, which have a circumscribed range, should generally be fixed instead of revolving, and may often, for the same reason, be easily distinguished by coloured media. In many cases also, where they are to serve as guides into a narrow channel, the leading lights which are used should, at the same time, be so arranged as to serve for a distinction from any neighbouring lights."

Table of Distances at which Objects can be seen at Sea, according to Distances to their respective elevations, and the elevation of the eye of the observer.

Heights in Feet	Distances in Geographical or Nautical Miles	Heights in Feet	Distances in Geographical or Nautical Miles	Heights in Feet	Distances in Geographical or Nautical Miles
5	3.098	70	9.098	210	19.14
10	3.028	75	9.063	220	19.67
15	4.448	80	10.207	230	20.19
20	5.139	85	11.147	240	20.69
25	5.738	90	10.98	250	21.13
30	6.263	95	11.18	260	21.65
35	6.707	100	11.47	270	22.15
40	7.195	110	12.08	280	22.61
45	6.686	120	12.68	290	23.05
50	8.112	130	13.08	300	23.46
55	8.600	140	13.67	310	23.84
60	9.080	150	14.25	320	24.21
65	9.540	200	16.22	3300	30.78

Example.—A tower 200 feet high will be visible 20.66 nautical miles to an observer whose eye is elevated 15 feet above the water; thus, from the table—

15 feet elevation, distance visible 4.44 nautical miles.	
200 " " " " " "	16.22 " "
	20.66 " "

Floating Lights
Prior to 1897 the only kind of floating light was a ship with small lanterns suspended from the masts or spars. The life

Lanterns. *Lanterns* are generally constructed of diagonally framed astragals (fig 77) to avoid the obstruction of light in any one azimuth as would be the case with dioptric fixed light apparatuses were vertical astragals used. The astragals are made of gun-metal, having a tensile strain of 38,000 lb to the square inch; the dome is made of copper plates rivetted

together, and the glass is the best plate $\frac{1}{2}$ inch thick. *Slim paces* are kept at hand which can be applied in a few minutes in the event of a pane being broken, which sometimes occurs from large hot droppings against the window and by stones thrown up from the faces of ships, by the wind and by stones thrown up from the faces of ships, by the wind and during storms. Mr Douglas's cylindrical or helical lanterns (fig. 73) have steel astas, galls, and the panes, which are also cylindrical, are $\frac{1}{2}$ inch thick.

Lighting Conductors — Each lightning tower is furnished with a copper lightning conductor consisting of a 2 inch copper rod or wire rope. These conductors terminate about 18 inches above the top of dome of lantern in a leaded shape with two platinum points, the lower end bolted are furnished with large copper ear plates is sunk into most earth or into the sea. The conductor is put into metallic connection with all large masses of metal outside or inside the lightroom. See **ILLUSTRATIONS**.

Machinery — revolving lights are propelled by clock-work. Machinery is of the simplest and lightest design. The machines are provided with a maintaining power which keeps the apparatus moving while the machine is being wound up, and a bell is attached which rings to warn the keepers when the machine requires winding up. A clock face is also attached which keeps time with the lightroom clock when the apparatus is revolving at the proper speed.





Fig 71 — Diagonal Lantern

Fig 72 — Helical Lantern

Masking Screens.—For the purpose of cutting off sharply the light Masking porcelain from any fixed light apparatus, the late Mr. J. M. Bailett screens devised what he called jadal masking screens. These screens, which are in use at several lighthouses where the runway for ships is narrow, consist of a series of thin plates placed with thin edges towards the apparatus, and with such a distance between them, and of such a length as will seem to cut only rays having the desired divergence *eye* pass through between them.

With revolving lights it is not possible to effect a "cut-off" as in the case of fixed lights, on any particular bearing, for the direction of the axis of the luminous beam projected by the lens or reflector is being continually changed in the horizontal plane by the revolution of the frame on which it is fixed. Sir Stevenson's mode of effecting a cut-off is by the use of a curved glass screen, and a coloured glass slide outside the revolving apparatus and on the safe side of the danger area. These screens are fitted with rollers for running on a slightly inclined plane or spiral path. Small projecting rods or snags fixed to the sides of such lens are, in revolving, brought against the edge of the screen, and gradually raise the screen back to its original position. Figure 1 shows the lens revolved, the edge of the danger area the screen has been pushed to the top of the inclined plane, and the full beam of light, coming from the now entirely uncovered lens, points in the required line of cut-off, which is the bearing of the danger area. But whenever the danger is removed the screen is gradually lowered by the action of the rods or snags, so as to free it from the pressure it immediately runs back again to its original position in front of the lens, so as to prevent any of the light being now sent seawards. By this continued reciprocative movement of the screen, as lens after lens comes round, the same effect will be successively produced, and the light will be cut off in the required direction of rotation, so that the flashes can never be seen within the danger area.

Mathematical investigations and formulae for constructing the Mathematical instruments for lighthouses will be found in the books mentioned by Alan Stevenson, Swan, Chance, Nehls, Reynard, formulae Allard, &c. to which the reader is referred.

Libraire – second, *Narrative of the Edgemoor Lightships*, London, 1798, Latera 18; Stevens, *Account of the Bell Rock Lightship*, Edinburgh, 1824, 1798, 1824, 1825, 1826, 1827, 1828, 1829, 1830, 1831, 1832, 1833, 1834, 1835, 1836, 1837, 1838, 1839, 1840, 1841, 1842, 1843, 1844, 1845, 1846, 1847, 1848, 1849, 1850, 1851, 1852, 1853, 1854, 1855, 1856, 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872, 1873, 1874, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 249

LIGHTING, ELECTRIC. Artificial light is generally produced by raising some body to a high temperature. If the temperature of a solid body be greater than that of surrounding bodies it parts with some of its energy in the form of radiation. Whilst the temperature is low these radiations are not of a kind to which the eye is sensitive; they are exclusively radiations less refrangible and of greater wave-length than red light, and may be called infra-red. As the temperature is increased the infra-red radiations increase, but presently there are added radiations which the eye perceives as red light. As the temperature is further increased, the red light increases, and yellow, green, and blue rays are successively thrown off. On pushing the temperature to a still higher point, radiations of a wave-length shorter even than violet light are produced, to which the eye is insensitive, but which act strongly on certain chemical substances; these may be called ultra-violet rays. It is thus seen that a very hot body in general throws out rays of various wave-length, our eyes, it so happens, being only sensitive to certain of these, viz., those not very long and not very short, and that the hotter the body the more of every kind of radiation will it throw out, but the proportion of short waves to long waves becomes vastly greater as the temperature is increased. The problem of the artificial production of light with economy of energy is the same as that of raising some body to such a temperature that it shall give as large a proportion as possible of those rays which the eye happens to be capable of feeling. For practical purposes this temperature is the highest temperature we can produce. As an illustration of the luminous effect of the high temperature produced by converting other forms of energy into heat within a small space, consider the following statements. 120 cubic feet of 15 candle gas will, if burned in ordinary gas burners, give a light of 360 standard candles for one hour. The heat produced by the combustion is equivalent to about 60 million foot-pounds. If this gas be burned in a gas-engine, about 8 million foot-pounds of useful work will be done outside the engine, or four horse-power for one hour. This is sufficient to drive an "A" Gramme machine for one hour; the energy of the current will be about 6,400,000 foot-pounds per hour, about half of which, or only 3,200,000 foot-pounds, is converted into radiant energy in the electric arc, but this electric arc will radiate a light of 3000 candles when viewed horizontally, and two or three times as much when viewed from below. Hence 3 million foot-pounds changed to heat in the electric arc may be said roughly to affect our eyes six times as much as 60 million foot-pounds changed to heat in an ordinary gas burner.¹ Owing to the high temperature at which it remains solid, and to its great emissive power, the radiant body used for artificial illumination is nearly always some form of carbon.

The consideration of electric lighting naturally divides into two parts—the production of suitable electric currents, and the conversion of the energy of such currents into radiations. Although electric lights were first produced from currents generated by batteries, they have only attained commercial importance by the use of machines for converting mechanical energy into electric current.

Dynamo-Electric Machines.—In the widest sense a dynamo-electric machine may be defined as an apparatus for converting mechanical energy into the energy of electrostatic charge, or mechanical power into its equivalent electric current through a conductor. Under this definition would be included the electrophorus and all frictional machines; but the term is used in a more restricted sense

for those machines which produce electric currents by the motion of conductors in a magnetic field, or by the motion of a magnetic field in the neighbourhood of a conductor. The general laws of electromagnetic induction need not be set forth here, as they are fully explained in the article **ELECTRICITY**, they will be assumed in all that follows. Since, if the current in a closed circuit be in one direction when the number of lines of force is increasing, it will be in the opposite direction when they are diminishing, it is clear that the current in each part of the circuit which passes through the magnetic field must be alternate in direction. Hence also the current in the wire outside the machine must also be alternate, unless something of the nature of a commutator be employed to reverse the connections of the internal wires, in which the current is induced, and the external circuit. We have then broadly two classes of dynamo-electric machines—the simplest, the alternate current machine,² where no commutator is used; and the continuous current, in which a commutator is used to change the connections to the external circuit just at the moment when the direction of the current would change.

The mathematical theory of alternate current machines is comparatively simple.³ Let τ be the period of the machine, that is, the time taken to move the armature from one position to the next exactly similar position, t θ , in a Siemens alternate current machine of sixteen magnets on each side, one-eighth of the time of revolution; let γ be the coefficient of self-induction of the whole circuit, and R the resistance of the whole circuit; and let t denote the time at any instant counting from any epoch as initial, and I the magnetic induction at time t multiplied by the number of convolutions. The electromotive force in the circuit at time t will be

$$\frac{dI}{dt},$$

and the equation of the current will be

$$\gamma \frac{dI}{dt} + RI = Z \sin \frac{t - t_0}{\tau},$$

where Z is the current. Now I may be expressed in the form

$$I = A \sin 2\pi \frac{t - t_0}{\tau},$$

where A , and t_0 are constants for the machine with given excitation of the fixed magnets. Hence

$$\gamma \frac{dI}{dt} + RI = 2\pi \frac{\gamma A}{\tau} \cos 2\pi \frac{t - t_0}{\tau},$$

$$= Ce \frac{-R}{\gamma} + 2\pi \frac{\gamma A}{\tau} \frac{\cos 2\pi \frac{t - t_0}{\tau} - \frac{t - t_0}{\tau}}{\sqrt{\left(\frac{2\pi \gamma}{\tau}\right)^2 + R^2}},$$

where

$$\tan \frac{2\pi \tau}{\tau} = \frac{2\pi \gamma}{RT}$$

The term $Ce \frac{-R}{\gamma}$ is unimportant except just after closing the circuit. In the Siemens machine M Joubert states that the only

¹ For descriptions of various alternate current machines, consult the following authorities.—ALLIANCE: H. Fontaine, *Éclairage à l'Électricité*, Paris, 1879, p. 114; Dr H. Schellen, *Die magnetischen und dynamo-electrischen Maschinen*, Cologne, 1879, p. 35. DR MARSHALL: *Engineering*, xxviii, 372, xxxi, 265, 385, 392; *Tel. Jour.*, vi, 598; *Shoobred, Electric Lighting*, London, 1879, p. 14; *Electrician*, li, 27. GRAMME: *Engineering*, xlii, 413, xlv, 25, xxxi, 124, xxxii, 615; *Tel. Jour.*, viii, 28, ix, 206; *Electrician*, iv, 176; *Shoobred*, 26, Fontaine, 161, Schellen, 176. Report from the Select Committee on Electric Lighting, 281. HOUKES: Fontaine, 119; Schellen, 36. HOMER-ALLIANCE: *Shoobred*, 13. LORRAINE: *Engineering*, xxii, 465; *Tel. Jour.*, ix, 381. LOWRY: *Engineering*, xxv, 48, xxxi, 174, *Shoobred*, 22; Fontaine, 171; Report from the Select Committee on Electric Lighting, 230; Schellen, 167. HARTLEY: *Tel. Jour.*, viii, 150. SIEMENS: *Tel. Jour.*, vii, 284; Schellen, 315.

² *Journal de Physique*, x, 141; Joubert, "Théorie des machines à courants alternatifs," in *Phil. Mag.*, x, 298, 564.

³ Proc. Inst. C. E., li, 69; Report from the Select Committee on Electric Lighting, 1879.

important term is that of longest period. Hence, properly choosing the epoch, we write

$$\alpha = \frac{2\pi h}{T} \frac{\cos 2\pi \frac{t-\tau}{T}}{\sqrt{\left(\frac{2\pi\gamma}{T}\right)^2 + R^2}},$$

where

$$\tan \frac{2\pi\tau}{T} = \frac{R\gamma}{2\pi\gamma}.$$

Hence we see the current is diminished either by increasing γ or increasing R , also that the moment of reversal of current is not coincident with that of no electromotive force, but occurs after that time by an amount depending on the relative magnitudes of γ and R . This explains in a general way what is known as the lead of the brushes in a continuous current machine. If we wished to apply a commutator to the Siemens alternate current machine for the purpose of producing an external current constant in direction, the charge effected by the commutator should occur at an epoch after that of greatest electromotive force, an epoch which, with varying external resistance or varying speed, will depend on the resistance and speed.

The power of the current is $R\alpha^2$, and the energy in any considerable time, Θ , is

$$\Theta R \frac{2\pi h^2 \Lambda^2}{T^2} \frac{1}{\left(\frac{2\pi\gamma}{T}\right)^2 + R^2},$$

which shows that most power will be required to drive the machine when

$$R = \frac{2\pi\gamma}{T}.$$

In what precedes it has been assumed that the copper wires are the only conducting bodies moving in the magnetic field. In most cases the moving wire coils of these machines have iron cores, the iron being in some cases solid, in others more or less divided. It is found that if such machines are run on open circuit the iron becomes hot, very much hotter than when the current of the copper wire is closed; in some cases the phenomenon is so marked that the machine actually takes more to drive it when the current is quite open than when the machine is short-circuited. The explanation is that on open circuit currents are induced in the iron cores, but that when the copper coils are closed the current in the latter by its induction diminishes the current in the iron. The effect of currents in the iron cores is not alone to waste energy and heat the machine, the current produced is also actually less for a given intensity of field and speed of revolution. The cure of the evil is to subdivide the moving iron as much as possible in directions perpendicular to those in which the current tends to circulate.

Continuous or Direct Current Machines.—It has been shown that to produce a continuous current a commutator is needed. If there is but a single wire in the armature, or if there are more than one, but all are under maximum electromotive force at the same time, the current outside the machine, though always in the same direction, will be far from uniform. This irregularity may be reduced to any extent by multiplying the wires of the armature, giving each its own connexion to the outer circuit, and so placing them that the electromotive force attains a maximum successively in the several circuits. A practically uniform electric current was first commercially produced with the ring armature of Pacinotti as perfected by Gramme. Suppose a straight bar electromagnet surrounded by a coil of copper wire from end to end. Let the electromagnet be bent with the copper wire upon it until its ends meet and it forms an annulus or anchor ring. Let the two ends of the copper wire be connected, so that the iron core is surrounded by an endless copper wire, and you have the Pacinotti or Gramme ring. This ring rotates about its axis of figure between two diametrically opposed magnetic poles of opposite name. The ring may at any instant be supposed divided in halves by a diameter perpendicular to the diameter joining the centre of the poles. Equal and opposite electromotive forces act on the copper wire of the two halves, giving two opposite electric poles half way between the magnetic poles. If electric connexions could be maintained with these two points as the ring revolves, a continuous current would be drawn off. In practice this

is only approximated to. The copper wire is divided into a series of equal sections, and at the point of junction of each section with its neighbour a connexion is made with a plate of a commutator, having as many divisions as there are divisions of the copper coil. Collecting brushes bear upon the commutator plates, which are connected to the coil nearest to the point of maximum potential. Owing to the self-induction and mutual induction of the several coils of the armature, this point is displaced in the direction of rotation when a current is being drawn off, to an extent greater as the current is greater in relation to the strength of the magnetic field. The magnetic field in the Gramme and other continuous dynamo-electric machines may be produced in several ways.¹ Permanent magnets of steel may be used, as in the smaller machines now made, and in all the earlier machines; these are frequently called magneto-machines.² Electromagnets, excited by a current from a smaller dynamo-electric machine, were introduced by Wilde; these may be described shortly as dynamos with separate exciters. The plan of using the whole current from the armature of the machine itself for exciting the magnets was proposed almost simultaneously by Siemens, Wheatstone, and S. A. Varley.³ For some purposes it is advantageous to divide the current from the armature, sending the greater part through the external circuit, and a smaller portion through the electromagnet, which is then of very much higher resistance, as the electromagnet is a shunt to the external circuit. Machines so arranged are sometimes called shunt dynamos.⁴ The last two arrangements depend on residual magnetism to initiate the current, and below a certain speed of rotation give no practically useful electromotive force.

In discussing the comparative efficiency of dynamo-machines there are two points to be examined—(1) how much of the power applied is converted into energy of current in the whole circuit, whether external or in the wires of the armature or of the electromagnets, and (2) how much of the power is available outside of the machine. The

¹ See for descriptions of various continuous current machines—*BALL*, *Engineer*, li. 307, *Tel. Jour.*, li. 416; *Electrician*, vi. 895; *Engineering*, xxxiii. 62. *BRODS*, *Engineering*, xxxi. 65, 86, 123; *Engineer*, xiv. 447, li. 16; *Tel. Jour.*, vi. 21, *Electrician*, li. 87; *Shoolbred*, 21; *Fontaine*, 181. *BUDGE*, *Engineering*, xxxii. 206, *Electrician*, vi. 229. *CANON*, *Tel. Jour.*, vii. 848. *DE MEERTENS*, *Engineering*, xxxi. 865, 880, 892. *EDMOND*, *Engineering*, xxxii. 409, 418, xxxiii. 228, 253, 806, 407; *Tel. Jour.*, x. 440, *Engineer*, li. 828, lii. 42, *Electrician*, vii. 26, 269. *FAIN*, *Electrician*, vi. 117, *Engineering*, xxxii. 116. *FINEBRAD*, *Engineer*, i. 284; *Electrician*, v. 324. *GRAMME*, *Engineering*, xxviii. 64, xxxii. 68; *Engineer*, xiv. 447, *Tel. Jour.*, vi. 401; *Electrician*, i. 16; *Shoolbred*, 18; *Fontaine*, 161. *Report from the Select Committee on Electric Lighting*, 226; *Schellen*, 118. *GLITCH*, *Engineer*, li. 848; *Electrician*, vi. 878. *HENRIOT*, *Engineering*, xxxi. 130; *Tel. Jour.*, vii. 852. *HILBERT*, *Tel. Jour.*, ix. 383. *JURGENSON*, *Engineering*, xxxii. 130; *Engineer*, li. 287; *Electrician*, vii. 381. *LAUD*, *Fontaine*, 124. *LOUDET*, *Fontaine*, 160. *MAXIDE*, *Engineering*, xxxi. 618; *Electrician*, vii. 228; *Tel. Jour.*, vii. 418. *PACINOTTI*, *Engineering*, xxxii. 601; *Engineer*, li. 268, *Tel. Jour.*, vi. 817, ix. 478; *Schellen*, 78; *Trans. Canada*, xix. 1864; *Journal de Physique*, x. 481. *SCHOLLEN*, *Schellen*, 139; *Engineering*, xxxii. 344, *Tel. Jour.*, vi. 119. *SIEMENS*, *Engineering*, xxviii. 101; *Electrician*, ii. 80, vi. 58; *Shoolbred*, 17; *Fontaine*, 173; *Schellen*, 49, 144. *WALLACE-FARMER*, *Engineer*, xiv. 447; *Shoolbred*, 20; *Report from the Select Committee on Electric Lighting*, 248. *WATSON*, *Engineering*, xli. 42; *Electrician*, i. 297, vii. 280. *WILDE*, *Shoolbred*, 19; *Fontaine*, 121; *Schellen*, 49.

² *Mascart*, *Journal de Physique*, v. vii.

³ See for experiments on machines so arranged—*AUERBACH* and *MEXES*, *Wiedemann's Annalen*, November 1879. *CROFTON*, *Engineering*, xxxi. 908. *HOPKINSON*, *Proc. Inst. Mech. E.*, 1879, 228, 1880, 928; *Engineering*, xxvii. 408, xxxi. 424, *Engineer*, xlvii. 349; *Tel. Jour.*, vii. 167, 186, vii. 167; *Electrician*, ii. 278, ix. 296. *ROTHWELL*, *Tel. Jour.*, vii. 47, 52, 896; *Electrician*, ii. 107, 117.

⁴ For experiments on "shunt dynamos" see *Siemens*, *Trans. Roy. Soc.*, 1880.

practical sources of loss are friction of bearings, and of the brushes on the commutator, electric currents induced in the iron of the machine, production of heat in the copper wire of the armature due to its resistance, and production of heat in the wire of the electromagnet due to its resistance. There is also a certain loss in sparks upon the commutator. The currents in the iron are reduced by dividing the iron by insulating surfaces perpendicular to the electromotive force tending to produce such currents. The loss by resistance of wire in armature and magnets greatly depends on the dimensions of the machine. For imagine two exactly similar dynamo-electric machines, the one being n times the dimensions of the other, we have the following relations between them, assuming the same magnetic field per square centimetre, and the same speed of rotation:—

The electric resistances of the several parts are as $1:n$;
The electromotive force of the armature as n^2 ;
Current round magnets required to produce the field as n .

Thus the work wasted in heating the wire of the electromagnets varies as the linear dimensions of the machine. The current which the armature can carry with safety to the insulation will increase more rapidly than the linear dimensions of the machines, but less rapidly than the square of the linear dimensions. If the current vary as the linear dimensions n , the whole electric work done by the machine will vary as its weight n^3 , and the work wasted in the coils both of the electromagnets and of the armature will only vary as n ,—showing a great theoretic advantage in favour of the larger machines.

Electric Lamps. Incandescent Lamp.—The simplest way of obtaining light from an electric current is by passing it through a considerable resistance in such small compass that the conductor becomes intensely hot. It is of course necessary that the conductor shall be able to endure a very high temperature without injury. Indium and platinum-iridium wire have been employed, but are too expensive for commercial use. Hitherto the only available substance is carbon, in the form of a thread or filament. This carbon must be protected from the air by enclosing it in a glass globe from which every trace of air has been removed. An electric current passing through a carbon filament obeys Ohm's law, as through a metallic wire. But in metals the resistance increases as the temperature rises, in carbon it diminishes.¹ The filament or thread of carbon being enclosed in a vacuum space, the energy of current converted into heat in the filament only leaves it in the shape of radiations. To light economically, it is necessary to heat the filament to such a temperature that the greatest possible proportion of these radiations shall belong to that part of the spectrum to which the eye is sensitive, i.e., to the highest temperature the filament will stand. The fundamental problem of incandescent electric lighting is to produce a carbon thread the substance of which shall permanently stand the highest possible temperature, to make good electrical connexion between the ends of the filament and the conducting wires, and above all to secure that the thread shall be uniform throughout its length, for the current which can be safely used is limited by the weakest point of the filament. Several inventors have recently succeeded in meeting these

conditions, but their relative merit and priority cannot be discussed here.²

Semi-incandescent Lamp.—The lamps of Werdemann, Reynier, and Joel are intermediate between arc lamps and incandescent lamps, and present the distinctive advantages of neither.³

Arc Lights.—Sir Humphry Davy discovered that if two pieces of carbon were placed in contact with each other, and the current from a battery of a sufficient number of elements were passed from one piece to the other, the current did not cease when the carbons were slightly parted, but that the current passed across the intervening space, causing an intensely high temperature and consequently brilliant light. The pieces of carbon gradually burned away, the positive carbon being consumed more rapidly than the negative. When an electric current passes through a conducting solid body maintained at a constant temperature, the difference of potential on the two sides of the body has a constant ratio to the current passing through, this constant ratio is known as the electric resistance of the body at its then temperature. No such constant ratio exists in the case of the electric arc. If you increase the current passing between two carbons at a small distance apart, you do not materially change the difference of potential at the two ends of the electric arc. It is, therefore, not strictly appropriate to speak of the resistance of the electric arc; the appropriate constant, or approximate constant, for an electric arc is the difference of potential between the two sides of the arc.⁴ However near the carbons approach without touching, this does not fall below a certain minimum value, and as the carbons are separated its value increases. In ordinary practice with continuous currents the potential of the electric arc may be taken as ranging from 35 to 45 volts. If the current in amperes be multiplied by the difference of potential in volts, and the product be divided by 746, we have the power used in the arc itself in horse-power, that is, the power effectively used in lighting. The mechanism of an electric lamp has two functions to perform, it has first to bring the carbons into contact and then part them, or simply part them if they are initially in contact when the light is started, or when it is accidentally extinguished (this is called striking the arc); it has also to bring the carbons together as they are consumed. The former function is always accomplished by an electromagnet or solenoid. In the electric candles, e.g., those of Jablonskoff, Rapieff, Wilde, or Siemens, the carbons are approximately parallel, and they burn down as does a candle,—the arc being forced to the ends of the carbons by the repulsion of the current in the carbons on the electric arc.⁵ In the ordinary arc lamps the carbons have their axes in the same line, and their approach or recession must be controlled by the current passing through, by the difference of potential, or by both combined. When the same current passes through a succession of lamps in series, it is clear that the regulation cannot be by the

¹ The application of incandescent lighting on a large scale has been thoroughly worked out in all its details by Edison. For a description of the whole system see *Engineering*, xxxiii. 225, 250, 305, 407.

² See for description of various semi-incandescent lamps.—JOEL: *Tel. Jour.*, vii. 864; *Electrician*, vi. 595. REYNIER: *Electrician*, ii. 88; *Tel. Jour.*, vi. 326. FONDAINE, 297; Shoobred, 38. WERDEMAN: *Engineer*, xlv. 312; Fontaine, 301; Shoobred, 39.

³ Edison, *Pap. Anal.*, 1867, 1868.

⁴ See for descriptions of various electric candles:—DR. MULLERS: Shoobred, 43. GATHEBOURN: *Tel. Jour.*, vii. 865. EITHEIM: *Engineer*, xlvii. 418. HOCKLEY: *Tel. Jour.*, vii. 220. JABLONSKOFF: *Engineering*, xxxi. 251, 300, 323; *Tel. Jour.*, vi. 10; Shoobred, 41; Fontaine, 307; Report from the Select Committee on Electric Lighting, 228; Schellen, 243. JAMON: *Tel. Jour.*, vii. 924; *Electrician*, v. 68; Fontaine, 81. RAFFERTY: *Tel. Jour.*, vii. 43; Shoobred, 44. WILDE: *Tel. Jour.*, vii. 40; Shoobred, 44; *Engineering*, xlvii. 365.

¹ See for descriptions of various incandescent lamps.—BROUHAAM and ANDRÉS: *Engineer*, xlix. 190; *Electrician*, iv. 213. EDISON: *Engineering*, xxxiii. 206, 407; *Tel. Jour.*, vii. 28, x. 440; *Electrician*, vi. 352. FOX (Sir G. JAMES): *Engineer*, li. 197; *Tel. Jour.*, ix. 87; *Electrician*, vii. 5. JABLONSKOFF: *Engineering*, xxxi. 391. KONS: *Electrician*, vii. 391; Fontaine, 292. MATHIE: *Engineering*, xxii. 618. NAPOLI: *Electrician*, vi. 138. SAWTHER-MANN: *Engineer*, xlvii. 6; *Tel. Jour.*, vii. 7; *Electrician*, ii. 100. STARR: *Electrician*, vi. 351. SWAN: *Tel. Jour.*, viii. 878; *Electrician*, vii. 218, 377.

² Thomson, *Tel. Jour.*, ix. 378.

current alone, as this is the same for all the lamps, and might be maintained constant by the adjustment of any one only of the lamps. When lamps are burned in series, it is essential that the difference of potential shall be an element in the control. This is done by using an electromagnet bound by fine wire so as to have a resistance of some hundreds of ohms, and connecting it to the two sides of the arc. In the Siemens differential lamp, and in some others, a potential or shunt coil and a current coil oppose each other, as the arc lengthens the current becomes less, and the potential greater, each acting to cause the carbons to approach. It will be seen that the possible combinations of mechanisms and electromagnets for adjusting an electric arc are endless, and so also are the patents for such combinations.¹ When an alternate current is used for an electric arc, the phenomena are much more complicated, owing to the difference of potential being a discontinuous function of the time. The difference of potential will be (say) 40 volts in one direction for a certain fraction less than half of the periodic time of the current, the current then entirely ceases, generally for a finite time, and is then reversed with a sudden reversal of difference of potential.² The work done in the arc is measured by the time integral of the product of difference of potential and current passing. A knowledge of neither the mean strength of the current, nor of the difference of potential, nor of both, gives the means of ascertaining the work done in an arc with alternate current. The only satisfactory electrical method is the quadrant electrometer suitably connected, and this is open to the objection that a considerable resistance must be introduced into the circuit.

Electric Light Measurements.—Under this head we content ourselves with a warning. A bare statement that an electric arc light is of so many candle power really conveys no accurate information at all. The light from an electric arc differs greatly in colour from that of a candle,³ a given arc light may have three thousand times as much red of a certain wave-length as a standard candle has of the same wave-length, but ten thousand times as much green light. Any one will admit that green light is not measurable in terms of red light; a mixture of red and green is not

measurable in terms of another mixture in which the proportions of the colours are wholly different. Again, the intensity of the light obtained from an arc light depends greatly on the direction in which it is viewed.⁴ Neither of these considerations applies in the same degree to incandescent lamps. (J. HO.)

LIGHTNING. See METEOROLOGY and THUNDER-STORMS.

LIGHTNING CONDUCTOR, or LIGHTNING ROD (*Paratonnerre, Blitzableiter*), is the name usually given to apparatus designed to protect buildings or ships from the destructive effects of lightning. The title, alike in English, French, and German, is misleading; for, when properly constructed, lightning rods serve rather to prevent the occurrence than to ward off the effects of a flash of lightning. Damping the enemy's powder would be a most efficient precaution against cannon-shot, but it would be very inappropriately termed fortification. When a conductor charged with electricity is brought near to another conductor connected with the earth, it induces on it a charge of the opposite kind of electricity. The result is an attractive force which tends to bring the conductors nearer to one another, and to augment the electric density on their opposed surfaces. When the density is sufficiently great, there is rupture of the dielectric (air) between the conductors, and the disruptive discharge takes place as an electric spark. If one of the conductors have projecting points or angles, the electric density is usually much greater at such places than over the rest of the surface. But, though the density is great at such places, the charge on them is usually small, and the discharge takes place in an almost continuous manner by a brush or glow. When, for instance, a large conductor, connected with an electric machine, is giving a rapid succession of bright sparks to a ball connected with the ground, the sparks cease as soon as a pointed wire, connected with the ground, is held in the vicinity of the conductor. No discharge is heard, but in the dark a faint glow is seen at the end of the wire, which continues as long as the machine is turned. Remove the wire and the sparks instantly recommence. This glow is known to sailors as St Elmo's (San Telmo's) fire, in old days Castor and Pollux (*Plin., H. N., ii. 37*). Suppose now one of the conductors to be a thundercloud, the other the surface of the earth, the discharge will usually take place between the places of greatest surface density, and it will in general be the more gradual as these are more pointed, and of less capacity. Hence Franklin's idea of furnishing buildings or other prominent objects with a projecting metal spike well connected with the ground, for the purpose of preventing a lightning discharge by substituting for it what is practically a continuous electric current.

To effect this object thoroughly, only three things are necessary:—(1) the points should so project from the building or ship, to be protected as to prevent any great development of electric density elsewhere than on themselves; (2) they should be effectually connected with the earth; (3) the connecting rod ought to be so good a conductor as not to be injured even by a powerful electric discharge.

The first of these conditions is realized by making the rod branch out to all the salient portions of the building or ship, and furnishing it with points projecting beyond each of them. No general rule can be laid down as to the extent of the region protected by a single point, though it may usually be assumed with safety that the region extends throughout a vertical cone whose vertex is at the point,

¹ See for descriptions of various arc lamps.—BROOKER: *Engineering*, xxi. 98; *Engineer*, xlix. 268; *Tel. Jour.*, viii. 114; *Electrician*, iv. 232. BRUSH: *Engineering*, xxxi. 55, 86, 128; *Engineer*, li. 15; *Tel. Jour.*, vi. 21; *Electrician*, li. 87; Fontaine, 45. CARON: *Engineering*, xxviii. 80. CHAMBERLAIN: *Engineering*, xxxii. 208; *Engineer*, xlix. 828; *Tel. Jour.*, viii. 131; *Electrician*, iv. 278, vi. 229. DE MERBAUX: *Engineering*, xxxi. 647, 650; Shoobred, 54. FONTAINE: Fontaine, 70. FOUCAULT and DUBOIS: Fontaine, 48; Schellen, 211. GAUTHIER: Fontaine, 38. GORDON: *Tel. Jour.*, viii. 597. GRAMER: *Tel. Jour.*, ix. 260; *Engineering*, xxxii. 172. GUICHET: *Engineer*, li. 848. *Tel. Jour.*, ix. 484; *Electrician*, vi. 878. HEDER: *Engineering*, xxxi. 393; *Electrician*, iv. 40, vi. 404; *Tel. Jour.*, ix. 418. HEINRICH: *Engineering*, xxxi. 154; *Tel. Jour.*, viii. 301, ix. 78; *Electrician*, li. 201. HICKLEY: *Tel. Jour.*, viii. 371. JASPER: *Engineering*, xxxi. 645; Fontaine, 40. KRUPE: *Engineer*, xlvii. 157; *Tel. Jour.*, vi. 103; *Electrician*, ii. 256. LAGASSAGNE and PETERS: Fontaine, 28. LONTY: Shoobred, 33; Fontaine, 69. MACKENZIE: *Engineering*, xxxi. 88. MAXIM: *Tel. Jour.*, viii. 417, ix. 144; Fontaine, 69. MOLENA and CHERIAU: *Tel. Jour.*, viii. 231. ORMS: *Tel. Jour.*, viii. 184. PILSER: *Engineering*, xxxi. 614, xxxii. 129; *Tel. Jour.*, viii. 419. RANNEY: *Engineering*, xlvii. 55; *Tel. Jour.*, vi. 60; Fontaine, 22. Shoobred, 84; *Report from the Select Committee on Electric Lighting*, 230. SCHREINER: *Tel. Jour.*, viii. 379. SEBRIN: Shoobred, 81; Fontaine, 58; Schellen, 218. STEINER: *Engineering*, xxxi. 278; *Tel. Jour.*, vi. 918, vii. 98; *Electrician*, li. 69. SCHILLER, 227; Fontaine, 68; Shoobred, 38. SOLER: *Engineering*, xxxi. 453. STEWART: *Tel. Jour.*, viii. 50, 115. THOMSON and HOUSTAT: *Engineer*, xlvii. 256; *Electrician*, li. 282; Fontaine, 67. TUCKER: *Electrician*, v. 80. WALLACE-FARMER: *Engineer*, xlvii. 265; Shoobred, 39; Fontaine, 83; *Report from the Select Committee on Electric Lighting*, 246. WATSON: *Engineering*, xxxi. 42; *Electrician*, vi. 248.

² Joubert, *Journal de Physique*, li. 297.

³ Abney, *Proc. Roy. Soc.*, 1878.

⁴ Allard, *Mémoire sur les phares électriques*, p. 13, Paris, 1881; *Proc. Acad. C. S.*, li. 130; Shoobred, 59.

and whose semivertical angle is about 45° . This is probably not true if the point be very high,—on the top of a tall chimney or tower, for instance. Objects not far from the base of such a protected tower, and within the cone just described, have occasionally been damaged by lightning.

The second condition is easily fulfilled in towns by connecting the lower end of the rod with the iron gas and water-mains, which form an excellent "earth," as it is technically called. Water-pipes, being usually joined with metallic-lead-washers, are preferable to gas-pipes, which are usually put together with white lead. This condition is also easy to secure in ships and in lighthouses, where large metal plates (in the case of a ship, the copper sheathing is precisely what is required) can easily be permanently immersed in sea-water. In country houses it is usually more difficult to obtain a proper earth. Plates and tubes of metal, of large surface, buried in ground which is permanently damp, form usually the best arrangement. A well makes a good earth, a carefully constructed water tank (of stone or cement) is not an earth at all.

The third condition, so far as experience can guide us, seems to be effectually realized by making the conductor throughout of iron rod of an inch in diameter, or of copper rod not less in diameter than $\frac{3}{16}$ of an inch. Such rods of equal length have nearly the same conducting power, and therefore would have equal amounts of heat developed in them by a given discharge. But if such a discharge took place, the copper would be heated much more than the iron, in consequence of its smaller mass per foot (the specific heat being approximately the same in the two materials). Hence iron is, in this respect, preferable to copper, if the conducting powers of the rods are equal. Another advantage possessed by the iron rod is that it is much less likely to be wilfully damaged or stolen. Against this may be set the objections that it is easily injured by rust, and is not nearly so flexible as the equivalent copper rod. Conductors are now usually made of wire-rope, so that the question of flexibility is no longer of serious importance; but when iron is used it should always be protected by zinc, *i. e.*, be what is absurdly called "galvanized." Many fantastic forms of lightning rods were devised in consequence of the old erroneous notion that their efficiency depended on their surface and not on their cross section. In reality all conductors of equal length, and of the same material, are equally efficient if their cross sections be equal.¹ Thus, instead of stating the diameter of a rod, we may speak of its weight per foot, and say that a copper conductor should weigh at least about half a pound, and an iron one at least two pounds and a half per foot,—provided the materials be of good conducting quality.

The points need not be very sharp, but they ought to be protected by a coating of platinum or other non-oxidizable metal. And they should be in a group of two or three at the end of each branch of the rod, lest one of them should be fused and impaired in efficiency by an accumulation of electricity so rapid as to make the silent continuous discharge impossible. Joints should be avoided as far as possible; where they are unavoidable they should be made, not by screws or brazing, but by means of a large mass of solder completely enveloping the ends to be connected.

Another point to be carefully attended to is that all large metallic bodies, such as lead or zinc roofing, metal tanks, &c., should be in good conducting connexion with the rod, so as to prevent discharges of electricity inside the ship or building. In many buildings we see the lightning rods

attached by means of glass or porcelain insulators, such as are employed for telegraph wires. This is a perfectly needless, expensive, and possibly dangerous practice.

The literature of this subject is very extensive, as may be seen from Ronald's *Catalogue of Works on Electricity*. The reader may also consult Anderson on *Lightning Conductors* (1880), and the *Report of the Lightning-Rod Conference* (1882). In the latter work will be found abstracts of many valuable papers, especially the reports on lightning-rods made to the French Academy by some of its most distinguished members, including Coulomb, Laplace, Poussin, Gay Lussac, Fresnel, Pouillet, Gagnard de la Tour, Regnault, &c. There will also be found hints about some of the most ludicrous devices employed by men ignorant of the laws of electrical phenomena. One of the most singular of these was the so-called "Repeller." A lightning-rod, in all respects sufficient, was wont to be capped by a piece of glass like a thick soda-water bottle, inverted upon its point. The effect of this could only have been to prevent the possibility of the silent discharge, to produce which is the proper function of the rod, and to make probable a lightning flash, just as if the rod had been terminated by a ball instead of a point. One of these dangerous monuments of ignorance was removed from a British lighthouse within the last ten years. In an Irish lighthouse, which was recently examined after suffering serious damage, it was found that the lower end of the lightning-rod was jammed into the solid rock—a truly original form of "earth."

In 1870 Clerk Maxwell suggested to the British Association the idea (based on Faraday's experiments) of protecting a building from the effects of lightning by surrounding it with a sort of cage of rods or stout wire. Here an "earth" would not be absolutely required. The present writer had some months previously suggested the same idea in a Report to the Board of Northern Lights. It is possible, though not certain, that this form of defence might be useful against globe-lightning, which undoubtedly occurs, and against which ordinary lightning-rods would probably be of little use.

These brief remarks contain all that is yet known to be necessary to the complete solution of an important practical problem about which many treatises have been written. (P. G. T.)

LIGNITE. See COAL.

LIGNUM VITÆ. See GUAIACUM.

LIGUORI, LIGUORIANISM. The name Liguorianism has been popularly given in the present century to a particular school of moral and devotional theology in the Roman Catholic Church by the controversial opponents of that school, whether themselves Roman Catholics or not. It is derived from the name of one of its principal and most influential exponents, Alfonso Maria de' Liguori, a theologian, saint, and doctor of the Roman Church. In strictness, the term is not accurate, for Liguori was in no sense the founder of the school, nor did he innovate upon, develop, or exaggerate its principles and maxims. He was simply a fair representative of the national type of piety of Italian devotees in his day; and, as a casuist, he was a diligent compiler, whose avowed design was to take a middle course between the two principal varieties of teaching in moral theology current in his own time, avoiding their extremes of severity or laxity. His own words, in the preface to his *Homo Apostolicus*, a work intended for the guidance of priests in hearing confession, explain clearly the intention of his bulkier treatise, the *Theologia Moralitatis*. He says—"When compiling that work, I spent the labour of fifteen years in pursuing and weighing the teaching of very many writers whom I examined, some of whom I found more lenient than is just; . . . while I found others who, strongly disliking such indulgence, fell into the other extreme of excessive rigour. And this was my principal task, to select from such a mass of opinions those decisions which, on the one hand, should uphold the obedience due to the precepts of God and of the church, and on the other should not add burdens which God has not imposed, by hiding every one to that perfection which, through human weakness, is morally impossible to the general body of believers." A brief glance at the names of those casuists whom he cites most frequently, as Covarruvias, Soto, Lessius, Vasquez, Bonacina, the doctors of Salamanca, Sanchez, Diana, &c., shows them to belong to the hundred years between 1580 and 1680, and

¹ Some curious modifications of this statement are introduced when we deal with magnetisable metals, but they are unimportant in practice.

therefore to the period of Jesuit predominance in moral theology, and of the prevalence of those maxims which Pascal lashed in the *Provinciales*, many of which were soon after condemned by Pope Innocent XI. in 1679. But, as Liguori embodies also in his materials the casuistical authors of the succeeding century, who were taught some caution by those mislapses of their predecessors, his works represent the final stage of casuistry in what is accounted a purified and moderate form, and have a yet greater importance, in that they have been accorded an official approval and authorization from the highest authorities of the Roman Catholic Church, such as those of no previous casuist of the post-Reformation era can allage. They are fully sanctioned, encouraged, and recommended for general use amongst the Roman Catholic clergy, and in fact only just fall short of being actually enjoined. Consequently they themselves, and the works based on them by Scavini and Gaume, as also the kindred manual of Gury, are all but universally found in use, and it is thus easy to learn from them what is now the accredited moral theology prevalent throughout the Latin obedience. So much being premised, we may now turn to the life of Liguori himself, and thence to the analysis of the system which he expounds.

Alfonso Maria de' Liguori, son of Giuseppe de' Liguori, a Neapolitan noble, and of Anna Cavaleri de' Brindisi, his wife, was born at Marianella, near Naples, on September 27, 1696. He was educated chiefly at home, though he attended an Oratorian school at Naples for a time, and, as his father desired that he should rise to office in the magistracy, he was especially directed to the study of jurisprudence, both civil and canonical. He took the degree of doctor in this faculty in January 1713, being then little more than sixteen years old. He was called to the bar in due course, and obtained considerable practice, while his biographers dwell much on the high moral tone of the rules he laid down for his guidance in the conduct of professional business. The loss of an important suit in which he was engaged as counsel for a Neapolitan noble against the grand-duke of Tuscany, and in which he had entirely mistaken the force of a leading document, so mortified him that, acting on a temper already disposed towards the monastic life, it induced his withdrawal from the legal profession, which he never resumed after this defeat. He soon adopted the ecclesiastical dress as a candidate for orders, which he received in December 1724, when he entered as a novice into the Congregation of Missions, being ordained priest in December 1726.

He soon became popular as a preacher and as a confessor, obtaining much influence in Naples and its vicinity. In 1732 he founded the "Congregation of the Most Holy Redeemer," usually known as Redemptorists, or, as they are often named, Liguorians, whose special object is the religious instruction of the rural poor and other uneducated classes, establishing the first house of the society, in the form of much opposition, at the little town of Scala, about 8 miles from Salerno. The headquarters were transferred somewhat later to Chieti, and in 1743 to Nocera dei Pagani, which is still the chief house. The confirmation of the rule and institute was obtained from Benedict XIV. in February 1749, and in the following year Liguori, who had previously made some minor literary ventures, published one of his most famous and popular books, *Le Glorie di Maria*, a book intended to promote the cultus of the Blessed Virgin; and in 1753 he issued his yet more celebrated *Moral Theology*, dedicating it to Pope Benedict XIV., expressly as a "via media" treatise. An Italian version of this book, somewhat abridged, recast, and adapted for the use of the clergy, was his next task; and, on this shorter treatise becoming

popular, and a demand for it arising outside of Italy, he translated it into Latin, and issued it in 1766 as the *Homo Apostolicus*.

In 1762, being then sixty-six years of age, he accepted the bishopric of Sant'Agata dei Goti, a small town in the province of Benevento, at the express desire of the pope (though he had several years before refused the archbishopric of Palermo, offered him by the king of Naples), and by a very unusual concession was permitted to retain his superiority of the Redemptorists, governing them by means of a vicar-general. He worked diligently in this sphere of labour for thirteen years, busying himself with practical reforms of various kinds in his diocese, notably in trying to raise the standard of clerical life and work, while not intermitting either his literary pursuits or his efforts to promote the growth of his Redemptorist institute. In 1776, being then seventy-nine years of age, he obtained permission from Pius VI. to resign his bishopric, on the plea of enfeebled health, and retired to the Redemptorist house at Nocera dei Pagani, where he died August 1, 1787, aged nearly ninety-one. He was decreed the rank of "Venerable" very speedily, being so named by Pius VI. in 1796, was beatified by Pius VII. in 1816, canonized by Gregory XVI. in 1839, and finally declared a "Doctor of the Church" by Pius IX., March 11, 1871. He is one of the most copious of the later Roman theologians, and his productiveness extended over a period of thirty years, from the issue of his *Visita to the Blessed Sacrament* in 1747 till the appearance of no fewer than eleven treatises in 1777; but his only writings necessary to be added here to those already named are his treatises *De Usu Moderato Opinionis Probabilis*, 1754, recast and reissued in 1766, *Præcis Confessariorum*, 1766; six apologies in defence of his views on probabilism and of his *Moral Theology*, in the same year, followed by three more in 1768; *Verità della Fede*, against Helvetius and the deists, 1767; *Storia della Breve*, directed chiefly against the Jansenists and Molinists, 1772; *Dissertationi teologiche morali*, 1772; and *Industria pro suprema Pontificia potestate, adversus Justinum Febronium*, in the same year.

He was a man of naturally amiable and gentle disposition, ascetic and self-denying in his personal habits, indefatigably diligent in many forms of activity, and of more than respectable abilities, though with the emotional side of his character in greater relief than its intellectual side. He was learned, as learning was understood amongst the Italian clergy of the 18th century, though altogether lacking in critical faculty, whence he is quite untrustworthy as a controversialist, not only as habitually quoting spurious or interpolated authorities, but by adding matter of his own to amplify genuine quotations which fall short of proving his case. In estimating the nature of his moral teaching, not only have these personal characteristics to be steadily kept in mind, but also the fact that his life exactly synchronizes with that epoch of European history which was the seed-time of the Revolution, and when, owing to reaction from the fervid theological controversies of the 16th and 17th centuries, a general languor, coldness, and indifference towards religious questions reigned in all parts of Western Christendom. It was Liguori's firm belief that only the most lenient and gentle treatment could win back the alienated laity; and consequently, though he professed to steer a middle course between errors of laxity and severity in moral teaching, and fully believed himself to have done so, yet in fact such a treatment was impossible to one who viewed the question as he did. For, while he regarded errors on the side of laxity as pardonable mistakes committed through excess of zeal in winning over penitents, contrariwise he looked on the stricter method of the rigorists, who upheld a loftier

morality, as not merely inexpedient, but as positively and intentionally evil, as designed to make religion odious by making it impossible, and so to prepare the way for the triumph of unbelief. He identified all teaching of the sort with Jansenism, and Jansenism, from its resistance to various pontifical decrees, seemed to him all but equivalent to atheism.

Hence the opinions of rigorist theologians find almost no place in his writings, save for the purpose of censure, since he did not regard them as authorities to be relied on; and accordingly the line he draws is not, what he probably thought it, an intermediate one between rigorism and laxity, but between a greater and a lesser degree of laxity, depending on the working of the principle known as "Probabilism." The meaning of this principle (due to the scholastic form of the Aristotelian dialectic, and thus visible in germ as early as St Thomas Aquinas, though not taking final shape till the writings of Medina, Valencia, Vasquez, and others, mainly, but not exclusively, Jesuits, at the close of the 16th century) is simply this.—when a doubt arises as to the binding force of some divine or human precept in any given case, it is permissible to abandon the opinion in favour of obedience to the law—technically known as the "safe" (*tuta*) opinion—for that which favours non-compliance, provided this laxer opinion be "probable." And by "probable" is meant any judgment or opinion based on some reasonable grounds, though with some doubt that the opposite view is perhaps the true one (Gury, *Theol. Mor.*, vol. i. n. 51). It may be probable in two chief ways,—intrinsically, because of reasons drawn from the nature of the thing itself, or extrinsically, because supported by one or more theologians of repute; and its degree of probability may vary according to a variety of conditions. Casuists are divided into six classes according to their mode of regarding probability.—(1) Rigorists, who lay down that the safer way, that of obedience to the law, is always to be followed; (2) Mitigated Rigorists, or "Tutorists," who holding that the law is always the safer and better way, yet allow that an opinion of the highest intrinsic probability in favour of liberty may sometimes be followed; (3) Probabiliorists, who hold that the law is always to be obeyed unless an opinion clearly very probable (*probabilior*) is opposed to it; (4) Equiprobabilists, who teach that in a balance of opinions the less safe opinion may be lawfully followed, provided it be as probable, or nearly as probable, as its opposite; (5) Moderate Probabilists, according to whom it is lawful to follow the less safe and somewhat less probable opinion, provided it have some degree of real probability, even if the opposite opinion be clearly more probable; (6) Laxists, who hold that even slightly probable opinions may be followed; but, as they were condemned by Innocent XI, they no longer exist as an avowed school, but are still latent under classes 4 and 5.

On further examination, it appears that the right of judging of the *intrinsic* probability of an opinion is restricted to persons of considerable learning, and specially versed in moral theology, since they alone can know that there is not any certain argument in opposition. All other inquirers must fall back on *extrinsic* probability, that is, on what may be called "counsel's opinions." And, in forming a judgment on this basis, the following rules are laid down by F. Gury:—a moderately educated person may accept as probable any opinion which he finds asserted by distinguished theologians of the present day, and may follow even a single author of repute, though teaching contrary to the commonly received view, provided he brings forward some fresh argument, and can urge reasonable pleas against former solutions; while an ignorant man may take the word of any person whom he thinks trustworthy, able, and

learned, that a particular opinion is probable (*Theol. Mor.*, vol. i. n. 54). Some classes of things are, however, excluded by Roman casuists from the operation of this principle; as, for example, all questions relating to matters of faith, in which the very highest degree of probability is not sufficient to excuse from following the safe opinion, which is that of the Roman Church. Liguori's own position is that of an equiprobabilist, and he therefore, as a rule, leans to the laxer side.

Before proceeding to illustrate the exact nature of his teaching by extracts from his works, it is desirable to ascertain what degree of authority attaches to those works in virtue of the position now accorded to him. In the first place, one of the earliest steps in the process of canonization is a strict review of every writing of the candidate proposed, whether published or unpublished. Every single proposition therein must be separately considered, and be judged on its own merits, without taking the author's probable intention into account, and if even one passage be found which fails to stand this test, as containing any moral or theological error, the process is stopped at once, unless proof be adduced that the author had in his lifetime formally and fully retracted the erroneous opinion. But a decree of the Congregation of Rites, confirmed by Pius VII. in 1803, declared that in none of the writings of Alfonso de Liguori was anything found meriting censure, and the testimony of Artico, bishop of Asti, and prince-bishop of the papal household, is that the examination had been unusually severe, that Liguori's system of morality had been discussed more than twenty times, and that the approval of the congregation was perfectly unanimous. Next, in the year 1831, Cardinal Rohan-Chabot, archbishop of Besançon, submitted a case to the cardinal grand penitentiary, desiring to know, whereas the teaching of Liguori's *Moral Theology* was resisted by some persons in his diocese, as too lax, dangerous to salvation, and contrary to the moral law, whether a professor of theology might safely follow and teach the opinions in that work, and further, whether a confessor should be molested for following those opinions in the confessional, solely on the ground that they had been pronounced free from censure by the apostolic see, and without having examined them independently himself. To the former of these questions an affirmative reply was given, to the latter a negative one. Thirdly, in the bull of canonization, issued by Gregory XVI. in 1839, the entire absence of error in Liguori's writings is once more asserted.

So far, no more is implied than the entire orthodoxy and moral soundness of Liguori's writings, vouched for to the ordinary Roman Catholic by the fact of his canonization. And, though the liberty is thereby taken away of directly censuring any proposition in the writings of a saint as doctrinally or morally untenable, yet there is no precise obligation to follow all things contained therein. It is still lawful to challenge the opinions of a saint, if it be done modestly and with the production of strong reasons (Bened. XIV., *De Canoniz.*, ii. 32, 12); but this liberty is very seriously abridged if the saint be also a "Doctor of the Church." For the meaning of that title is that the person who bears it is one who has not merely transmitted the teaching of the church to others, but has taught the church itself (Bened. XIV., *De Canoniz.*, ii. xi. 11), and whose doctrine has consequently been generally followed and authorized by the church. The number of these doctors of the church is very small; and, in the special case of Liguori, he is not only the latest so named, but the only post-medieval casuist who has yet been canonized. Accordingly, it is not merely permissible, as heretofore, to follow his teaching, but it is now clothed with so high a degree of authority that it becomes matter of grave doubt

whether even such a modified expression of dissent from his teaching as occurs in the *Apologia* of Cardinal Newman in 1894 be now feasible without risk of censure. For the letters apostolic of Pius IX declare that the works of Liguori may be used publicly in the same manner as the writings of other doctors of the church, such as Augustine, Gregory the Great, and Thomas Aquinas, with, however, this notable difference that, whereas the teaching of those earlier doctors is necessarily qualified and conditioned by the subsequent development of theology, and by the successive glosses which they have received, on the other hand, Liguori's recent date makes him the sole authoritative interpreter of all moral theologians earlier than himself, while no writer has yet appeared to modify authoritatively, much less to supersede, his own moral teaching.

It may seem, at first sight, that a great advantage is gained by having thus a standard text-book on morals, even if some exceptions may be taken to its rulings in certain cases, because it may be expected to check serious divergency of opinion, and to put, indirectly at least, a high ethical ideal before the body of religious teachers. This, however, can be the case only when such a text-book expressly repudiates the principle of probabilism, and so comes to be ranked amongst rigorist works. For once probabilism is conceded as part of the system, as is the case with Liguori, then every opinion not officially condemned by authority, which is set down in the text-book itself, and is fortified with the names of any casuists of repute, becomes thereby probable and sanctioned, even though it be not the one professed by Liguori himself. Thus it may freely be followed by any priest in the confessional; and, what is yet more startling, it is the common and preferable doctrine that a penitent in confession can require absolution to be given him as a right, if he claim to have followed a probable opinion as to the act involved, even though not only the opposite opinion may be the more probable in the confessor's judgment, but that of the penitent seem absolutely false, and the confessor is therefore bound *sub gravi* to absolve in such a case (*Lig. Theol. Mor.*, v. 605); nor is it necessary that the opinion which the penitent advances should really convince or satisfy his own conscience. It is enough that it stands in the books, and is citable. Accordingly, the only practical effect of such a text-book as Liguori's is to undermine all rigorist propositions, and to make tenable every lax proposition, except the very few which have been specifically condemned.

As regards Liguori himself, his usual method is to begin with taking very high ground, and to state in unexceptionable terms the moral obligation of the precept with which he is concerned, but then to evacuate it of all real force by exceptions and qualifications. That such was felt to be the case, even in the relaxed society of his own day, appears from the frequency with which, even before his death, his moral teaching was impugned in Italy and France as of dangerous consequences, and from the number of apologies he was obliged to put forward in its defence.

He lays down broad general propositions, such, for example, as that all voluntary departure from the divine rule, whether of human and natural law or of revealed law, is sin (*Theol. Mor.*, ii. 1, 1); that nearly all sins against the decalogue are mortal sin (*Ibid.*, ii. 52, 2); that all sins, whether mortal or venial, deserve punishment (*Ibid.*, ii. 51, 1, 2); and, specifically, that all lying and falsehood is a breach of one precept of the decalogue (*Ibid.*, vi. 1, *proem*), and all theft and dishonesty a breach of another (*Ibid.*, iv. 518); but the favourable impression which such unimpeachable rulings produce is not maintained on further inquiry.

In the first place, he lays down that, to make any act sinful, three conditions must be fulfilled:—(1) it must be

done with consent of the will; (2) it must be free, that is, it must be in the power of the will to do it or leave it undone; (3) there must be intellectual consciousness (*advertentia*) of its evil nature. These look specious enough, and against the first no objection can be raised. But Liguori then alleges that violent gusts of passion or desire, which disturb the reason, and take away liberty of action, sometimes excuse from sin (*Ibid.*, ii. 1, 2). He is not speaking of actual insanity, which is not under consideration, and he adds that evil acts done by a drunken person are either not sinful at all, or are at most venial sins (*Ibid.*, ii. 1, 4), because the effect cannot be more sinful than the cause. And as to the degree of advertence necessary as a condition of sin, he first mentions the stricter view, that actual and immediate attention to the nature of the act is not required, but that a virtual knowledge of its character suffices, by which a man might reasonably be expected to recognize it, since otherwise all evil-doers who are blinded by their passions, or by a long course of malpractices, may go on taking no notice, and continue to commit sins with moral impunity. He then states the laxer and commoner view, that some direct advertence of the sinful nature of the act is necessary to constitute sin in doing it, and proceeds to reconcile these two opinions by ruling that voluntary ignorance, whether due to conscious neglect, to deliberate following of passion, to a course of evil habit, or to omission of the degree of consideration which the act demands, does not excuse from sin; but that all other forms of it do acquit the offender. The obscurity inseparable from some of these qualifications complicates a sufficiently simple matter, and in any case the doubter is at liberty to fall back on the laxer opinion. But there is one exception;—unbelievers and heretics cannot plead ignorance as their excuse. All their errors, of whatever kind, are imputed to them as sin (*Ibid.*, ii. 1, 4). A further difficulty is created by the distinction made between mortal and venial sins, and by the inferences drawn from this distinction. "A mortal sin is that which, by reason of its gravity, dissolves grace and friendship with God, and merits eternal punishment. It is called mortal, because it takes away the principle of spiritual life, that is, habitual grace, and brings death on the soul. A venial sin is that which, by reason of its slightness, does not take away grace and friendship, though it abates the warmth of charity, and deserves temporal punishment. It is called venial, because, without damage to the principle of spiritual life, that is, grace, it brings on the soul an easily curable weakness, and easily obtains pardon" (*Ibid.*, ii. 51). This seems at first merely a recognition of the broad practical distinction between serious and trifling offences acknowledged by every sound ethical thinker and by every civilized penal code. But its consequences go much further, for in the Roman system of casuistry the aim is as a rule to attenuate mortal sins into venial ones; while these latter are regarded as of such little moment as scarcely to deserve the very name of sin. This appears from the fact that, whereas the canon (xxi.) *Omne utriusque sexus fidelis* of the council of Lateran (1515), which first made private confession compulsory, enjoins the confession of all one's sins at least yearly, on the other hand, the council of Trent (Sess. xiv. c. 5) lays down that only mortal sins need be so disclosed, while venial sins, though they may be named in confession, according to the practice of devout persons, can be passed over in silence without any fault. And Liguori gives his own sanction to the proposition that a Christian does not sin gravely who proposes to commit *every one* of the venial sins (*Theol. Mor.*, v. 1, 12). Such being the light estimate of these sins, it might be fairly supposed that great care would be taken to mark them off so clearly from mortal sins that even the least instructed conscience could not

confuse them with each other. But every sin which, considered in itself, is mortal, becomes venial if any one of these three conditions be absent—full advertence and deliberation; entire consent; for the most part, gravity of the subject matter. Insufficient deliberation may be known in three ways.—imperfect consciousness of the sinfulness of the act, as if one were half asleep, subsequent regret, and a conviction that you would not have done the act had you fully apprehended it, such disturbance, through passion, alarm, or distraction, as to confuse the sense of what you were doing. Imperfect consent is established by the presence of a doubt in any one's mind whether he did really consent; by the habitual disposition being that of regarding mortal sin as a worse evil than death; by consciousness of having proceeded very timidly and hesitatingly in the action, by being half asleep, so as to be only doubtfully conscious, and being of opinion that the act would not have been done in case of full possession of the senses. And gravity of the subject matter is to be decided, not merely on the merits of the thing in itself, but in its relation to the end proposed by the agent. If it make but little for this end, it is trifling; if much, then it becomes serious (*Theol. Mor.*, ii. 54, 55, 56).

It is obvious that each of these subdivided qualifications admits of indefinite hair-splitting, and so that the security apparently provided by the general distinction between mortal and venial sins is elusive. It is true that there are also causes which will raise a venial sin to the rank of mortal, but the ascending process is more uncertain and difficult than the descending one. A venial sin, committed deliberately as a stepping-stone to a mortal sin, is to be judged in respect of this its object, and so becomes mortal. A venial sin, so passionately clung to as to make its votary ready to commit a mortal sin rather than forego its indulgence, also becomes mortal. But in neither of these cases is it necessary to confess the venial sin, only the mortal sin to which it has led up. The third mode of a venial sin becoming mortal is when it is committed with the formal and express purpose of disobedience to a superior, or to a precept, just because it is a precept. And in this case alone, because of the supreme place given to obedience in the Roman system, wherein it is not only the first and highest of virtues, but practically almost the only one insisted on for all, there is no manner of withdrawal from the category of mortal sins (*Theol. Mor.*, ii. 59, 60, 61).

So far, only the general principles on which Liguori's system is based have been explained. It next remains to exhibit their practical application, both as regards his own statements and also as regards the opinions of other casuists which, though not accepted by himself, he yet embodies without censure in his work, thereby giving them the character and sanction of probability. It will simplify the inquiry to limit it mainly, though not exclusively, to the teaching on falsehood and theft.

Both of these are declared by Liguori to be sins of grave character, and in regard to the former he cites, amongst other authoritative condemnations, these words of Pope Innocent III: "Not even to defend our life is it lawful to speak falsely." He adds that persons who are being lawfully questioned by such as have a right to interrogate, as judges in court, or a priest in the confessional, are bound to disclose truly all that they know of the matter inquired into. Those who are questioned by such as have no right to interrogate them, or are questioned irregularly by lawful authority, are not bound to communicate their knowledge, and may set aside and avoid such questioning by any lawful means—such means however, not including falsehood, nor answers made with mental reservation, making the words actually spoken false, this latter mode of evasion having been formally condemned by Innocent XI. in 1679, though it was permitted by the casuists of the immediately preceding period. This is all tenable enough, but its apparent force is only reduced by a little argument.

In the first place, he distinguishes amphibology or equivocation from mental reservation, and names three varieties of equivocation: (1) that of a word having two quite different senses, as *elo* in Latin means to "visit" and to "fly,"—to which may be added the frequent English ambiguity of two distinct words having the same sound, as *air* and *heir*, (2) a sentence having two main meanings, as "This

book is Peter's," which may signify his ownership or his authorship, (3) that of words having two senses, one more common than the other, or one literal and the other metaphorical. The example he gives of this last form is the phrase "I say No," uttered by a person who wishes to conceal something as to which he is questioned. The words seem to his hearer to denote express denial of the fact, the meaning in which he uses them is merely "I utter the word 'No,'" this sentence being complete in itself. "It is certain," adds Liguori, "and the common opinion of all, that it is lawful for a just cause to use equivocation in the manners described, and to confine it with an oath." And the reason is because we do not thus deceive our neighbour, but for a just cause permit him to deceive himself, and, besides, we are not bound, if there be a just cause, to speak so that others may understand. And any honest object for retaining any good things that are useful to our body or spirit may be a just cause" (*Theol. Mor.*, iv. 151).

But suppose that it is impossible to allege a just cause, is it then mortal sin to swear with such equivocation? Some of the stricter casuists say so, but Liguori sides with the laxists, and declares it merely venial, except in a court of law or in formal contracts,—alleging that, save in these two cases, any reasonable cause, such as desire to be quit of troublesome and irregular questioning, is sufficient to mitigate the sin. He adds, however, two cautions,—that a more serious cause is required to justify equivocation with an oath than without one, and that, in proportion as the equivocal words employed give greater occasion for mistake, a graver cause is required for their proper use, a qualification instantly modified by the next clause, which lays down that, when words which are in themselves equivocal, having two equally valid meanings, are used, then they give little or no cause for error, and may be used on the very lightest grounds.

Next, as to mental reservation, or "restriction," which is the technical name that was expressly condemned in three propositions by Innocent XI., forbidding it in all cases. According to the analogy of all prohibitory laws, this general prohibition of the genus should include prohibition of all the species also. But the casuists, unable to oppose direct resistance to the papal decree, have turned its flank by averring that the prohibition is unknown in 1679. They have not availed mental restriction into two main heads, the first of which, absolute or "pure" mental restriction (by which is meant such reservation as cannot possibly be observed by the hearer, or conjectured from the attendant circumstances), is always illicit, whether with or without an oath. But "non-pure" mental restriction, which is such as may possibly be observed and inferred from attending circumstances, such as an inaudible whisper, or a qualifying gesture) does not, they allege, fall under the ban of Innocent XI., and is always lawful for a just cause. The reason of this opinion is that, if it were not permissible to use non-pure mental restriction, there would be no manner of concealing a secret, which one could not disclose without loss or inconvenience, which would be as hurtful as lying to human intercourse. And therefore the condemnation passed by the pope on mental restriction is rightly to be understood of a restriction taken absolutely and strictly, for that alone can be called true mental restriction which takes place in the mind alone, and so remains hidden, and can in no way be recognized from external circumstances" (*Theol. Mor.*, iv. 152). And the following illustrations are supplied. (1) A confessor may affirm with an oath that he is ignorant of a crime which he has heard in confession, secretly meaning thereby that he is ignorant of it as a mere man, though not as a minister of religion. (2) An accused or a witness, if irregularly questioned by the judge in court, may swear that he knows nothing of a crime which he does in fact know of, understanding thereby that he does not know it so as to be legally bound to answer or depose concerning it. Thus when the interrogation of the judge is in, and the answer is lawfully questioned is bound to obedience, and barred from all equivocation. But this safeguard is at once fatally weakened by the further provisions that, if the act be not a crime in the witness's opinion, he need not disclose it, and that if the crime be altogether hidden (4), where only the criminal himself and the witness know the facts, the witness is not merely permitted, he is actually bound, to say that the accused did not commit it. And the accused is equally free to do so, unless there be already "half-full" proof against him, because, in the absence of such a degree of presumption, the judge has no legitimate right to question him as to his guilt. Those who have deceived the court by such sworn equivocation are, Liguori rules, entitled to absolution without the declaration of the truth being imposed as a condition. (3) A needy man, who has made

¹ I find in this teaching is the maxim laid down in another place, that it is lawful to procure the giving of perjury, provided "it be for a great interest in employing perjury to expose the fraud of another person in order to obtain your own rights" (*Theol. Mor.*, iii. 8, 77), with which may be coupled the permission for satutors to offer and for judges to take bribes for expediting causes, so long as the bribing is not expressly for delivering false judgment (*Ibid.*, v. 190, 212).

away, for his maintenance, with property due to his creditors, may affirm to the judge that he has nothing (4) A witness asked by the judge whether he has had any conversation with the accused may deny it, meaning that he has not talked with him so as to co-operate in the crime. (5) An adulterer, questioned by her husband as to her guilt, may deny it in any of these four ways. (a) that she has not broken the marriage-to, because it is not voided by adultery; (b) if she have gone to confession, she may say that she is innocent of the crime, because it has been remitted in confession; (c) that she has not committed adultery, using the word in its frequent Biblical sense of "violence"; (d) that she has not committed it so as to be bound to tell him of it (*Theol. Mor.*, iv. 163-162).

Promises are no safer than omissions under this code. As usual with Liguori, a broad statement of their binding character is prefixed to the qualifications which leave nothing but the outer shell remaining. For we are told (a) that "the whole obligation is commonly understood as depending on the intentions of the promisor, and not binding unless that be confirmed with an oath or a formal document, in the absence of which it may be considered a mistake or a jest"; and (b) that "it is certain that every promise, even an accepted one, does not bind, if after the date of the promise it becomes impossible, or very hurtful, or unlawful, or useless, and, generally speaking, when there has been a serious change of circumstances, which, if foreseen, would have prevented the promise, such a promise is always presumed to have been made under some such tacit condition" (*Theol. Mor.*, iv. 720).

Theft is treated in a very similar fashion. A broad general rule is laid down as to its sinfulness, and this is at once traversed by the following doctrine: "It is certain that a man who in an extreme necessity may pilfer other people's goods, especially to relieve himself from such necessity. So the doctors in common say, agreeing with St. Thomas." Extreme necessity is defined as meaning lack of loss of life, or of some limb or other important bodily member, peril of perpetual captivity, or of any serious disease or discredit. And Liguori, contradicting the stricter casuists, includes under the same heading the case of a man of rank ashamed to work or to beg, who then lawfully steal to maintain himself. Then the case is put whether a poor man in extreme need is free to steal before asking. One ignorant lays down that it is a mortal sin to do so, because no man can be held to be in an extreme necessity who can get what he wants by asking. But the laxer casuists rule that, though he is bound to ask first, he sins only venially by omitting to do so; and Ignatius takes it upon himself by saying that the robber sins mortally if he takes it not absolutely necessary to relieve his want, but that, if he does so need it that the owner, if aware of the fact, would be bound by the laws of charity to give it him, then he does not sin even venially by stealing it, because he has in that case an absolute right (*Theol. Mor.*, iv. 580).

Some of these rulings are convolved so as to evade the condemnation passed by Innocent XI. on the proposition that "it is allowable to steal, not only in extreme necessity, but also in grave necessity." But a more direct conflict with the papal ruling appears in respect of another censured proposition, that "men and women servants may secretly pilfer from their employers to compensate themselves for their work, which they account as of more value than the wages they receive." This is explicit enough, but it is set once and for all by the casuists, who allege that the rule holds good only in the case of a servant who has of his free will contracted to accept a low salary, as he thereby binds himself from compensation, but if he has made the bargain under any sort of constraint, as, for instance, being in great poverty, and thus glad to take any situation, he is at liberty to steal to the amount of what he considers his just additional wages. Some casuists do, indeed, question the servant's right to be judge and assessor in his own cause, but the point is ruled practically in his favour (*Theol. Mor.*, iv. 523-524). Again, casuists may pilfer such eatables and drinkables as are not locked up, provided they do so for their own consumption, and not to sell out of doors, and so long as each such theft is singly trifling (*Ibid.*, iv. 54). Even when restitution is enjoined, there is a notable provision in favour of the thief, who is to ascertain who it is he has robbed, he is to make restitution in one or other of certain ways, one of which is that if he be poor he may apply the proceeds of the theft to himself or to his family (*Prax. Confess.*, ii. 44).

In addition to these glosses on the decalogue, there is one element of doubtfulness introduced into nearly all questions of theft, which is, as to the "gravity of matter" constituting the offence mortal or venial according to the degree of this factor, and a comparison of the various places where Liguori employs the term "gravitas materiae" shows that in all cases where numerical expression can apply he means *quantity*. Accordingly, he is in common with many other casuists, concerned with the degree of guilt, depending, as a rule, on the amount stolen (*Theol. Mor.*, iv. 523-528).

A few brief citations from other decisions will show that the same principles applied to questions of lying and theft extend to the remaining forms of sin. (1) A man of high position may lawfully kill any one who attempts to slap his face, if there be no other way of warding off the insult (*Theol. Mor.*, iv. 85). (2) He who kills

A, meaning to kill B, is not bound to make compensation, because the homicide is casual and inadvertent as regards A; and similarly if a man burns down the house of his friend, meaning to burn that of an enemy (*Ibid.*, iv. 628, 626). (3) Though we are bound to love our enemies, we are not bound to salute them, to speak to them, to restrain them, to comfort them in any trouble, to receive them into our house, or to hold any kind of familiar intercourse with them (*Ibid.*, v. 3, 28). (4) A servant may help his master, by lifting him on his shoulders, or by providing him with a ladder, to enter a house, even forcibly, for immoral purposes, for the act is innocent and colourless in itself, may even an act of charity or good-will, and the servant is not responsible for the subsequent conduct of his employer (*Ibid.*, iii. 8, 6).

For all practical purposes, the probabilism which is at the base of all this casuistical method, and which is simply the substitution of an external authority for the dictates of conscience, is now in absolute possession throughout the Latin obedience, having finally conquered the resistance it has encountered at intervals since its first formulation as a working theory. Although it owes its chief development to the Jesuits, yet some of its ablest opponents were members of that company, such as Comitolus, Rebellus, Gubert, and even some of the generals, Mario Vicioli and Trino Gonzalez; while the Solonians and the Dominicans were also engaged in the controversy against its upholders, and in censuring the teaching of several of Liguori's favourite authorities, such as Lessius, Escobar, Tamburini, Baumy, Viva, Busembeur, and Diana.

Authorities.—Gottlieb, *Vita di Liguori*, Roma, 1816. *Life of St. Alfonso Maria de Liguori*, edited by F. W. Faber, 4 vols., London, 1848-49. *Theologia Moralis S. Alphonsi de Liguori*, 10 vols., Mechlin, 1848. *Summa Apostolica*, 3 vols., Mechlin, 1849. Scavini, *Theologia Moralis Universalis*, 4 vols., Firenze, 1856. Gury, *Compendium Theologiae Moralis*, 3 vols., Verona, 1859, and *Compendium Theologiae*, 2 vols., Lugano, 1864. *The Provincial Letters of Pascal*, edited by John de Soyria, Cambridge, 1861. Articles "Probabilism" in *Richard and Grand*, *Encyclopedia Sacra*, vol. xix., 20 vols., Paris, 1852-71. Busembeur, *Morale Christiane*, 3 vols., Toulouse, 1748 (the best of the anti-probabilist treatises). Morley, *Moral and Developmental Theology of the Church of Rome*, according to the Teaching of St. Alfonso de Liguori, London, 1861. *Chicago of Archdeacon Sandars*, in 1861. (R. F. L.)

LIGURIA, in ancient geography, was the name given to a portion of the north-west of Italy, including the districts, on both sides of the Maritime Alps and the Apennines, which border on the Tyrrhenian Sea from the frontiers of Gaul to those of Etruria. Along the sea-coast it extended from the river Varus or Var, which separated it from Gaul, to the Mactra (Magna), which formed its limit on the side of Etruria, thus comprising the whole district between the mountains and the sea, now known as the Riviera of Genoa. But besides this it comprehended a broad tract to the north of the same range, formed by the underfalls of the Apennines and the hilly tract adjoining them, extending to the plains of the Padus or Po,—that river itself constituting its northern limit under the Roman administration. But at an earlier period the term had a much wider significance,—all the tribes on the south slopes of the Alps, in the north-west of Italy, being apparently of Ligurian origin. This we are expressly told by ancient authors in the case of the Taurini, who dwelt around Turin, and of the Levi and Libici, who extended from thence to the Ticinus; and there can be little doubt that it was true also of the Salassi, who occupied the modern Val d'Aosta. But to the west of the Maritime Alps also the Ligurians were undoubtedly widely spread in ancient times, and occupied a considerable extent of what was afterwards included in Gaul. Thus the Salysae, who held all the southern part of Provence from the Var to the Rhone, are distinctly termed a Ligurian tribe, as well as the minor tribes of the Oxybii and Deciates, near Frejus and Nice. All the early Greek writers speak of the important colony of Massilia as founded in Liguria.

Of the origin or affinities of the Ligurians (or Lygians, as they are termed by Greek writers) we know absolutely nothing. All ancient writers concur in representing them as a distinct people from the Gauls on the one hand, and from the Iberians on the other; and the attempts of some modern writers to assign them to a Celtic stock rest upon no adequate foundation. In the absence of all remains of their language, all such speculations must be matters of mere conjecture. They appear in the historical period as a rough and hardy race of mountaineers, cultivating a

rugged territory with much industry, and opposing a stubborn resistance to the efforts of the Romans to reduce them to subjection. They first came in contact with the Roman arms in 235 B.C., but it was not till after the Second Punic War—in which the Ligurians had openly opposed the cause of Hannibal—that a serious struggle began, which, commencing in 200 B.C., was continued with little intermission for more than eighty years. While the Roman generals in the East were overthrowing, with comparative ease, the powerful monarchies of Macedonia and Syria, one of the consuls was generally engaged in inglorious hostilities with the hardy mountaineers of the Ligurian Apennines. Even after these were reduced to subjection, the tribes which held the still more rugged fastnesses of the Maritime Alps long maintained their independence, and it was not till the reign of Augustus that they were finally subdued. The construction by that monarch of a Roman highway along the coast, which followed almost exactly the same line as the modern road of the Corniche, marked the period of their complete subjection.

The physical geography of Liguria has been already described in the article of ITALY. All the rivers which take their rise on the northern slope of the mountains ultimately discharge their waters into the Po; of these by far the most considerable is the Tanaro, which receives the tributary streams of the Stura and the Bormida, while to the east of it flow the Scrivia and the Trebia, celebrated by the victory of Hannibal over the Romans. This last stream, according to the division of Augustus, formed the boundary between Liguria and Gaul south of the Po. The streams which flow from the Apennines southward to the sea are for the most part inconsiderable, and mere mountain torrents. But the Magra, which forms the limits of the province on the east, is an important stream, and brings with it the waters of its tributary, the Boates or Vara. On the west also the Var is a river of considerable magnitude, which forms a natural boundary on this side between Liguria and Gaul, as it long constituted their political limit. The Rattuba or Roya, a little farther east, is also a considerable river, descending through a deep mountain valley from the Col di Tenda.

The principal Ligurian tribes were (1) the Apuani, inhabiting the valley of the Magra, including the district known in modern times as the Lunigiana; (2) the Friniates, on the northern slope of the Apennines towards Modena; (3) the Briniates, in the valley of the Vara; (4) the Gennates, around Genoa; (5) the Veturi, immediately west of the preceding; (6) the Ingauni, whose capital was Albium Ingaunum, still called Albenga; (7) the Intemelii, whose chief city still retains the name of Vintimiglia; and (8) the Vediauti, extending thence to the Var. North of the Apennines the most important tribes were the Vagienni, who held the whole mountain tract from the Monte Viso and the sources of the Po to the Tanaro; and the Statielli, east of them, whose chief town was Aquæ Statiellæ or Aouë.

The chief city on the Ligurian sea-coast was, in ancient as in modern times, that of Genoa, which combined an excellent natural port with a central position, and easy communications with the interior. West of it, along the coast, were Vada Sabotta (Vado, near Savona), Albium Ingaunum (Albenga), Albium Intemelium (Vintimiglia), the Portus Herculis Monacensis (Monaco), and Nicaea (Nice), which was founded by a colony from Massilia. In its immediate vicinity was the Roman town of Camenellum (Cimiez). On the northern slope of the Apennines were several considerable towns, almost all of them of Roman origin. The chief of these were Augusta Vagiennorum (Bene), Alba Pompeia, Asta, Aquæ Statiellæ, Derconia (Torlona), and Iris (Voghera), but none of them attained

to anything like the same prosperity and importance as the great cities of Cisalpine Gaul. The towns on the eastern Riviera, between Genoa and the Gulf of Spezia, were inconsiderable places, and even on the shores of that gulf, forming the magnificent port called the Portus Lunæ, there was never any town of importance, Lunæ itself being some distance inland, and within the confines of Etruria. (S. U. A.)

LILAC, *Syringa vulgaris*, L., belongs to the olive family, *Oleaceæ*. The common lilac is said to have come from Persia in the 16th century, but according to Heuffel it is indigenous in Hungary, the borders of Moldavia, &c. (De Candolle, *Prod.*, viii p. 283). Two kinds of *Syringa*, viz., *alba* and *cærulea*, are figured and described in Gerard's *Herball* (1597), which he calls the white and the blue pipe privets. The former is the common privet, *Ligustrum vulgare*, L., which, and the ash tree, *Fraxinus excelsior*, L., are the only members of the family native in Great Britain. The latter is the lilac, as both figure and description agree accurately with it. It was carried by the European colonists to North-East America, and is still grown in gardens of the Northern and Middle States. There are several varieties of lilac, e.g., "Dr Lindley," which bears large clusters of reddish lilac flowers, *alba*, *violacea*, *rubra insignis*, and *rosea grandiflora*. *S. dubia*, Pers., or *chinensis*, Willd., the Siberian lilac, is a closely allied species, if it be really distinct. The variety *Rothomogensis*, Mirb., or *Lilac Farnæ* of the French, probably belongs to this species. Of other species, there is *S. Josikeæ*, Jack., from Transylvania, with scentless bluish-purple flowers, *S. Emodi*, Wall., a native of the mountains of India, and *S. persica*, L., the Persian lilac, rarely exceeding 4 or 5 feet, the flowers of which vary from rosy carmine to white.

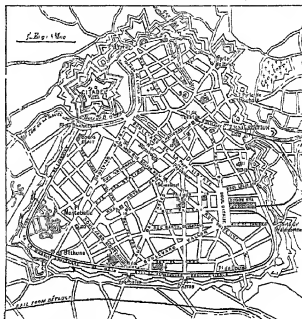
LILBURNE, JOHN (1618-1657), an English sectary and prolific pamphleteer, was the younger son of a gentleman of good family in the county of Durham, and was born in 1618. At the age of twelve he was apprenticed to a clothier in London, but he appears to have paid only slight attention to business, and to have early addicted himself to the "contention, novelties, opposition of government, and violent and bitter expressions" for which he afterwards became so conspicuous as to provoke the saying of Marten that, "if the world was emptied of all but John Lilburn, Lilburn would quarrel with John, and John with Lilburn." He appears at one time to have been law-clerk to Prynne. In February 1638, for the part he had taken in importing and circulating the *Merry Leitanie* and other publications of Bastwick and Prynne, offensive to the bishops, he was sentenced to be publicly whipped from the Fleet prison to Palace Yard, Westminster, there to stand for two hours in the pillory, and afterwards to be kept in jail until a fine of £600 had been paid. Though gagged at the pillory, and confined in prison, he was not the man to give up his opinions or forego the pleasure of expressing them, and in the following year he did not improve his prospects of a speedy release by the kind of literary activity to which he devoted his enforced leisure.¹ In point of fact he did not regain his liberty until November 7, 1640, when one of the earliest recorded speeches of Oliver

¹ Come out of Her, My People: or An Answer to the Questions of a Gentleman, a professor in the Anti-Christian Church of England, about Hearing the public Ministers; where it is largely discussed, and proved to be unlawful. Also a Just Apology for the way of Total Separation, commonly but falsely called "Brownism"; that it is the truth of God though slightly esteemed in the eyes of the world. With a challenge to dispute them publicly before King and Council, to prove whatsoever I have said at the pillory against them: viz., that the calling of them is Jure Diaboli, even from the Devil himself. By John Lilburne, close prisoner in the Fleet for the cause of Christ. Printed in the year of hope of England's Purgation and the Prelates' Dissolution, 1639.

Cromwell was made in support of his petition to the House of Commons. In 1641 he received an indemnity of £3000. He now entered the army, and in 1643 was taken prisoner at Brentford and tried for his life, sentence would no doubt have been executed had not the parliament by threatening reprisals forced his exchange. He soon rose to the rank of lieutenant-colonel, but in April 1645, having become dissatisfied with the general conduct of affairs, and especially with the predominance of Presbyterianism, he resigned his commission, presenting at the same time to the Commons a petition for considerable arrears of pay. His violent language in Westminster Hall about the speaker and other public men led in the following July to his arrest and commitment to Newgate, whence he was discharged, however, without trial, by order of the House, in October. In January 1647 he was again committed to the Tower for accusations which he had brought against Cromwell, but was again set at liberty in time to become a disappointed spectator of the failure of the levelling or ultrademocratic party in the army at the Ware rendezvous in the following December. The scene produced a deep impression on his mind, and in February 1649 he along with other petitioners presented to the House of Commons a paper entitled *The Serious Apprehensions of a part of the People on behalf of the Commonwealth*, which he followed up with a pamphlet, *England's New Chains Discovered* (March 1, 1649), criticizing Ireton, and another exposing the conduct of Cromwell, Ireton, and other leaders of the army since June 1647. *The Hunting of the Foxes from Newmarket and Triploe Heath to Whitehall by Five Small Hengles*, the "beagles" being Lilburne, Overton, Walwyn, Prince, and another. Finally, the *Second Part of England's New Chains Discovered*, a violent outburst against "the dominion of a council of state, and a constitution of a new and unexperienced nature," became the subject of discussion in the House, and led anew to the imprisonment of its author in the Tower on April 11. His trial in the following October, on a charge of seditious and scandalous practices against the state, resulted in his unanimous acquittal, followed by his release in November. In January 1652, for printing and publishing a petition against Sir Arthur Hasling and the Haberdashers' Hall for what he conceived to have been an injury done to his uncle George Lilburne in 1649, he was sentenced to pay fines amounting to £7000, and moreover to be banished the Commonwealth, with prohibition of return under the pain of death. In June 1653 he nevertheless came back from the Low Countries, where he had busied himself during the interval in pamphleteering and such other agitation as was possible, and was immediately arrested; the trial, which was protracted from July 13 to August 20, indeed issued in his acquittal, to the great joy of London, but it was nevertheless thought proper to keep him in captivity for "the peace of the nation." He was detained successively in the Tower, in a castle at Jersey, and in Dover Castle. At Dover he came under Quaker influence, and signified his readiness at last to be done with "carnal sword fightings and fleshly brawlings and contests", and in 1656, on giving security for his good behaviour, he was set free. He now settled at Eltham in Kent, frequently preaching at Quaker meetings in the place and neighbourhood during the brief remainder of his troubled life. He died on August 29, 1657.

See Masson, *Life of Milton*, who refers (iv 150) also to Walker (*History of Independency*, ii 247), Godwin (*Commonwealth*, iii 193-177), and Bisset (*Unsettled Chapters of the History of England*, 191-201), and adds, "Mr. Bisset relates Lilburne's trial (on 1649) at length, with curious extracts, and makes John more of a hero than Godwin does, though Godwin is not unfavorable. On the whole, I like him myself, and am glad that he is in the history of England, but think he was an ass."

LILLE, capital of the department of Nord, France, and the ancient capital of Flanders, is situated about 155 miles by rail north of Paris, and at an elevation of 75 feet, in a low plain on the Deule, which flows to the Scheldt by the Lys. It is the chief fortress of the north of France, and headquarters of the first army corps, and is defended by a rampart and by a pentagonal citadel situated to the west of the town beside the Deule. The water of the river fills the moat, and the environs of the citadel can be laid under water. Prior to 1858 the town occupied an elliptical area of about 2500 yards by 1300, with the church of Notre Dame de la Treille in the centre, but the ramparts on the



Plan of Lille.

- | | | |
|-----------------------|-------------------------|---------------------------|
| 1 Borneau de St André | 7 Grand Theatre | 15 Church of St Michel |
| 2 Cattle Market and | 8 Exchange | 16 Church of St Peter and |
| St Quentin Hoare | 9 Hôtel de Ville | St Paul |
| 3 Palais de Justice | 10 Military Hospital | 17 Nouvelle Assemblée |
| 4 Bank of France | 11 Ch. of St Servais | Market |
| 5 Notre Dame de la | 12 St Sauveur Hospital | 18 Arsenal |
| Trille | 13 Paris Gate | 19 St Eugene Hospital |
| 6 Lycée and Museum | 14 Industrial Institute | 20 Ch. of St Martin |

south side have since been demolished and the ditches filled up, their place being now occupied by the great Boulevard de la Liberté, which extends in a straight line from the goods station of the railway to the citadel. The new enceinte is much more extensive, and encloses the old communes of Esquermes, Wazemmes, and Moulins-Lille, the area of the town being thus more than doubled, in the new quarters fine boulevards and handsome squares, such as that of De la République, have been laid out in pleasant contrast with the sombre and dirty aspect of the old town. The district of St André to the north, the only elegant part of the old town, is the residence of the Lille aristocracy.

At the demolition of the old fortifications, the Paris gate, a triumphal arch erected in 1682 in honour of Louis XIV., after the conquest of Flanders, was preserved, as also the Ghent and Ronbaix gates, which date from the time of the Spanish domination, and are built in the Renaissance style, with bricks of different colours. The present rampart is pierced by eleven gates, besides a special gate for the railway, and two water gates for the canal of the Deule. The goods station has also its special outlet, and a line from it, after making the round of the new quarters, passes within the enceinte to the quays of the river. Crossing the bridges which span the different arms of the Deule, we reach the citadel, the glacis of which,

planted with trees, form a public walk. Within the citadel are extensive barracks and a considerable arsenal. The church of Notre Dame de la Traille, in the style of the 13th century, which has been in process of building since 1855, occupies the site of the old Château du Buc, the original nucleus of the city. The town-house, on the site of the old palace of the duke of Burgundy, Philip the Good, was built in 1846. The exchange, which dates from the period of the Spanish domination, is in an original style. It is surmounted by a graceful campanile, and contains a statue of Napoleon I., made from cannon taken at Austerlitz. In the middle of the great square stands a column, erected in 1848, commemorating the defence of the town in 1792. There are several large hospitals, faculties of medicine and of science, a Catholic institute, comprising the five faculties of theology, letters, law, science, and medicine, an academy of music affiliated to the Conservatoire at Paris, several learned societies, and a large number of various kinds of schools. The picture gallery, with upwards of eight hundred works, is one of the richest in the provinces, and the Wier museum contains a unique collection of original designs of the great Italian masters. Lille possesses also an ethnographical museum (Musée Moillet), as well as museums of archaeology, numismatics, the industrial arts, and natural history. The communal library is also worthy of mention; it includes numerous MSS., and particularly a valuable *Evangelicarium* of the 12th or 13th century. On the front of the building where the departmental archives are kept are to be seen medallions of all the sovereigns who have successively possessed Lille from Baldwin of the Iron Arm to Louis XIV. Lille, which is pre-eminently a manufacturing and commercial town, enjoys exceptional advantages as regards means of transit. The lower Deule is canalized to its junction with the Lys, and there is continuous water communication with the Scheldt in Belgium, and with Paris by way of Douai and St Quentin. The town is at the same time an important railway junction, and is also provided with tramways.

The principal industry is flax-spinning, in which thirty-five mills, with 190,000 spindles, give employment to 14,000 persons (of whom 9000 are females), the annual turnover being £1,800,000. Forty thread mills employ 2000 persons, and produce thread to the annual value of £240,000. Fifteen factories, with 1000 operatives, produce woollen goods worth from £120,000 to £160,000 per annum; 5000 persons are engaged in cotton-spinning (115,000 spindles), to the amount of £800,000. There are besides eighty factories in which damasks, tickings, and the usual staples of the linen trade are manufactured; quilts and pocketbags occupy from 6000 to 7000 persons, and 4000 are employed in producing the fabric out of which the smock frocks of the peasantry are made. Connected with these industries are dye-works, bleach-fields, and establishments for the production of engines, looms, and combing and carding machines; and there are also chemical works, sugar-works, breweries, and oil-works.¹ The state manufacture of tobacco in Lille gives employment to 1200 persons. The total population of Lille in 1876 was 162,775.

Lille is said to date its origin from the time of Count Baldwin IV., who in 1080 surrounded with walls a little town which had arisen around the castle of Buc. At the end of the 12th century Lille, which had developed rapidly, obtained communal privileges. Destroyed by Philip Augustus in 1212, it was rebuilt by John of Constantinople, but besieged and taken by Philip the Fair in 1297. After having taken part with the Flemings against the king of France, it was ceded to the latter in 1312. In 1869 Charles V. gave it to Louis de Male, who transmitted his rights to his daughter

Margaret, wife of Philip the Bold, duke of Burgundy. Under the Burgundian rule Lille enjoyed great prosperity, its merchants were at the head of the London fairs. Philip the Good made it his residence, and within its walls held the first chapters of the order of the Golden Fleece. With the rest of Flanders it passed from the dukes of Burgundy to Austria, and then to Spain. After the death of the Philip IV. of Spain, Louis XIV. reclaimed the territory, and besieged Lille in 1667. He forced it to capitulate, but preserved all its laws, customs, privileges, freedoms, and liberties. In 1708, after an heroic resistance, it surrendered to Prince Eugene and the duke of Marlborough. The treaty of Utrecht ceded it to France. In 1792 the Austrians bombarded it for nine days and nights without intermission, but had ultimately to raise the siege. (G. ME.)

LILLEBONNE, capital of a canton in the department of Seine-Inférieure, France, 131 miles west-north-west by rail from Paris, and 20 miles due east from Havre, is a pretty little town, picturesquely built at the foot of wooded hills, in the valley of the Bolbec, which falls into the Seine 3 miles lower, at Port Jérôme. The principal industries are cotton-spinning and the manufacture of calico. The population in 1876 was 5400.

Lillebonne was the capital of the Calvetae, or inhabitants of the Pays de Caux, in the time of Cæsar, by whom it was destroyed. It was afterwards rebuilt by Augustus, who called it Julibona after his daughter, and before it was again ruined by the barbarian invasions it had become a very important centre, whence Roman roads branched out in all directions. Some forty years ago the remains of a mosaic baths and of a theatre capable of containing 3000 persons were brought to light. Statues, tombstones, all sorts of articles in iron, bronze, ivory, marble, stone, glass, &c., have been found in the course of excavation, and deposited, for the most part, in the museum at Rouen. The most beautiful object yet discovered is a large mosaic found in 1870 (some 28 feet by 21). In the Middle Ages the fortifications of the town were constructed out of the materials supplied by the theatre. William of Normandy built at Lillebonne a castle whence he dates several charters. It is now a ruin within a charming park. The 18th century houses, with walls over 19 feet in thickness, is an admirable preservation. The church of Notre Dame, of the 16th century, had a fine porch, formerly adorned with rich sculptures, which have mostly disappeared. The graceful tower is about 180 feet high.

LILLY, WILLIAM (1602–1681), an astrologer somewhat famous in his day, was born in 1602, at Diseworth in Leicestershire, his family having been settled as yeomen in the place for “many ages.” He received a tolerably good classical education at the school of Ashby-de-la-Zouche, but he naively tells us what may perhaps have some significance in reference to his after career, that his master “never taught logic.” In his eighteenth year, in consequence of his father having fallen into great poverty, he went to London, and was employed in a sort of menial situation in attendance on an old citizen and his wife, with whom he so managed to ingratiate himself that his master, at his death in 1627, left him an annuity of £20; and, Lilly having soon afterwards married the widow, she, dying in 1633, left him property to the value of about £1000. Having now a good deal of leisure on his hands, he began to dabble in astrology, reading all the books on the subject he could fall in with, and occasionally trying his hand at unravelling mysteries by means of his art. The years 1643 and 1643 were devoted to a careful review of all his previous reading, and in particular having lighted on Valentine Nailod’s *Commentary on Alcabitus*, he “seriously studied him and found him to be the profoundest author he ever met with.” Him he “traversed over day and night,” and so “advanced his judgment and knowledge” to the utmost height he ever arrived at. He characterizes him as “a most rational author and the sharpest expositor of Ptolemy that hath yet appeared.” About the same time he tells us that he “did carefully take notice of every grand action betwixt king and parliament, and did first then incline to believe that as all sub-lunary affairs depend on superior causes, so there was a possibility of discovering them by the configurations of the superior bodies.” And, having thereupon “made some essays,” he “found encouragement to proceed further, and

¹ The old commune of Moulins, now annexed to the town, derived its name from the windmills in which the oil was pressed.

ultimately framed to himself that method which he ever afterwards followed." He then began to issue his prophetic almanacs and other works, and it is a curious illustration of the state of intelligence even among educated people at the time that trash of this kind really seems to have met with serious attention from some of the most prominent members of the Long Parliament. If we may believe himself, Lilly lived on friendly and almost intimate terms with Bulstrode Whitlocke, Lenthall the speaker, Sir Philip Stapleton, Elias Ashmole, and others. Even Selden seems to have given him some countenance, and probably the chief difference between him and the mass of the community at the time was that, while others believed in the general truth of astrology, he ventured to specify the future events to which its calculations pointed. Even from his own account of himself, however, it is evident that he did not trust implicitly to the indications given by the aspects of the heavens, but like more vulgar fortune-tellers kept his eye and ears open for any information which might make his predictions safe. It appears that he had correspondents both at home and in foreign parts to keep him conversant with the probable current of affairs. He was evidently a proficient in all the unscrupulous cunning, adroitness, and plausibility which go to make up the successful quack and impostor, and not a few of his exploits indicate rather the quality of a clever police detective than of a profound astrologer. After the Restoration he very quickly fell into disrepute. His sympathy with the parliament, which his predictions had generally shown, was not calculated to bring him into royal favour, and the frivolous and sceptical character of the age could scarcely be expected to fall in with transcendentalism either in the shape of sense or nonsense. He came under the lash of Butler, who, making allowance for some satiric exaggeration, has given in the character of Sildrophel a probably not very incorrect picture of the man; and, having by this time amassed a tolerable fortune, he bought a small estate at Hersham in Surrey, to which he retired, and where he diverted the exercise of his peculiar talents to the practice of medicine. He died in 1681, in the eightieth year of his age.

Lilly's life of himself, published after his death, is still worth looking into as a remarkable record of credulity and successful imposture. Superstition dies hard; and it is a curious evidence of the inveteracy of popular delusions that so lately as 1869 a prominent London publisher put forth a new edition of Lilly's *Introduction to Astrology*, "with numerous emendations adapted to the improved state of the science."

LILY, *Lilium*, the typical genus of *Liliaceae*, embraces nearly fifty species, all confined to the northern hemisphere, about fifteen being natives of Japan and China, six of the mountains of India, eight of south Europe, five of the east and nine of the west coasts of North America. The earliest in cultivation were described in 1597 by Gerard (*Herbal*, p. 146), who figures eight kinds of European (true) lilies, viz., *L. album*, *L. candidum*, L., and a variety, *L. biancolum*, two umbellate forms of the type *L. bulbiferum*, Park., named *L. aureum* and *L. cruentum latifolium*, and three with pendulous flowers, apparently forms of the martagon lily. Parkinson, in his *Paradiſus* (1629), described five varieties of martagon, six of umbellate kinds—two white ones, and *L. pomponium*, *L. chalcedonicum*, *L. corniculatum*, and *L. pyrenaicum*—together with one American, *L. canadense*, which had been introduced in 1629. For the ancient and medieval history of the lily, see M. de Cannart d'Harnale's *Monographie historique et littéraire des Lis* (Malines, 1870). Since that period many new species have been added. The latest authorities for description and classification of the genus are J. G. Baker ("Revision of the Genera and Species of Tulipæ," *Journal of Tenn. Soc.* xiv. p. 211. 1874) and J. H. Elwes

(*Monograph of the Genus Lilium*, 1877-78), who first tested all the species under cultivation, and has published every one beautifully figured by W. H. Fitch, and some hybrids. With respect to the production of these latter, the genus is remarkable for its power of resisting the influence of foreign pollen, for the seedlings of any species, when crossed, generally resemble that which bears them. For the harder kinds in cultivation, reference may be had to Hemsley's *Handbook of Hardy Trees*, &c., p. 601. The structure of a lily is of simple type, consisting of two whorls, of three free parts each, six free stamens, and a consolidated pistil of three carpels, ripening into a three-valved capsule containing many winged seeds. In form, the flower assumes three types:—trumpet-shaped, with a more or less elongated tube, e.g., *L. longiflorum* and *L. candidum*; an open form with spreading perianth leaves, e.g., *L. auratum*, or assuming a pendulous habit, with the lips strongly reflexed, e.g., the martagon type. All have scaly bulbs, which in three west American species, as *L. Humboldtii*, are remarkable for being somewhat intermediate between a bulb and a creeping rhizome. *L. bulbiferum* and its allies produce aerial reproductive bulbils in the axils of the leaves. The bulbs of several species are eaten, such as of *L. aviculatum* in Kamchatka, of *L. Martagon* by the Cossacks, and of *L. tigrinum*, the "tiger lily," in China and Japan. Medicinal uses were ascribed to the species, but none appear to have any marked properties in this respect. See **HORTICULTURE**, vol. xii. p. 257.

The white lily, *L. candidum*, the *lilyon* of the Greeks, was one of the commonest garden flowers of antiquity, appearing in the poets from Homer downwards side by side with the rose and the violet. According to Heins, roses and lilies entered Greece from the east by way of Phrygia, Thrace, and Macedonia (*Kulturpflanzen und Haustiern*, 3d ed., p. 217). The word *lilyon* itself, from which *lilium* is derived by assimilation of consonants, appears to be Roman (*Idia*, p. 827), and according to ancient etymologists (*Leviada*, *Idia*, p. 227) the term of Sans was connected with the Persian name of the lily *shian* (*Græcorum*, Heb. *shohan*). Mythologically the white lily, *Rosa Junonia*, was fabled to have sprung from the milk of Hera. As the plant of purity it was contrasted with the rose of Aphrodite. The word *epion*, on the other hand, included red and purple lilies. Plin. *H. N.*, xvi. 5 (11, 12), the red lily being best known in Syria and Judæa (Phœnias). This perhaps is the "red lily of Constantinople" of Gerard, *L. chalcedonicum*, L. The lily of the Old Testament (*shohan*) may be conjectured to be a red lily from the simile in Cant. v. 18, unless the allusion is to the fragrance rather than the colour of the lily, in which case the white lily must be thought of. The "lilies of the field," Matt. vi. 28, are *epion*, and the comparison of their beauty with royal robes suggests their identification with the red Syrian lily of Phrygia. Lilies, however, are not a conspicuous feature in the flora of Palestine, and the red Galilee are dotted in the spring, is perhaps more likely to have suggested the figure. For the lily in the pharmacopœia of the ancients see Adams's *Paul. Ægineta*, lib. 106. It was used in unguents and against the bites of snakes, &c. In the Middle Ages the flower continued to be common, and was taken as the symbol of heavenly purity. The three golden lilies of France are said to have been originally three leaves-buds.

LILYE, WILLIAM (c. 1436-1523), one of the introducers of a knowledge of the Greek language into England, was born at Odham, in or about the year 1466. He entered the university of Oxford in 1484, became a demy of Magdalen in 1486, and after taking his first degree in arts went on a pilgrimage to Jerusalem. On his return he put in at Rhodes, which was still occupied by the Knights, under whose protection many Greeks had taken refuge after the taking of Constantinople by the Turks. Here he laid the foundation of a knowledge of the Greek language. We next hear of him in Italy, following the lectures of John Sulphitius and Pomponius Letus at Rome. From this he passed on to Venice, from which place he writes to his friend and patron Thomas Starkey, that "he is assiduously attending the lectures of Egnatius in Latin, but that he finds no one in Venice who can assist him in the study of Greek. He reads, however, Greek by himself, and has

read seven plays of Sophocles, five of Euripides, three of Aristophanes, besides extracts from Xenophon and Plutarch, by himself without a teacher." After his return he settled in London, as a private teacher of grammar, and is believed to have been the first who taught Greek in that city. In 1510 Colet, dean of St Paul's, who was then founding the school which afterwards became famous, appointed Lilye the first highmaster. He held this office only twelve years, dying of the plague in February 1523.

Lilye's name deserves commemoration, not only as one of the pioneers of Greek learning, but as one of the joint authors of a book, familiar to many generations of students, down to the present century, the old Eton Latin grammar. The *Discretissima Institutio*, a sketch by Colet, corrected by Erasmus, and worked upon by Lilye, contains two portions, the authorship of which is indisputably Lilye's. These are the lines on the genders of nouns, beginning "Propria que maribus," and those on the conjugation of verbs, beginning "As in presenti." The "Carmen de moribus" bears Lilye's name in the early editions, but Hearne asserts that it was written by Leland, who was one of his scholars, and that Lilye only adopted it. Besides the *Discretissima Institutio*, Lilye wrote a variety of Latin pieces both in prose and verse. Some of the latter are printed along with the Latin verses of Sir Thomas More in *Progymnasmata Thomae Mori et Gulielmi Lylii Sodalium*, Basel, 1518. Another volume of Latin verse directed against a rival schoolmaster and grammarian, Whittington, whose grammar that of Lilye superseded, is entitled *Antibosscon ad Gulielmum Hovmannum*, 1521.

The only authority for the few facts which make up the above life of Lilye is a short sketch furnished by his son George to Paulus Jovius who was collecting for his history the lives of the learned men of Great Britain. All the other names, such as Paley, Pitt, Fuller, Wood, which figure in the dictionaries as authorities, are only transcripts of George Lilye. To these scanty memoranda the present article adds an extract from three letters of Lilye's preserved in the British Museum, Cotton Nero, B vi. fol. 167, now printed for the first time.

LIMA, capital of the republic of Peru, as also of the department and province of Lima, is situated on an extensive plain, 500 feet above the sea-level, and 7 miles east from its port Callao on the Pacific coast, in $12^{\circ} 2' 34''$ S lat., $77^{\circ} 7' 36''$ W. long. The general configuration of the main portion of the city, previous to 1870 surrounded by walls, is that of an irregular triangle, whose base rests on

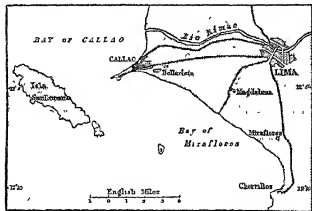


FIG. 1.—Neighbourhood of Lima and Callao

the river Rimac, which separates the city from its offshoot or suburb of San Lazaro. Sheltered on the north and east by the spurs of the Andes, the city is exposed to the winds prevailing from the south-east, as also to those from the south and west. Although the atmosphere is moist, and the transitions of the seasons are rapid, the climate is not unhealthy, the rainfall being slight, and the variations of

temperature not excessive. The summer commences in December, and the winter in June, and the mean temperature for the year is about 73° Fahr. The city is divided into five quarters or parishes, and is well laid out with broad and regular thoroughfares, the streets intersecting one another at right angles. The houses are spacious, but generally of only two stories, and are approached by portal leading into an open court or yard. In the principal square, which covers an area of 9 English acres in the centre of the city, stands a fine fountain of bronze. Here also are the cathedral, a stone structure with two lofty towers and a broad façade, the archiepiscopal palace, the Government house, and the Portal de los Escribanos, containing the municipal offices and archives. Besides the cathedral there are five chief parochial and sixty-two other churches and chapels, and numerous monasteries and convents. Of the churches, the largest is that of San Pedro (1598), which has seventeen altars, of the religious houses that of the Dominicans is the finest, and that of the Franciscans the most extensive. The university, built in 1576, is the oldest in America, it contains the hall and offices

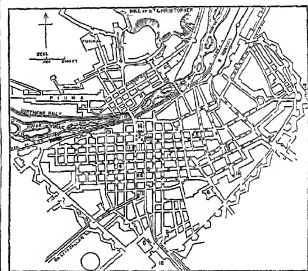


FIG. 2.—Plan of Lima

- | | | |
|-----------------------|----------------------|-----------------------|
| 1. Cathedral | 7. Cavalry Barracks | 22. Municipal Hall |
| 2. Plaza Mayor | 8. Penitentiary | 24. Governor's Palace |
| 3. Plaza Bolívar | 9. Military Hospital | 25. Telegraph Office |
| 4. Principal Theatre | 10. " | 26. Museum, &c. |
| 5. Infantry Barracks | 11. Railway Stations | 27. Library |
| 6. Artillery Barracks | 12. " | 28. Botanical Garden |

used by the chamber of deputies. Lima has more than seventy schools, a public library containing upwards of forty thousand volumes, and many charitable institutions, several of them connected with the religious orders. The principal place of amusement is the amphitheatre for bull-fights in the Plaza del Acho, accommodating nine thousand spectators. In the Plaza de la Exposición is a marble statue of Columbus unveiling a figure of America. Of the many other monuments in Lima the most famous is the bronze equestrian statue of Simon Bolivar in the Plaza de la Independencia (or de Bolívar), 11 tons in weight, commemorating the battle of Ayacucho, which secured the independence of Peru. Among the public promenades are reckoned the cemetery outside the Marvillas gate, and the Paseo de la Alameda de los Descalzos, in the centre of which is a gorgeous garden. As the capital of Peru, Lima is one of the most important trading centres in South America. It has, however, but few home industries, its manufactured goods being chiefly imported from Europe via Callao, the medium of nearly all its foreign commerce. Several attempts have from time to time been made to establish factories, but the high

price of labour has hitherto prevented any efforts on a large scale being permanently successful. There are, however, manufacturers for tallow, soap, sperm candles, glue, gold lace, gut leather, and silver filigree works, and the capital supplies the towns of the republic with coarse woollen fabrics. The market is attended daily by about a thousand dealers. Fish is supplied from Callao, and vegetables partly from gardens in the city and environs, and partly from the native villages. Since 1857 the water for drinking purposes has been obtained filtered from the Rimac, and supplied by pipes to the houses. The imports are various; the exports include guano, cinchona, Indian wool, raw cotton, hides, sugar, saltpetre, gold, silver, and other minerals. Under ordinary conditions the imports and exports together exceed \$5,000,000 annually. There are railways from Lima leading to Callao, Chancay, Chorrillos, and Oroya; the construction of several other lines has been stopped by the war with Chili. In 1780 the population of Lima was 50,000; in 1860 it had reached 100,341, and in 1868 121,363, of whom 38,761 were foreigners. A recent estimate (1877) gives the number at about 200,000, but, considering the vicissitudes the city has since then endured, these figures must be considered at the present time (1882) as far too high. The Spanish natives have the reputation of being courteous, affable, and generous, but at the same time fond of pleasure, improvident, and superstitious. By confession they are mostly Roman Catholics.

Lima was founded 161 January 1535, by Francisco Pizarro, who named it *Ciudad de los Reyes* in honor of the emperor Charles V. and Don Juan his mother, or, according to some authors, from its site having been selected on the 8th January, the Feast of the Epiphany. The name afterwards gave place to that of *Lima*, a Spanish corruption of the Quichua word *Rimac*. In 1548 Lima received its first archbishop, and in 1552 the earliest provincial council for the state was held there. Remaining under Spanish rule during the 17th, 18th, and early part of the 19th centuries, the city continued to increase in prosperity, though often visited by terrible earthquakes, of which the most disastrous was that of the 28th October 1746, when 5000 of the inhabitants perished and the port of Callao was destroyed (see CALLAO, vol. xv. p. 107). On the 12th July 1821, after a short siege, Lima was entered by a Chilean force under General San Martín, who on the 28th was proclaimed protector of Peru as a free state, but its independence was not finally secured until after the victory of Ayacucho (9th December 1824). In March 1828 the city again suffered from an earthquake, and in 1854-55 the yellow fever carried off a great number of the inhabitants. On the 11th of August 1867, Mr Sullivan, British minister to Peru, was assassinated. In November 1868 a congress of plenipotentiaries from Chili and other South American states was held here to concert measures of mutual defence. Of the various revolts which have during the last few years taken place at Lima may be mentioned that of November 1866, when President Pizarro was displaced for Canseco; the riots against religious toleration, 15th April 1867, and the military insurrection, 22d July 1873, when Gutierrez, minister of war, arbitrarily assumed power, had President Belzu imprisoned, and shot, but himself soon fell a victim to the popular fury, order being afterwards with difficulty restored by Vice-President Zavala. In consequence of the ill-success of the war with Chili, Lima towards the close of 1879 was again in an unsettled condition; President Prado fled, and on the 22d December, after a sanguinary coup d'état, Pierola was proclaimed dictator. In April 1880 Callao was blockaded by Chilean war ships, and Lima had to be placed in a state of defence. On the 20th of November the Chilean army effected a landing at Pisco, a fortified place about 100 miles south of Lima, and, having afterwards advanced upon the capital, forcibly occupied it upon the 17th of January 1881.

See Mariano F. Paz Soldán, *Diccionario geográfico-estadístico del Perú*, Lima, 1877, pp. 618-27; Mateo Paz Soldán and M. F. Paz Soldán, *Geografía del Perú*, Lima, 1892, vol. i. pp. 260-302; M. A. Pavón, *Lima, or Sketches of the Capital of Peru*, Historical, Statistical, &c., London, 1845; C. R. Mearns, *Cusco*, &c., and *Lima*, London, 1866. For further information as to the early history of Lima, see Lopez de Ovando, *Hist. pen. de los Ind.*; A. de Herrera, *Hist. pen. de los Ind. Occid.*; W. H. Prescott, *Hist. of the Conquest of Peru*, v. 50 Xerez, *Conquista del Perú*; and G. Zarate, *Hist. de la Conq. del Perú*, and J. de Forerster, *Hist. d'Espagne* (French translation by M. de La Harpe), Paris, 1782.

LIMA, capital of Allen county, Ohio, U.S., on the Ottawa river, and at the intersection of four railway lines, 130 miles north of Cincinnati. It is pleasantly situated

in a fine farming country, and has two large railway repairs shops, extensive car-works, and other smaller manufactures. The population in 1880 was 757; in 1860, 1939; in 1870, 4464, and in 1880, 7557.

LIMBORCH, PHILIP VAN (1633-1712), a prominent Remonstrant theologian, was born June 10, 1633, at Amsterdam, where his father held a good position in the legal profession. He received his education at Utrecht, at Leyden, in his native city, and finally at Utrecht university, which he entered in 1652. In 1657 he became a Remonstrant pastor at Gouda, and in 1667 he was transferred to Amsterdam, where, in the following year, the office of professor of theology in the Remonstrant seminary was added to his pastoral charge. He died there on April 30, 1712.

His most important work, *Institutiones theologice christianae, ad praecepta pietatis et promissiones pacis christianae unice directae* (Amsterdam, 1698, 6th ed. 1785), remains survived as a full and able exposition of the system of Episcopius and Cocceius. The fourth edition (1715) included a posthumous "Relatio historica de origine et progressu controversiarum in fœderato Belgio de praedestinatione." Limborch also wrote *De veritate religionis Christianae amice eccliae cum erudito Judio*, Gouda, 1687; *Historia Inquisitionis (1682)*, in four books prefixed to the "Liber Sententiarum Inquisitionis Tolosanae" (1807-1838), and *Commentarius in Acta Apostolorum et in Epistolae ad Romanos et ad Hebraeos*, Rotterdam, 1711. His editorial labours included the publication of various works of his predecessors, and of *Epistolae ecclesiasticae praestantissimae ac eruditissimae* (Amsterdam, 1684), chiefly by Arminius, Uytenbogaardus, Vorstius, Vosius, Grotius, Episcopius (his grand-uncle), and Barleus; they are of great value for the history of Arminianism. An English translation of the *Theologia*, with improvements, from Wilkinson, Tilson, Scott, and others, was published in the beginning of last century by W. Jones (*A Complete System or Body of Divinity, both Speculative and Practical, founded on Scripture and Reason*, London, 1709), and a translation of the *History of the Inquisition*, by S. Chandler, with a large introduction concerning the rise and progress of persecution and the real and pretended cause of it" prefixed, appeared in 1781.

LIMBURG, or LIMBOURG, one of the nine provinces of Belgium, is bounded on the N. and E. by Holland, on the S. by the province of Liège, and on the W. by those of Brabant and Antwerp; this area is 932 square miles, with a population, in 1880, of 311,694. The surface is for the most part flat, but rising somewhat towards the south-east. Most of the province is included in the barren and marshy district of sandy heath known as *La Campine* (Flem., *Kempen*). The Meuse, with a tolerably fertile valley, is its chief river. The soil is metalliferous; the chief vegetable products are cereals, leguminous plants, flax, hemp, and beetroot; and stock-breeding is largely carried on. Industries are less developed in Limburg than in the rest of Belgium; but the distilleries of the province are very considerable and noted. Limburg is divided for administrative purposes into three arrondissements, of which the capitals are Hasselt (population 11,500), Tongres (7800), and Maaseyck (4400). The last-named is the birthplace of Hubert and John van Eyck, the Flemish painters. One of the most interesting towns of the province is ST TROUV (q.v.), thought to be the ancient *Astrucum Oppidum*, the oldest town in Belgium. Near Tongres is a mineral well, described by Pliny.

The territory of Limburg was that of the *Eburones*, whom the Romans exterminated, and was afterwards inhabited by the *Franks* and *Frisians*. It was one of the first conquests of the invading Franks, who established themselves and proclaimed their first kings there. In the Middle Ages it constituted the county of Loos, holding of the bishop of Liège; afterwards it became the duchy of Limburg, which was taken possession of in 1382 by the duke of Brabant. From the 12th to the end of the 15th century the duchy included only a small portion of the present province; it extended eastward from the Meuse as far as Aix-la-Chapelle, and southward to the Vesdre. In the 18th century Limburg remained in the possession of Spain, and it passed to Austria in 1713. After the treaty of Campo Formio (1797) it was a French department, Meuse-Inférieure, with Maestricht as capital. By the treaty of

Vienna (1815) it formed one of the nineteen provinces of the kingdom of the Netherlands, and by that of London (1831) the eastern portion was ceded to Holland, becoming a Dutch province, the remainder constituting the present provinces of Belgium.

LIMBURG, or **LIMBOURG**, one of the eleven provinces of Holland, is bounded on the W. by Belgium (Limburg) and North Brabant, on the N. by North Brabant and Guelderland, on the E. by Rhinish Prussia, and on the S. by Belgium (*Liège*), and has an area of 851 square miles, with a population in 1876 of 235,135 (97 per cent. being Roman Catholics). The surface, which is flat, is partly covered with heaths and fens; of the latter the most considerable is the "peel" or marsh in the north, which extends into North Brabant. The province is traversed by the Maas, of which the chief affluent here are the Geule, the Geleen, and the Roer, all on the right; means of water communication are also supplied by the Zuid Willem's canal and its branches. The agricultural products are similar to those of Belgian Limburg; bee-keeping is also engaged in. Coal occurs within the province, and there is a mine at Kerkrade. The arrondissements are two in number,—Maastricht and Roermonde,—Maastricht being the capital. For the history of the province see the preceding article.

LIMBURG, a town in the circle of Unterlahn and district of Wiesbaden, Prussia, is situated 360 feet above the sea-level, on the Lahn, here crossed by a bridge dating from 1316, and on the Nassau Railway midway between Coblenz and Wieslar. A local branch line connects it with Hadamar. It is the seat of a Catholic bishop, and has one evangelical and four Catholic churches. The only prominent architectural feature is the small seven-towered semi-Byzantine cathedral, picturesquely situated on a rocky site overlooking the river; it was founded by Conrad Kurzbild, count of Niederlahngau, in 905, and finally consecrated in 1235 (restored 1872-78). Limburg has a seminary for the education of priests, and a variety of schools; the industries, which are unimportant, include manufactures of cloth, tobacco, machinery, pottery, and leather. The population in 1875 was 6161.

Limburg, which was a flourishing town during the Middle Ages, passed in 1404 into the possession of the archbishops of Treves after the extinction of its own line of counts, and in 1803 fell to the duke of Nassau. It was the scene of a victory of the archduke Charles of Austria over the French under Jourdan on September 16, 1796. It possesses an interesting MS. fragment of the chronicles, the *Festii Longipresens*. The original writer is supposed to have been the recorder Tillmann (ab. 1400), additions being made by subsequent copyists; the document, which has been more than once printed, is valuable especially for the ancient rhymes it embodies, and for its notices of old German poets.

LIMBUS. The *Limbus Infantum* or *Puerorum* in medieval theology is the "margin" or "border" (limbus) of hell to which human beings dying without actual sin, but with their original sin unwashed away by baptism, were held to be consigned; the category included, not unbaptized infants merely, but also idiots, cretins, and the like. The word "limbus" in the theological application, occurs first in the *Summa* of Thomas Aquinas; for its extensive currency it is perhaps most indebted to the *Commedia* of Dante (*Infer.*, c. 4). The question as to the destiny of infants dying unbaptized presented itself to theologians at a comparatively early period, and received very various answers. Generally speaking it may be said that the Greek fathers inclined to a cheerful and the Latin to a gloomy view. Thus Gregory of Nazianzus (*Orat.* 40) says "that such children as die unbaptized without their own fault shall neither be glorified nor punished by the righteous Judge, as having done no wickedness, though they die unbaptized, and as rather suffering loss than being the authors of it." Similar opinions have been expressed by Gregory of Nyssa, Severus of Antioch, and others,—

opinions which it is almost impossible to distinguish from the Pelagian view that children dying unbaptized might be admitted to eternal life, though not to the kingdom of God. In his recoil from Pelagian heresy, Augustine was compelled to sharpen the antithesis between the state of the saved and that of the lost, and taught that there are only two alternatives,—to be with Christ or with the devil, to be with Him or against Him. Following up, as he thought, his master's teaching, Fulgentius declared that it is to be believed as an indubitable truth that, "not only men who have come to the use of reason, but infants dying, whether in their mother's womb or after birth, without baptism in the name of the Father, Son, and Holy Ghost, are punished with everlasting punishment in eternal fire." Later theologians and schoolmen followed Augustine in rejecting the notion of any final position intermediate between heaven and hell, but otherwise inclined with practical unanimity to take the mildest possible view of the destiny of the irresponsible and unbaptized. Thus the proposition of Innocent III. that "the punishment of original sin is deprivation of the vision of God" is practically homologated by Thomas, Scotus, and all the other great theologians of the scholastic period, the only outstanding exception being that of Gregory of Rimini, who on this account was afterwards called "tortor infantum." The first authoritative declaration of the Latin Church upon this subject was that made by the second council of Lyons (1274), and confirmed by the council of Florence (1439), with the concurrence of the representatives of the Greek Church, to the effect that "the souls of those who die in mortal sin or in original sin only forthwith descend into hell, but to be punished with unequal punishments." Perrone remarks (*Prat. Theol.*, pt. iii. chap. 6, art. 4) that the damnation of infants and also the comparative lightness of the punishment involved in this are thus *de fide*, but nothing is determined as to the place which they occupy in hell, as to what constitutes the disparity of their punishment, or as to their condition after the day of judgment. In the council of Trent there was considerable difference of opinion as to what was implied in deprivation of the vision of God, and no definition was attempted, the Dominicans maintaining the severer view that the "limbus infantum" was a dark subterranean fireless chamber, while the Franciscans placed it in a lightsome locality above the earth. Some theologians continue to maintain with Bellarmine that the infants "in limbo" are affected with some degree of sadness on account of a felt privation; others, following Sfrondati, hold that they enjoy every kind of natural felicity, as regards their souls now, and as regards their bodies after the resurrection, just as if Adam had not sinned. In the condemnation (1794) of the synod of Pistoia (1786), the twenty-sixth article declares it to be false, rash, and injurious to treat as Pelagian the doctrine that those dying in original sin are not punished with fire, as if that meant that there is an intermediate place, free from fault and punishment, between the kingdom of God and everlasting damnation.

The *Limbus Patrum*, *Limbus Inferni*, or *Sinus Abrahæ* is defined in Roman Catholic theology as the place in the underworld where the saints of the Old Testament were confined until liberated by Christ on his "descent into hell." Regarding the locality, and its pleasantness or painfulness, nothing has been taught as *de fide*, and opinions have been various. It is sometimes regarded as having been closed and empty since Christ's descent, but other authors do not think of it as separate in place from the *limbus infantum*. The whole idea, in the Latin Church, has been justly described as the mere caput mortuum of the old catholic doctrine of hells, which was gradually superseded in the West by that of purgatory.

LIME is the name of the strongly basic monoxide CaO of the metal calcium. This base is widely diffused throughout the three kingdoms of nature in the form of salts, of which the carbonate CaCO_3 and the hydrated sulphate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ are by far the most abundant. Both are found in the mineral kingdom in a variety of forms. Of native carbonates of lime, *calc-spar* (Iceland spar), though comparatively rare, may be mentioned first as representing the purest native form of the compound. It generally presents itself in the form of well-developed transparent colourless rhombohedra, which possess to a remarkable degree the property of producing double refraction of light, whereupon is founded its application in the construction of certain optical instruments. Of the varieties of massive or crystalline carbonate of lime, those which, through the fineness of their grain and other qualities, lend themselves for the purposes of the sculptor go by the name of marble, while the remainder are embraced under the generic term of limestone. This name, however, is understood to exclude chalk, a soft, amorphous variety which, according to Ehrenberg, consists mainly of *Foraminifera* shells. All limestones contain at least traces of magnesia. When this foreign base is present in considerable proportion the rock is termed "dolomite" (see **MAGNESIUM**). Among the native forms of (hydrated) sulphate of lime the mineral "selenite" (glacies Marie) corresponds to Iceland spar among the carbonates. It forms colourless transparent rhombohedral prisms, generally united into "twins," and flattened down into plates readily cleavable along planes parallel to the surface. Hardness ranges from 1.6 to 2; the specific gravity is 2.3. Far more common than selenite are the massive varieties known as **ALABASTER** (see vol. i. p. 439) and ordinary **GYPSEUM** (vol. xi. p. 337).

Both sulphate and carbonate of lime, apart from their occurrence as independent minerals, are almost universally diffused throughout the earth's crust, and in the waters of the ocean. Now the sulphate is appreciably soluble in even pure water, while the carbonate, though practically insoluble in pure, is quite decidedly soluble in carbonic acid water. As all atmospheric water must necessarily hold carbonic acid gas in absorption, most natural waters, and certainly all deep-well waters, are contaminated with more or less of bicarbonate or sulphate of lime, or with both. When such a water is being boiled, there is an escape of the free and the loosely combined carbonic acid, and the carbonate of lime comes down as a loose precipitate or as a "crust", and, when the water is sufficiently concentrated by evaporation, the sulphate likewise is partly deposited. The decomposition of the "bicarbonate" in fact takes place, though slowly, even at ordinary temperatures, when the water in which it is held in solution is exposed to the atmosphere. It is in this manner that stalagmites and stalactites frequently seen within rock-caverns are produced, and there is no difficulty in accounting for the grotesque and fantastic forms which the latter often exhibit.

Quicklime.—The native carbonate always serves as the starting-point in the preparation of calcium compounds. From it the oxide CaO , known as quicklime or caustic lime, is produced industrially by heating limestone or marble in kilns, between layers of fuel, which in the United Kingdom is generally coal. The carbonic acid goes away with the gaseous products of combustion, and the oxide remains in unfused lumps of the form of the original stones. Lime, when pure, is an amorphous white solid, which is absolutely infusible and non-volatile; and on this account, when raised to high temperatures, it emits a brilliant white light ("lime-light"). The commercial article is generally grey or otherwise discoloured by the presence of foreign metallic oxides.

The decomposition that goes on in a limekiln is not brought about by the effect of heat alone. Gay-Lussac found long ago that carbonate of lime, when heated to intense redness in a closely covered crucible, loses its carbonic acid only very slowly, while the acid goes off readily even at somewhat lower temperatures when a current of steam is passed over, the heated limestone. This may be accounted for by assuming that the steam, in the first instance, produces hydrate—from the carbonate—of lime, which latter then at once breaks up into its two components. More probably, however, the steam acts only by producing a *quies vacuum*, that is, by clearing out the carbonic acid which, if allowed to stagnate even at high temperatures, would react on the quicklime produced, thus preventing the decomposition of a portion of the carbonate.

Quicklime acts readily and energetically on water, with evolution of much heat (269 units per unit weight of lime, Berthelot) and formation of a bulky white powder of the hydrate Ca(OH)_2 or Ca(OH)_2 . This powder readily mixes with water into a smooth paste, which may be diluted to a milky liquid—milk of lime. This, when filtered through paper, yields "lime-water," a strongly alkaline liquid containing about $\frac{1}{17}$ th of its weight of lime (calculated as CaO). When boiled it deposits a part of its dissolved lime as such, and when exposed to ordinary air it quickly draws a skin of carbonate of lime. Hence its application as a reagent for carbonic acid, and the extensive use of milk of lime (whitewash) as a cheap white pigment in wall-painting. Lime paste, as every one knows, is most extensively used as a mortar or cement for bricks and stones in building. For this purpose it is always mixed with a certain proportion of sand. This admixture in all probability was originally intended only to save lime and prevent shrinking. But it is now generally assumed to have a chemical function, causing the formation of a hard silicate of lime pervading and thus strengthening the mortar. Some chemists deny the practical importance though not the occurrence of this silication, what admits of no doubt is that the hardening of mortar involves the very gradual conversion of the original hydrate into carbonate of lime. Under the name of plaster, a fine smooth paste of lime and sand, with short hair to increase the tenacity of the mixture, is a most important material for coating the internal walls and roofs of ordinary buildings.

Hydraulic Cements.—Ordinary mortar, on account of the solubility of lime in water, is unfit for aquatic masonry; for this purpose hydraulic cements must be used. Of these there are a great variety, which, however, mostly agree in this that they consist of calcined mixtures of limestone and clay (preferably aluminiferous clay) and other silicates. By calcining such mixtures at temperatures short of that at which a glass would be produced, the lime becomes caustic, and part of the caustic lime, by uniting with the clay (and silicate generally), forms a silicate sufficiently basic to be disintegrable by acids and even by water. When such cement, as a powder, is mixed with water, the lime acts upon the silicate of alkali and the gelatinous silica-hydrate transiently produced, and with the silica and alumina and oxide of iron units into a hard, waterproof, very complex, silicate mixture.

H. Ste. Claire Deville having found that magnesia has hydraulic properties, hydraulic cements have been made by calcining dolomites of the proper composition so far as to decompose only the carbonate of magnesia (into MgO and CO_2). See **CEMENT**, vol. v. p. 328.

Lime, being the cheapest of powerful bases, is largely used in chemical manufacturing. It serves for the causticizing of soda, for the preparation of ammonia from ammonia salts, and for the manufacture of bleaching powder. It also enters into the composition of certain kinds of glass, and is used (as lime or as carbonate), in the making of soda ash.

Lime Salts.—These can in general be prepared by the saturation of the respective acids with lime hydrate. Thus the (pure) car-

bonate CaCO_3 may be prepared by passing carbonic acid into lime-water. But a more convenient method is to decompose a solution of pure chloride of calcium with excess of carbonate of ammonia, previously at $70-80^\circ\text{C}$, when the carbonate assumes the form of a crystalline precipitate which settles readily and is easily washed with hot water. The sulphate (artificial gypsum) appears as a voluminous white precipitate, consisting of minute colourless needles, when sulphuric acid is added to a not too dilute solution of chloride of calcium or other lime salt. The precipitate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ is appreciably soluble in water, 1000 parts of which at 0° , 35° , and 100°C dissolve 2.05, 3.54, and a little over 2 parts respectively of gypsum. The hydrated sulphate at temperatures exceeding 110°C loses its water. The anhydrous sulphate, if formed below about 200°C , readily recombines with water into compact gypsum (plaster of Paris). By exposure to high temperatures (600°C and upwards) sulphate of lime loses its power of recombining with water, at very high temperatures it fuses. A naturally anhydrous sulphate of lime (anhydrite) occurs in association with rock salt, and otherwise, as a not very common mineral.

The well-known favorable action of gypsum as a manure, more especially for clover (see AGRICULTURE), has lately been explained by Deheran on the strength of analyses and vegetation experiments of his own, by assuming that it converts the carbonate of potash of the soil into sulphate, which, being less obstinately retained by the soil, more readily finds its way into the roots of the plants.

Chloride of Calcium (sulfate of lime), CaCl_2 , is prepared by dissolving marble or limestone in aqueous muriatic acid. The iron and manganese generally present as impurities can be eliminated, after peroxidation by chlorine water, by digestion with hydrate of lime, which also, if allowed sufficient time, removes the magnesia. The filtrate is acidified with hydrochloric acid and concentrated by evaporation, so far that, on cooling, it deposits part of the dissolved porous kind of chloride of calcium which analytical chemists prefer for the drying of gases. This substance, when heated to redness—which must be done in platinum to prevent contamination—loses the rest of the water and at 729°C (O. Carrelly) fuses into the anhydrous salt CaCl_2 , which on cooling becomes into a stone-like mass. In this form chloride of calcium is much used in laboratories as a powerful dehydrating agent. It combines with ammonia gas into a solid compound. It dissolves in methyl alcohol and in ethyl alcohol, forming crystallizable "alcoholates" (Graham), compounds of CaCl_2 with "crystal alcohol".

Trihydrate of Calcium, $\text{Ca}(\text{NO}_3)_2$, crystallizing with $4\text{H}_2\text{O}$, is a very hygroscopic salt, soluble in even absolute alcohol. It is mentioned here as a material for the convenient preparation of pure lime—by simple ignition of the salt in a platinum crucible. Regarding bleaching powder, a double salt of hypochlorite and chloride of calcium $\text{O}(\text{Cl})_2$, see CHLORINE, vol. v. p. 678.

Fluoride of Calcium, CaF_2 , obtainable by precipitation of chloride of calcium with an alkaline fluoride, occurs in nature as FLUORSPAR (q.v.). Fluoride of calcium is widely disseminated throughout the mineral kingdom as an admixture with other minerals. All native forms of phosphate of lime contain it; some in considerable quantity. Traces of it are found in bones and in the scales of most plants.

Metallic Calcium cannot be prepared by the reduction of the oxide with charcoal. It may be produced, however, by the electrolysis of the fused chloride or—more conveniently—by heating the solid CaF_2 (seven parts) with calcium (one part) in a very crucible. The metal has a yellow colour; it is somewhat harder than lead, and very malleable and ductile (Litt-Bodart and Jobin). The specific gravity is 1.578 (Busen and Matthiessen). It does not tarnish in dry air, but readily decomposes water, with evolution of hydrogen and formation of hydrate of lime. It is practically non-volatile. When heated in air or oxygen it burns with a most brilliant light into oxide, CaO .

Tests—Solutions of ordinary calcium salts are not affected visibly by sulphuretted hydrogen, sulphide of ammonium, or pure ammonia. Carbonate of ammonia, even in the presence of sal-ammoniac, precipitates the carbonate of calcium between the bars and strontium. From the former it is distinguished by its not being precipitated by either hydrosulphuric acid or bichromate of potash, and from both by its spectrum and the relatively large solubility of its sulphate in water. The latter is obtained from any calcium solution by addition of sulphuric acid or alcohol. The sulphate is washed with alcohol on a filter. When then boiled with water it yields a solution which, dilute as it is, gives a very distinct pre-

cipitate with oxalate of ammonia (barium and strontium sulphates in these circumstances give negative results). Oxalate of ammonia is the most delicate precipitant for calcium, the precipitate is insoluble in water, in ammonia and ammonia salts, and in acetic acid. From solutions (in acids) of phosphate or oxalate of calcium ammoniac and likewise sulphide of ammonium precipitate the metal as phosphate or oxalate. To detect it in such a precipitate, dissolve in hydrochloric acid and add sulphuric acid and alcohol. The calcium is precipitated as sulphate, which can be identified as just explained.

For the phosphates of lime, see PHOSPHATES.

(W D)

LIME, or LINDEN. The lime trees, species of *Tilia*, are familiar timber trees with mellifluous flowers, rarely if ever maturing their fruit in England, which are borne on a common peduncle proceeding from the middle of a long bract. *T. europæa*, L., is indigenous to Europe, excepting the extreme north, and extends eastwards across Russian Asia to the Altai. The lime is much planted in Britain, and is probably wild in south and west England, and perhaps in Ireland. The truly indigenous form in north Europe is always a small-leaved one. The large leaved variety (*T. grandifolia*, Ehrh.) is of South-European origin (Bentham, *Handbook of the British Flora*, i. 157); *T. parvifolia*, L., is perhaps the English wild form of the Continental *T. europæa*, L.; while *T. intermedia*, D. C., probably a sub-species of *T. europæa*, L., is the so-called common lime (Hooker, *Student's Flora of the British Isles*, p. 76). For a full description of the European and American forms, see London, *Arboretum*, i. p. 364, and De Candolle, *Prod.* i. 513. The lime sometimes acquires a great size: one is recorded in Norfolk as being 16 yards in circumference, and Ray mentions one of the same girth. The famous linden tree which gave the town of Neustadt in Württemberg the name of "Neustadt an der grossen Linden" was 9 feet in diameter.

The economic value of the tree chiefly lies in the inner bark or liber, called bast, and the wood. The former was used for paper and mats and for tying garlands by the ancients (*Od.* i. 38; *Pliny*, xvi. 14, 25; xxiv. 8, 38). *T. grandifolia* and *T. parvifolia* have been found in the debris of lake dwellings in Switzerland. Bast mats are now made chiefly in Russia, the bark being cut in long strips, when the liber is easily separable from the corky superficial layer. It is then plaited into mats about 2 yards square, 14,000,000 come to Britain annually, chiefly from Archangel. The wood is used by carvers, being soft and light, and by architects in framing the models of buildings. Turners use it for light bowls, &c. The flowers, alone, are used for an infusion in Austria and elsewhere, with much success in vertigo and spasms, producing perspiration, and alleviating coughs, but the bracts and fruit are astringent.

The common lime was well known to the ancients. Theophrastus says the leaves are sweet and used for fodder for most kinds of cattle. Pliny alludes to the use of the liber and wood, and describes the tree as growing in the mountain valleys of Italy (xvi. 30). See also *Verg.* *Georg.* i. 178 &c.; *Cr.* *M.* vii. 521, x. 92. The *Salix* (Eid., i. 67) was the lime of the Greeks, perhaps *T. argentea* (see Pickering's *Chron. Hist. of Plants*, pp. 214, 227, 418). Allusion to the lightness of the wood is made in Aristoph., *Birds*, 1378. For the sweet lime (*Citrus Limetta*) and lime juice, see LEMON.

LIMERICK, a maritime county of Ireland, in the province of Munster, is bounded on the N. by the estuary of the Shannon and the counties of Clare and Tipperary, on the E. by Tipperary, on the S. by Cork, and on the W. by Kerry. Its greatest length from north to south is 35 miles, and its greatest breadth east and west 54 miles. The total area comprises 662,978 acres, or 1036 square miles.

The greater part of the county is comparatively level, and rests on limestone, but in the south-east the picturesque Galtees, which extend into Tipperary, and are composed of Silurian strata overlaid by Old Red Sandstone, attain in Galtymore a height of 3015 feet, and on the west stretching

into Kerry there is a circular amphitheatre of less elevated mountains composed of volcanic rocks. The Shannon is navigable to Limerick, above which are the rapids of Doonins and Castlery. The Maag, which rises in the Galtees, and flows into the Shannon, is navigable as far as the town of Adare. Limerick includes the greater part of the Golden Vale, the most fertile district of Ireland, which stretches across the county from Cash in Tipperary to near the town of Limerick. Along the banks of the Shannon there are large tracts of flat meadow land formed of deposits of calcareous and sandy matter, and possessing extraordinary fertility. The soil in the mountainous districts is, for the most part, thin and poor, and incapable of improvement. In 1880 there were 175,774 acres under tillage, 415,107 pasture, 8,407 plantations, and 62,465 waste. The total number of holdings in 1880 was 16,366, of which 1937 were less than one acre, and 11,273 between 15 and 100 acres in extent, 1019 between 100 and 200 acres, 339 between 200 and 500 acres, and 29 above 1000 acres. The large farms occupy the low grounds, and are almost wholly devoted to grazing. The following table shows the area under the principal crops in 1855 and 1881—

	Wheat	Oats	Cereals Other than Oats	Potatoes	Turneps	Other Grasses	Flax	Straw and Clover	Total
1855	17,149	15,475	12,057	25,725	11,574	2,771	213	71,292	196,651
1881	7,227	21,410	4,034	21,025	7,220	3,791	16	112,278	176,831

The table shows a remarkable increase in the area under meadow, notwithstanding which the total area under tillage has considerably decreased. The number of horses has, since 1855, declined from 17,206 to 15,389, of which 10,228 were used for agricultural purposes. Cattle have increased from 159,710 to 201,456, an average of 28 to every 100 acres under cultivation, the average for Ireland being 25.8. The number of cows was 95,225. Sheep have diminished from 80,914 to 50,599, and pigs from 61,733 to 48,801. The number of goats was 10,012, and of poultry 428,398.

According to the corrected returns of 1878, the land, exclusive of that in the county of the city of Limerick, was divided among 1576 proprietors, possessing 660,336 acres, of the annual value of £461,213, or 13s. 11d. per acre. Of the owners nearly 40 per cent possessed less than 1 acre, the average extent being 394. The following were the largest proprietors—Earl of Devon, 33,026; Earl of Dunraven, 14,298; Lord Ashton, 11,273; Archdeacon Gould, 10,936; Lady Louisa Fitzgibbon, 10,316; Sir Croker Barrington, 9485.

Manufactures—The inhabitants are employed chiefly in agriculture, but coarse woollens are manufactured, and also paper, and there are a considerable number of meal and flour mills. At one time there were a number of flax-spinning and weaving mills, but that industry is now almost wholly extinct.

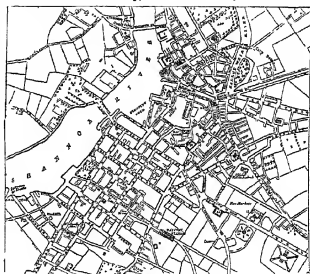
Administration and Population—The county includes 14 baronies, 181 parishes, 2067 townlands, and the city and parliamentary borough of Limerick. The number of members returned to the Irish parliament was eight, two being returned for each of the boroughs of Askeaton and Kilmallock, in addition to the two returned as at present for the county, and the two returned for the county of the city of Limerick. There are three poor-law unions wholly within the county, and portions of four others. Assizes are held at Limerick, and quarter sessions at Bruff, Limerick, Newcastle, and Rathkeale. The county is within the Cork military district, with a brigade depot at Tralee. The population, estimated in 1760 at 92,376, had increased in 1821 to 277,477, and in 1841 to 331,009, but since that period it has been gradually diminishing, being 217,277 in 1861, and in 1881 only 177,208, of whom 86,541 were males and 90,662 females. The decrease since 1871 has been 7.7 per cent, the decrease per cent in Ireland being 4.7. Besides the city of Limerick, with a population in 1881 of 48,346, only two other towns, Rathkeale and Newcastle, had a population of over 2000. From 1st May 1851 to 31st December 1880 the number of emigrants

from the county was 139,333, a proportion of 66 per cent of the population in 1861.

History and Antiquities—Limerick, originally inhabited by the Corioudi, was included in the kingdom of Thomond. Afterwards it had a separate existence under the name of Aine-Cluich. From the 8th to the 11th century it was partly occupied by the Danes. By Henry II it was granted to Henry Fitzthelbert, but his claim was afterwards resigned, and subsequently various Anglo-Norman settlements were made. About 100,000 acres of the estates of the earl of Desmond, which were forfeited in 1586, were situated in the county, and other extensive confiscations took place after the Cromwellian wars. In 1709 a German colony from the Palatinates was settled by Lord Southwell near Bruff, Rathkeale, and Adare.

There are only slight remains of the round tower at Anghatrick, but that at Carrigea is much better preserved. There are important remains of stone circles, pillar stones, and altars on Loch Gull. In several places there are remains of old mounds and tumuli. Besides the monasteries in the city of Limerick, the most important monastic ruins are those of Adare Abbey, Askeaton Abbey, Kilsheane Abbey, Galbally Friary, Kilfin Monastery, Kilmallock Abbey, and Monaster-Neragh Abbey. See the *History of Limerick* by Fitzgerald and McGregor, 1828-29.

LIMERICK, a county of a city, parliamentary borough, and the chief town of the county of Limerick, is situated on both sides of the Shannon, at the head of its estuary, and on an island of the river, 120 miles west-south-west of Dublin by rail. The western bank of the river is occupied by Irish Town, the island by English Town, and the eastern bank by Newtown Pery,—the two former divisions consisting chiefly of mean houses occupied by the poorer classes, and Newtown Pery including the principal streets, shops, and public buildings. The different parts of the town are connected by several bridges, the most important of which is Wellesley bridge, erected in 1827 at a cost of £285,000. The cathedral of St Mary, founded in 1180, and rebuilt in



Plan of Limerick.

1490, is a cruciform structure in the Gothic style, with an embattled tower 120 feet in height. A Roman Catholic cathedral in the First Pointed style was erected in 1860. The other principal public buildings are the court-house, the custom-house, the exchange, the chamber of commerce, the town-hall, the county jail, the city jail, the infirmary, and Barrington's hospital. There are barracks for cavalry, artillery, and infantry. Limerick as a port occupies the fourth position in Ireland, and, while possessing secure and open communication with the Atlantic, is included in a vast network of inland navigation. Vessels of 1000 tons can unload at the floating dock, and vessels of 500 tons at the quays. A graving dock, admitting vessels of 1800 tons for repair, has lately been constructed. The value of the imports in 1880 was £237,269, the average for the four years 1876-79 being £294,279, and, for 1872-75

£373,533. For the same dates the value of the exports was £20,569, £3552, and £12,516. The principal industries are flax spinning and weaving, and the manufacture of lace and gloves. There are also breweries, distilleries, tanneries, and flour-mills. The population in 1861 was 48,901, which in 1871 had increased to 49,980, but in 1881 had diminished to 48,246.

Limerick is said to have been the ancient *Regia* of Ptolemy and the *Rosse-de-Mailtoigh* of the Annals of Mulhernan. There is a tradition that it was visited by St. Patrick in the 5th century, but it is first authentically known as a settlement of the Danes, who in the middle of the 9th century made it one of their principal towns, but were expelled from it in the 11th century by Brian Borumhe. From 1166 till its conquest by the English in 1174 it was the seat of the kings of Thomond or North Munster, and although in 1179 the kingdom of Limerick was given by Henry II. to Herbert Fitzherbert, the city was frequently in the possession of the Irish chieftains till 1195. By King John it was committed to the care of William de Burgo, who founded English Town, and for its defence erected a strong castle. The city was frequently besieged in the 13th and 14th centuries. In the 15th century its fortifications were extended to include Irish Town, and until their demolition in 1780 it was one of the strongest fortresses of the kingdom. In 1651 it was taken by General Innes, and after an unsuccessful siege by William III. in 1690 its resistance was terminated in October of the following year by the treaty of Limerick. The town first obtained municipal privileges in 1199, and these were confirmed and extended by Edward I. and other sovereigns. In 1609 it received a charter constituting it a county of a city, and also incorporating a society of merchants of the staple, with the same privileges as the merchants of the staple of Dublin and Waterford. The powers of the corporation were remodelled by the Limerick Regulation Act of 1823. The prosperity of the city dates chiefly from the foundation of Newtown Pery by Mr. Sexton Pery in 1769. It returns two members to parliament. See the *History* by Linahan, 1866.

LIMITATION, STATUTES OF, are Acts of Parliament by which rights of action are limited to a fixed period after the occurrence of the events giving rise to the cause of action. This is one of the devices by which lapse of time is employed to settle disputed claims. There are mainly two modes by which this may be effected. We may say that the active enjoyment of a right—or possession—for a determined period shall be a good title against all the world. That is the method known generally as **PRESCRIPTION** (*q.v.*). It looks to the length of time during which the defendant in a disputed claim has been in possession or enjoyment of the matter in dispute. On the other hand, the principle of the statutes of limitation is to look to the length of time during which the plaintiff has been out of possession. The point of time at which he might first have brought his action having been ascertained, the lapse of the limited period after that time bars him for ever from bringing his action. In both cases the policy of the law is expressed by the maxim *Interest reipublice ut sit finis litium*.

The principle of limitation was first adopted in English law in connexion with real actions, *i.e.*, actions for the recovery of real property. At first a fixed date was taken, and no action could be brought of which the cause had arisen before that date. By the Statute of Westminster the First (3 Edward I. c. 39), the beginning of the reign of Richard I. was fixed as the date of limitation for such actions. This is the well known "period of legal memory" recognized by the judges in a different class of cases to which a rule of prescription was applied. Possession of rights *in alieno solo* from time immemorial was held to be an indefeasible title, and the courts following the statutes above mentioned held time immemorial to begin with the first year of Richard I.

A period absolutely fixed became in course of time useless for the purposes of limitation, and at last the method of counting back a certain number of years from the date of the writs was adopted in the Statute 32 Henry VIII. c. 2, which fixed periods of thirty, fifty, and sixty

years for various classes of actions named therein. A large number of statutes since that time have established periods of limitation for different kinds of actions. Of those now in force the most important are 21 James I. c. 16 for personal actions in general, and 3 & 4 Will. IV. c. 27 relating to actions for the recovery of land. The latter statute has been repealed and virtually re-enacted by the Real Property Limitation Act, 1874, which reduced the period of limitation from twenty years to twelve, for all actions brought after the 1st January 1879. The principal section of the Act of Will. IV. will show the *modus operandi*—"After the 31st December 1833, no person shall make an entry or distress, or bring an action to recover any land or rent but *within twenty years next after the time* at which the right to make such entry or distress or to bring such action shall have first accrued to some person through whom he claims, or shall have first accrued to the person making or bringing the same." Another section defines the times at which the right of action or entry shall be deemed to have accrued in particular cases, *e.g.*, when the estate claimed shall have been an estate or interest in reversion, such right shall be deemed to have first accrued at the time at which such estate or interest became an estate or interest in possession. Thus suppose lands to be let by A to B from 1850 for a period of fifty years, and that a portion of such lands is occupied by C from 1851 without any colour of title from B or A—C's long possession would be of no avail against an action brought by A for the recovery of the land after the determination of B's lease. A would have twelve years after the determination of the lease within which to bring his action, and might thus, by an action brought in 1891, disestablish a person who had been in quiet possession since 1831. What the law looks to is not the length of time during which C has enjoyed the property, but the length of time which A has suffered to elapse since he might first have brought his action.

It is to be observed, however, that the Real Property Limitation Act does more than bar the remedy. It distinguishes the right, differing in this respect from the other Limitation Acts, which, while barring the remedy, preserve the right, so that it may possibly become available in some other way than by action.

By section 14 of the Act of Will. IV., "when any acknowledgment of the title of the person entitled shall have been given to him or his agent in writing signed by the person in possession, or in receipt of the profits or rent, then the right of the person (to whom such acknowledgment shall have been given) to make an entry or distress or bring an action shall be deemed to have first accrued at the time at which such acknowledgment, or the last of such acknowledgments, was given. By section 15, persons under the disability of infancy, lunacy, or coverture, or beyond seas, and their representatives, are to be allowed ten years from the termination of this disability, or death (which shall have first happened), notwithstanding that the ordinary period of limitation shall have expired.

By 21 James I. c. 16, actions of trespass, detinue, trover, replevin, or account, actions on the case (except for slander), actions of debt arising out of a simple contract, and actions for arrears of rent not due upon specialty, shall be limited to six years from the date of the cause of action. Actions for assault, menace, battery, wounds, and imprisonment are limited to four years, and actions for slander to two years. Persons labouring under disabilities are allowed the same time after the removal of the disability. When the defendant is "beyond seas" (*i.e.*, outside the United Kingdom and the adjacent islands) a similar extension of time is allowed.

An acknowledgment, whether by payment on account or by mere spoken words, was formerly sufficient to take

the case out of the statute. The Act 9 Geo. IV. c. 14 (Lord Tenterden's Act) requires any promise or admission of liability to be in writing and signed by the party to be charged, otherwise it will not bar the statute.

Contracts under seal are governed as to limitation by 3 & 4 William IV. c. 42, which provides that actions for rent upon any indenture of demise, or of covenant, or debt, or any bond or other specialty, and on recognizances, must be brought within twenty years after cause of action. Actions of debt on an award (the submission being not under seal), or for a copyhold fine, or for money lent on a writ of *fiel i facias*, must be brought within six years.

Of the miscellaneous limitations fixed by various Acts, the following may be noticed. Suits and indictments under penal statutes are limited to two years if the forfeiture is to the crown, to one year if the forfeiture is to the common informer. Penal actions by persons aggrieved are limited to two years (3 & 4 Will. IV. c. 42). Actions brought against a justice of the peace for acts done in the execution of his office are limited to six calendar months (11 & 12 Vict. c. 44). Acts done under any local or personal Act of Parliament can only be sued upon within two years (5 & 6 Vict. c. 97).

A defence under the statutes of limitations must in general be specially pleaded. Limitation is regarded strictly as a law of procedure. The English courts will therefore apply their own rules to all actions, although the cause of action may have arisen in a country in which different rules of limitation exist. This is also a recognized principle of private international law.

United States—The principle of the statute of limitations has passed with some modification into the statute-books of every State in the Union except Louisiana, whose laws of limitation are essentially the prescriptions of the civil law drawn from the *Partidas*, or "Spanish Code." As to personal actions, it is generally provided that they shall be brought within a certain specified time—usually six years or less—from the time when the cause of action accrues, and not after, while for land the "general if not universal limitation of the right to bring action or to make entry is to twenty years after the right to enter or to bring the action accrues" (Bouvier's *Law Dictionary*, art. "Limitations"). The constitutional provision prohibiting States from passing laws impairing the obligation of contracts is not infringed by a law of limitations, unless it bars a right of action already accrued without giving a reasonable term within which to bring the action. (E. R.)

LIMOGES, capital of the department of Haute Vienne, France, and the ancient capital of Limousin, lies in the form of an amphitheatre on the right bank of the Vienne, 248 miles by rail south-south-west from Paris, on the Paris and Toulouse Railway, at its junction with the Charente line. It has also direct railway communication by Bellac with Poitiers. The population in 1876 was 59,011. In spite of many modern improvements and cleanances, commencing with the administration of Turgot in 1762, the city still contains old quarters, which are dark, wretched, and unhealthy.

The cathedral, the most remarkable building, not only in the town but in the entire province, is in the Parisian Ogival style, and occupies the site of an old heathen basilica, which, according to tradition, was transformed into a Christian church by St. Martial. The present edifice was built between 1273 and 1327, and has been quite recently restored, the north front of the transept, distinguished by the richness and perfection of its details, having been finally completed in 1851. The campanile is an elegant slightly leaning tower, 204 feet high. The interior of the church is remarkable for the boldness and elegance of its construction. It has a magnificent rood-loft, attributed to Bishop

Jean de Langeac (1533); close by the choir screen is the mausoleum of the same prelate. The glass was repaired in the 16th century, but is still undergoing restoration. Under the choir is the crypt of the old Roman church, containing frescoes of the 11th century. Some of the houses still standing in Limoges date from the Middle



Plan of Limoges.

Agés; and commemorative tablets mark the birthplace of the chancellor D'Aguesseau and of Marshals Jourdan and Bugeaud. There is a museum of painting and sculpture, and, in connexion with the local industry, a very valuable ceramic museum. Limoges is the headquarters of the 12th army corps, and is also the seat of several learned societies, and of a court of appeal.

The principal industry is the manufacture of porcelain. The kaolin of St Yrieix is of such superior quality that it is exported even to America; the pegmatite used for enamel is obtained at Chanteloube, about 25 miles from Limoges, on the Paris railway. Thirty-five factories with eighty furnaces and fifty-four painting rooms (800 artists) employ 5800 workers of both sexes, and produce goods to the annual value of 12 millions of francs. There are many others in the immediate neighbourhood of the town. Limoges has also wool and cotton spinning-mills, and cloth factories, paper-works, foundries, &c. Shoemaking gives employment to 600 persons, and the manufacture of clogs to 250. There is an extensive trade in wine and spirits, cattle, cereals, and wood. The Vienne is navigable for rafts above Limoges, and the logs brought down by the current are stopped at the entrance of the town by the inhabitants of the Navexis quarter, who form a special guild for this industry.

Limoges was a place of importance even at the time of the Roman conquest, and sent ten thousand soldiers to the defence of Alesia. In 11 n.c. it took the name of Augustus (*Augustonem*), but in the 4th century it was again called by the name of the *Lemovices*, whose capital it was. It then contained palaces and baths, had its own senate and the right of coinage (711 1837 it had a mint). Christianity was introduced by St. Martial. In the 6th century Limoges was devastated by the Vandals and the Visigoths. Viscounts were set over it by Clovis. It suffered again in the wars between the Franks and the people of Aquitaine, from Nerian

invasion, and from a struggle which arose between two parties into which the city was divided, led by the abbot of St Martial and by the bishop respectively. During the Hundred Years' War it was taken again and again by the French and English. Confiscated under John Lackland, it was again seized by Louis IX. In 1370 the Black Prince took it by assault, and gave it up to fire and sword, — a disaster from which it was slow to recover. The religious wars, pestilence, and famine desolated it in turn, but the ravages of all these were surpassed by the plague of 1630-31, which carried off more than twenty thousand persons. The wise administrations of Henri d'Angouleme, father of the chancellor, and of Turgot enabled Limoges to recover its former prosperity. There have been several noteworthy conflagrations, destroying whole quarters of the city, built, as it then was, of wood. That of 1790 lasted for two months, and destroyed one hundred and ninety-nine houses, that of 1804 laid under ashes an area of 10,000 square metres. Limoges celebrated every seven years a curious religious festival (*Fête d'Octonion*), during which the relics of St Martial are exposed for seven weeks, attracting large numbers of visitors. It dates from the 10th century, and commemorates a pestilence (*mal des ardois*) which, after destroying forty thousand persons, is believed to have been stayed by the intercession of the saint.

LINACRE, or LYNACER, THOMAS (1460-1534), a distinguished humanist and physician, was born at Canterbury about the year 1460. Of his parentage or descent nothing certain is known. He received his early education at the cathedral school of Canterbury, then under the direction of William of Selling, afterwards prior of Canterbury. Selling was an ardent scholar, and one of the earliest in England who cultivated Greek learning. From him Linacre must have received his first incentive to this study, in which he afterwards became eminent. Linacre entered the university of Oxford about the year 1480, and in 1484 was elected a fellow of All Souls' College. Shortly afterwards he visited Italy in the train of William of Selling, who was sent by Henry VIII. as an envoy to the papal court, and accompanied his patron as far as Bologna. There he became the pupil of Angelo Poliziano, and afterwards shared the instruction which that great scholar imparted at Florence to the youthful sons of Lorenzo de' Medici. The younger of these princes became Pope Leo X., and was in after years mindful of his old companionship with Linacre.

Among his other teachers and friends in Italy should be mentioned Demetrius Chalcondylas, Hermolaus Barbarus, Aldus Romanus the printer of Venice, and Nicolaus Leoniconius of Vicenza. Linacre took the degree of doctor of medicine with great distinction at Padua. On his return to Oxford, full of the learning and imbued with the spirit of the Italian Renaissance, he formed one of the brilliant circle of Oxford scholars, including Colet, Grocyen, and William Latimer, who are mentioned with so much warm eulogy in the letters of Erasmus.

Linacre does not appear to have practised or taught medicine in Oxford. About the year 1501 he was called to court as tutor of the young prince Arthur, and continued to act in this capacity till the prince's death in 1503. On the accession of Henry VIII. he was appointed the king's physician, an office at that time of considerable influence and importance, and practised medicine in London, having among his patients most of the great statesmen and prelates of the time, as Wolsey, Warham, and Fox.

After some years of professional activity, and when in advanced life, Linacre received priest's orders. But, as he had for some years previously held several clerical benefices, it would seem that he must have been already a deacon, and thus nominally at least a cleric, but this status would not in those days have interfered with his practising as a physician. There is no doubt, however, that his ordination as priest was connected with his retirement from active life. Literary labours, and the care of the foundation which owed its existence chiefly to him, the Royal College of Physicians, occupied Linacre's remaining years till his death in 1524.

Linacre was more of a scholar than a man of letters, and rather a man of learning than a scientific investigator. It is difficult now to judge of his practical skill in his profession, but it was evidently highly esteemed in his own day, and several instances are recorded of his wise, prompt, and judicious treatment. He took no part in political or theological questions, and died too soon to have to declare himself on either side in the formidable controversies which were even in his lifetime beginning to arise.

But his career as a scholar was one eminently characteristic of the critical period in the history of learning through which he lived. He was one of the first Englishmen who studied Greek in Italy, whence he brought back to his native country and his own university the lessons of the "New Learning." His teachers, who have already been named, were some of the greatest scholars of the day. Among his pupils was only — Erasmus — whose name alone would suffice to preserve the memory of his instructor in Greek, and others of note in letters and politics, such as Sir Thomas More, the lamented Prince Arthur, and Queen Mary. Colet, Grocyen, William Lilye, and other eminent scholars were his intimate friends, and he was esteemed by a still wider circle of literary correspondents in all parts of Europe.

Linacre's literary activity was displayed in two directions, in pure scholarship and in translation from the Greek. In the domain of scholarship he was known by the rudiments of (Latin) grammar composed in English for the use of the Princess Mary, and afterwards translated into Latin by George Buchanan, and by a work on Latin composition, *De emendata structura Latinæ orationis*, which enjoyed a wide popularity. It was originally composed for the use of St Paul's school, when founded by Dean Colet, but was set aside as unsuited for the purpose. It was, however, printed in London, in 1524, and many times reprinted on the Continent.

Linacre's only medical works were his translations. It was the cherished project of his life to make the works of Galen (and indeed those of Aristotle also) accessible to all readers of Latin. What he effected in the case of the first, though not trifling in itself, is inconsiderable as compared with the whole mass of Galen's writings, and of his translations from Aristotle, some of which are known to have been completed, nothing has survived. The following are the works of Galen translated by Linacre: — (1) *De emendata structura Latinæ orationis*, Paris, 1519; (2) *Methodus Medendi*, Paris, 1519; (3) *De Temperamentis et de Inequali Intemperie*, Cambridge, 1521; (4) *De Naturalibus Facultatibus*, London, 1523; (5) *De Symptomatum Differentiis et Causis*, London, 1524; (6) *De Pulsum*, London, without date. He also translated for the use of his pupil Prince Arthur an astronomical treatise of Ptolemy, *De Sphæra*, which was printed at Venice by Aldus in 1499. The accuracy of these translations and their elegance of style were universally admitted. They have been generally accepted as the standard versions of those parts of Galen's writings, and frequently reprinted, either as a part of the collected works or separately.

But the most important service which Linacre conferred upon his own profession and science was not by his writings. To him was chiefly owing the foundation by royal charter of the College of Physicians in London, which first gave the medical profession in this country a recognized legal status, and which has been the model of all the similar colleges of physicians and surgeons in the three kingdoms. He was the first president of the new college, which he further aided by conveying to it his own house, and by the gift of his library. Shortly before his death Linacre obtained from the king letters patent for the establishment of readerships in medicine at Oxford and Cambridge, and placed some valuable estates in the hands of trustees for their endowment. Two readerships were founded in Morton College, Oxford, and one in St John's College, Cambridge, but owing to neglect and bad management of the funds, they fell into uselessness and obscurity. The Oxford foundation was revived by the university commissioners in 1553 in the form of the Linacre professorship of anatomy. Fortunate has done justice to the generosity and public spirit which prompted these foundations; and it is impossible not to recognize a strong constructive genius in the scheme of the College of Physicians, by which Linacre not only first organized the medical profession in England, but impressed upon it for some centuries the stamp of his own individuality. The intellectual fastidiousness of Linacre, and his habits of minute accuracy were, as Erasmus suggests, the chief cause why he accomplished so little and left behind no more permanent literary memorials. It will be found, perhaps, difficult to justify by any extant work the extremely high



reputation which he enjoyed among the scholars of his time. His Latin style was so much admired that, according to the flattering eulogium of Erasmus, Galen spoke better Latin in the version of Linacre than he had before spoken Greek; and even Aristotle displayed a grace which he hardly attained to in his native tongue. Erasmus himself also Linacre's critical judgment (*vir non evecti tantum sed severi pulcrit*). According to others it was hard to say whether he were more distinguished as a grammarian or a rhetorician. Of Greek he was regarded as a consummate master, and he was equally eminent as a "philosopher," that is, as learned in the works of the ancient philosophers and naturalists. In this there may have been, as the custom of the day was, some exaggeration; but all have acknowledged the elevation of Linacre's character, and the fine moral qualities summed up in the epitaph written by John Caius:—"Frenuolus doloresque mifer perens; fidus amicus, amantibus ordinatus iuxta carum."

The materials for Linacre's biography are to a large extent contained in the older biographical collections of George Lilly (*On Paulus Jovius, Eusebio Brilioniensis*), Haly, Leland, and Pitt, in Wood's *Athenae Oxonienses*, and in the *Biographia Britannica*, but all are completely collected in the *Life of Thomas Linacre*, by Dr. Noble Johnston, London, 1855. Reference may also be made to Dr. Munk's *Roll of the Royal College of Physicians*, 3d ed., London, 1878, and the *Introduction*, by Dr. Payne, to a facsimile reproduction of Linacre's version of *Galien de Temperamentis*, published by Messrs Moonlight, Gussall, W. With the exception of this treatise, none of Linacre's works or translations has been reprinted in modern times. (P. F. 2)

LINARES, an important mining town in the province of Jaen, Spain, is situated in an acid plain, near the foot of the Sierra Morena, 24 miles north-east from the town of Jaen, 12 north-east from that of Baza, and half an hour by rail from the Vadollano station of the Madrid and Cordova line. The streets are ill paved, irregular, and ugly, and, apart from a fine fountain of Roman origin, the town presents no architectural features of interest. There is some trade in the oil and wine of the neighbourhood, which are excellent and plentiful, wool is exported to Catalonia and Valencia; and cattle-breeding, especially of animals for the bull-ring, is also carried on. But the population, which in 1877 numbered 36,630, and includes some 120 English, with a consul and a chaplain, is chiefly engaged in the working of the extensive lead-mines to the north-west of the town, and in various concomitant industries, such as the manufacture of gunpowder, dynamite, match for blasting purposes, rope, and the like. The mining plant is entirely imported, principally from England. In respect of the quantity and uniform excellence of their productions the lead-mines of the province of Jaen are unsurpassed. For the year 1876-77 the joint output of those of Linares, Vilches, Bailen, Carboneros, Santa Helena, and (in part) La Carolina was stated at 1,630,000 cwts. of ore, worth upwards of £800,000,—the proportion of silver to lead varying from 30 to 60 grammes of the former to every 50 kilogrammes of the latter. The best class of ore is exported, chiefly to France and Belgium; the inferior classes are smelted for the most part in Spain. About 2 miles to the south of Linares in the village of Cazalona, which still shows some remains of the ancient Castulo; and the ancient mines some 5 miles to the north, which are now known as "Los Pozos de Anibal," may with some probability be assigned to the Carthaginian period.

LINCOLN, one of the four eastern maritime counties of England, lies between 52° 39' and 53° 43' N. lat., and 0° 22' E. and 0° 56' W. long. It is bounded on the N. by the Humber, E. by the German Ocean and the Wash, S.E. for 3 miles by Norfolk, S. by Cambridge and Northampton, S.W. by Rutland, W. by Leicestershire and Nottingham, and N.W. by Yorkshire. Its greatest length north and south, from Barton-on-Humber to Market Deeping, is 75 miles, its greatest breadth, from Wroton to the west to Saltfleet on the east, is 50 miles, its circuit about 260 miles. Its area is 1,767,962 acres, or about 2762 square miles, making it the second largest county in England.

Coast-Line.—The coast-line, about 110 miles in length, is low and marshy, and artificial banks for guarding against the inroads of the sea are to be found, in places, all along the coast. From Grimsby to Skegness traces of a sub-

marine forest are visible; but while the sea is encroaching upon some parts of the coast it is receding from others, as shown by Holbeach, which is now 6 miles from the sea. Several thousand acres have been reclaimed from this part of the Wash, and round the mouth of the Nene on the south-east. The deep bay between the coasts of Lincolnshire and Norfolk, called the Wash, is full of dangerous sandbanks and silt, the navigable portion, of the Lincolnshire coast, is known as the Boston deeps. The rapidity of the tides in this inlet, and the lowness of its shores, which are generally indistinct on account of mist from a moderate offing, render this the most difficult portion of the navigation of the east coast of England.

Surface and Geology.—The surface of Lincolnshire is generally a large plain, some portions of which are below the level of the sea. The south-east parts are perfectly flat, and about one-third of the county consists of fens and marshes, intersected in all directions by artificial drains, called locally dykes, delphs, drains, becks, leams, and eaus. This flat surface is, however, broken by two ranges of calcareous hills running north and south through the county, and known as the Cliff and the Wolds. The former range, on the west, runs nearly due north from Grantham to Lincoln, and thence to the Humber, traversing the Heaths of Lincolnshire, which were formerly open moors, rabbit warrens, and sheep walks, but are now enclosed and brought into high cultivation. Parallel with this range on the east side of it runs the old Roman Ermine Street, sometimes called the Cliff Row Road. The Wolds form a ridge of bold hills extending from Spilsby to Barton-on-Humber for about 40 miles, with an average breadth of about 8 miles. Between the Wolds and the sea lie the Marshes, a level tract of rich alluvial soil extending from Barton-on-Humber to Waufleet, varying in breadth from 5 to 10 miles. Between the Welland and the Nene in the south-east of the county are Gedney Marsh, Holbeach Marsh, Moulton Marsh, and Sutton Marsh.

The Fens, the soil of which has been formed partly by tidal action and partly by the decay of forests, occupy the Isle of Axholme on the north-west, the vale of Ancholme on the north, and most of the county south-east of Lincoln. The chief of these are the Holland, Wildmore, West, and East Fens draining into the Witham; and the Deeping, Bourn, Great Fownd, and Whapload Fens draining into the Welland. Owing to the dead level of these districts there is perhaps more artificial drainage in Lincolnshire than in any other English county; and thus part of the country resembles in many respects, especially in embankments and dykes, the continental Holland.

The drainage of the Fens appears to have early occupied attention Shortly after the Norman Conquest Richard de Rulois, lord of Brum, and chamberlain to William I., enclosed and drained a large part of Deeping Fen in so complete a manner that the work would not be surpassed by a comparison with the more scientific efforts of modern times. Excluding the Welland by a bank, he changed "deep lakes and impassable fens into most fruitful fields and pastures, and the most humil and moorish parts thereof into a garden of pleasure."

The drainage of the remaining levels of Lincolnshire was chiefly commenced in the reigns of James I. and Charles I. The East, West, and Wildmore Fens were contracted for in the 7th Charles I. The earl of Lindsey undertook all the fens in Holland and Kesteven, north of the River Glen up to Lincoln, on the completion of which 34,000 acres were awarded to him. In the 13th of the same reign, the king declared himself the "undertaker" of the Holland Fen, containing 22,000 acres, out of which he was to have 8000 for his share. Sir John Manners with other freeholders drained the Ancholme level in the north, and had 5827 acres assigned to them. In the same reign the Isle of Axholme was undertaken by Cornelius Vermuyden and his Dutch and Flemish followers. These operations were interrupted during the civil wars, and many of the works destroyed by the "still-walkers," so curiously described by Camden. Little was done towards restoring the works thus destroyed till the middle of the 18th century, when several townships, having a right of common over particular fens, began to join in procuring Acts of

Parliament for their drainage, enclosure, and division. The Holland Fen was the first to be dealt with, about 1788; in spite of renewed and potent opposition from the "stilt-walkers," all the fen lands were successfully drained and enclosed, and on the completion of the East, West, and Widmore Fens (about 60,000 acres) the race of "stilt-walkers" became extinct. The low lands adjoining the tidal reaches of the Trent and Humber, and part of those around the Wash, have been raised above the natural level, and enriched by the process of warping, which consists in letting the tide run over the land, and retaining it there a sufficient time to permit of the deposit of the sand and mud held in solution by the waters.

The general appearance of the county is very pleasing. The level tracts are richly cultivated; the hills and dales are interspersed with wood and lawn; and many spots on the Cliff or Wolds command extensive and charming views. The charms of the Fen districts are described as "a beauty as of the sea, of boundless expanse and freedom" (Kingsley). Not a few passages in the writings of Tennyson (a native of the county) bear the impress of the scenery and colourings of the Fens.

The geological formations, for the most part, extend in parallel belts, nearly in the line of the length of the county, from north to south, and succeed one another, in ascending order, from west to east.

1. The lowest is the *Triassic* or *New Red Sandstone* found in the Isle of Axholme and the valley of the Trent in the form of marls, sandstone, and gypsum. The presence of the porphyry of iron which tinges the beds red seems to have been prejudicial to animal life; therefore few fossils are found. Fish scales and teeth, with bones and footprints of the *Labyrinthodon*, are to be met with in the sandstone. The red clay is frequently dug for brick-making. The beds dip gently towards the east. At the junction between the Triassic and Lias are series of beds termed *Rhætic*, which seem to mark a transition from one to the other. These beds are in part exposed in pits near Newark, and extend north by Gainsborough to where the Trent flows into the Humber, passing thence into Yorkshire. The characteristic shells are found at Lea, 2 miles south of Gainsborough, with a thin stratum of bone bed full of fish teeth and scales.

2. The *Lower Lias* comes next in order, with a valuable bed of *nostons* now largely worked. This bed is about 27 feet in thickness, and crops out at Southorpe, where the workings are open and shallow. The *Middle Lias*, which enters the county near Wootton, is about 20 or 30 feet thick, and is very variable both in thickness and mineralogical character. The *Upper Lias* enters the county at Stunby, passing by Grantham and Lincoln. It forms the west slope of the Cliff range, and is thickest upon the highest hills. The Lias thus occupies a band about 6 or 10 miles in width in the south, narrowing until on the Humber it is about a mile wide.

3. To this succeed the three *Oolite* formations. The *Lower Oolite*, somewhat narrower than the Lias, extends from the boundary with Rutland due north past Lincoln to the vicinity of the Humber. The *Middle Oolite*, very narrow in the south near Wiltshire, widening suddenly about Sleaford, and then suddenly contracting again south of Lincoln, sends out a narrow band south-east towards Spilsby. It then proceeds north from Lincoln with decreasing width to the vicinity of the Humber. The *Upper Oolite* and *Kimberidge* clay start from the vicinity of Stamford, and after attaining their greatest width near Horncastle, run north-north-west to the Humber.

4. In the *Ordovician* system of the Wolds, the *Lower Greensand* runs nearly parallel with the *Upper Oolite* past South Willingham to the Humber. The *Upper Greensand* and *Gault* run north-west from Irby, widening out as far as Kelso in the east, and cross the Humber. The *Chalk* formation, about equal in breadth to the three preceding, extends from Burgh across the Humber.

5. All the rest of the county, comprising all its south-east portions between the Middle Oolite belt and the sea, all its north-east portion between the Chalk belt and the sea, and a narrow tract up the course of the Ancholme river, consists of alluvial deposits or of reclaimed marsh.

Minerals.—Gypsum is dug in the Isle of Axholme, whiting is made from the chalk near the shores of the Humber, and lime is made on the Wolds. Freestone is quarried around Auster, and good oolite building stone is quarried near Lincoln and other places. Ironstone is found and worked at Claxby near Caistor, and carried into Yorkshire to be smelted; it is also worked at Frodingham, 9 miles north-north-west of Brigg.

Rivers.—The Humber separates Lincolnshire from Yorkshire. Its ports on the Lincolnshire side are Barton, New

Holland, and Grimsby. The Trent divides the Isle of Axholme from Lindsey, and falls into the Humber about 30 miles below Gainsborough. Like the Severn, it is noted for a tidal phenomenon called the "eager" or bore, which, at spring tides, rises to the height of from 6 to 8 feet. The *Widham* rises on the south-west border of the county, flows north past Grantham to Lincoln, and thence east and south-east to Boston, after a course of about 80 miles. This river was once noted for its silt. The *Welland* rises in north-west Northamptonshire, enters the county at Stamford, and, after receiving the *Glen*, flows through an artificial channel into the *Fossdyke* Wash. The *Nene* on the south-east has but a small portion of its course in Lincolnshire, it flows due north through an artificial outfall called the *Wisbech* Cut.

Canals.—The principal canals are—the *Stainforth* and *Keadby*, connecting the Trent with the Yorkshire coal-field; the *Louth Navigation*, from Louth to Tetney Haven; the *Sleaford Navigation*, connecting Sleaford with the *Witham*; and the *Grantham Canal*, from that town to the Trent at Nottingham. The remainder are chiefly small rivers artificially deepened and embanked.

Climate.—The climate of the higher grounds is now noted for its salubrity, and meteorological observation does not justify the reputation for cold and damp often given to the county as a whole. The mean annual temperature of the Fens as given by ten years' observation (1864-73) is 47°·9, 1°·6 below that of Greenwich. The rainfall of the Fen district is very small as compared with other parts of England. While the average of the whole country was little over 30 inches, at Boston the average fall from 1830 to 1849 was 23·58 inches, and from 1850 to 1869 22·08. At *Wisbech* south-west winds prevail on an average six months in the year, and north-east winds barely two months.

Soil and Agriculture.—The soils vary considerably, according to the geological formations; ten or twelve different kinds may be found in going across the country from east to west. A good sandy loam is common in the Heath division; a sandy loam with chalk, or a stony loam on chalk marl, abounds on portions of the Wolds; an argillaceous sand, merging into rich loam, lies on other portions of the Wolds; a black loam and a rich vegetable mould cover most of the Isle of Axholme on the north-west; a well-reclaimed marine marsh, a rich brown loam, and a stiff cold clay variously occupy the low tracts along the Humber, and between the north Wolds and the sea; a peat earth, a deep sandy loam, and a rich scaly blue clay occupy most of the east and south Fens; and an artificial soil, obtained by "warping," occupies considerable low strips of land along the tidal reaches of the rivers. The wide grazing lands of Lincolnshire have long been famous, and the arable lands are specially adapted for the growth of wheat and beans. There is no generally recognized rotation of crops. The cattle raised are the *Shorthorns* and improved *Lincolnshire* breeds. The dairy, except in the vicinity of large towns, receives little attention. The sheep are chiefly of the *Lincolnshire* and large *Leicestershire* breeds, and go to the markets of Yorkshire and the metropolis. Lincolnshire has long been famous for a fine breed of horses both for the saddle and draught. Horse fairs are held every year at Horncastle and Lincoln. Large flocks of geese were formerly kept in the Fens, but their number has been diminished since the drainage of these parts. Where a large number of them were bred, nests were constructed for them one above another; they were daily taken down by the gooseherd, driven to the water, and then reinstated in their nests, without a single bird being misplaced. Decoys were once numerous in the undrained state of the Fens.

According to the agricultural returns for 1881, the total area under crops comprehended 1,498,676 acres, a percentage of 84.7 instead of 81.7 in 1870, corn crops had an area of 611,977 acres, a percentage of 34.6 instead of 34.9 in 1870, green crops, 288,719 acres, a percentage of 18.6 instead of 18.2 in 1870; rotation grasses, 167,502 acres, a percentage of 9.4 instead of 9.4, permanent pastures, 440,422 acres, a percentage of 24.9 instead of 24.8. The area under crops is thus more than three times the amount under pasturage. The area under woods in 1881 was 39,431 acres, and under orchards 1788, under market gardens 860, under nurseries gardens 137. Of the corn crops the most largely grown is wheat, which in 1881 occupied 245,646 acres,—barley or bere, grown mostly on the Wolds and the Heath districts, coming next with 199,900 acres; then oats, 118,664 acres; lastly rye, 1800 acres. Beans occupied 41,078 acres, peas 10,496 acres. Of the green crops the most largely grown in 1881 were turnips and swedes, 142,800 acres, mostly on the Wolds and Lincoln Heath. Potatoes occupied 36,794 acres, mangold, 21,438; vetches and other green crops, except clover or grass, 18,615 acres; cabbage, kohlrabi, and rape, 16,057 acres, carrots, 1516 acres. Onions are raised to a great extent in the Isle of Axholme, and under good management have been known to return £50 per acre. Flax occupied 855 acres, and hops 3. The bare fallow or uncropped arable land in 1881 was 39,865 acres. In 1870, 81.7 per cent of

Class of holding	50 Acres and under		50 to 100 Acres		100 to 500 Acres		500 to 600 Acres		600 to 1000 Acres		1000 Acres and upwards		Total
	1875	1880	1875	1880	1875	1880	1875	1880	1875	1880	1875	1880	
Number	19,706	20,908	2,181	2,104	2,838	2,930	817	833	370	366	28	38	25,449
Area in acres . .	221,687	224,898	106,095	145,559	611,495	600,478	213,126	218,013	206,448	240,468	38,878	45,215	1,476,447

Manufactures and Trade.—The manufactures are few and comparatively small. There are, however, some large agricultural machine and steam-engine factories in and around Lincoln; and similar works exist at Boston, Gainsborough, Grantham, and Louth. At Frodingham there are extensive iron-works. At Little Bytham a very hard brick, called the adamantine clinker, is made of the silicious clay that the Romans used for their manufactures of pottery. At Louth there is a carpet manufactory, also several tanneries and iron foundries. Bone crushing, leather working, the manufacture of oil-cake for cattle, rope making, and sack weaving are carried on in various places. The chief ports are Grimsby, Boston, Sutton Bridge, and Gainsborough, the first being by far the most important. For the fisheries of GAINSBY see vol. ix. p. 249.

Railways.—The first line opened in the county was the Midland Railway to Lincoln, in August 1846. The Manchester, Sheffield, and Lincolnshire Railway, first opened in 1848-49, goes from Lincoln north-east to Market Rasen, and thence, by way of Barnetby and Ulceby junctions, to Grimsby and Cleethorpes. A second branch runs north-east from Gainsborough to New Holland and Barton on the Humber, and a third from Barnetby due west to the Yorkshire coal-fields. The Great Northern main line runs through the south-west of the county past Grantham to Newark, and throws off several branches. A loop line connecting Spalding, Boston, and Lincoln with the direct line from London to York was opened in 1848. The East Lincolnshire Railway (leased to the Great Northern) runs from Boston to Grimsby.

Administration.—The primary divisions of Lincolnshire are three trithings or ridings. The north division constitutes the Parts of Lindsey, the south-west the Parts of Kesteven, and the south-east the Parts of Holland. Each of these divisions had before the Norman Conquest its own trithing courts or reeve, and to this day each has its separate trithing, quarter sessions, clerk of the peace and treasurer, but they are all under one lord-lieutenant and one sheriff, and subject to the court of assize held at Lincoln. These "Parts" are again subdivided into wapentakes, soke, and hundreds. The trithings do not in any way coincide with parliamentary divisions. The Parts of Lindsey comprise more than half the county, and contain seventeen wapentakes. The Parts of Kesteven, exclusive of the soke and borough of Grantham and the borough of Stamford, comprise nine wapentakes. The Parts of Holland comprises three wapentakes only. Before the passing of the Reform Act of 1832 Lincolnshire sent twelve members to parliament—two for the county, two for the city of Lincoln, and

the entire area of Lincolnshire was returned as cultivated, in 1879, 84.1 per cent, and in 1880, 84.5. The number of horses used solely for agriculture in 1881 was 49,366; mares and unbroken heifers, 15,171—total, 64,537. The number of cows and heifers in milk or in calf in 1881 was 53,496, and of other cattle 166,706. The number of sheep was 1,836,147, or 90.2 for every 100 acres, the average for Great Britain being 76.8, for England 82.4. Pigs in 1881 numbered 82,497.

The agriculture of Lincolnshire is only second to that of East Lothian, by which alone it is excelled in the use of fixed steam-engines upon its farmsteads. In the south part of the county small proprietors abound. According to the landowners' returns for 1879-73, the land in the county of Lincoln was divided among 80,497 owners, and its gross estimated rental was £3,173,826. Of the owners, 13,768, or more than 46 per cent., possessed less than 1 acre; the average value per acre was £1, 18s. 6d. There were four proprietors possessing over 10,000 acres each.—Earl of Yarborough, 55,272 acres, Lady Willoughby de Eresby, 24,698 acres; Henry Chapin, M.P., 28,870 acres, and Christopher Turner, 20,664 acres.

The following table gives a classification of holdings according to size as returned on the 26th June 1875 and the 4th June 1880:—

two each for the boroughs of Great Grimsby, Boston, Grantham, and Stamford. After the passing of that Act the county returned four members, and Grimsby lost one. In 1867 Stamford also lost a member, and the representation of the county, newly divided into Mid, North, and South Lincolnshire, was increased to six, each new division returning two members. Lincolnshire comprises one city, Lincoln (population 37,312), which is also a municipal and parliamentary borough, four other municipal and parliamentary boroughs—Boston (18,887), Grantham (17,845), Great Grimsby (45,378), Stamford, partly in Northampton (8996); and one municipal borough—Louth (16,680).

The county belongs to the midland arc. Besides the winter and summer assizes held at Lincoln, there are spring assizes held at the same place for Lincoln and North, and autumn assizes at Nottingham for North and Lincoln. Quarter sessions for the Parts of Lindsey are held at Lincoln and Spilsby, for the Parts of Kesteven at Boston and Stamford, for the Parts of Holland at Boston and Spalding. The county is divided into 177 vestmental county court districts, many of which coincide with the unions. For the convenience of rating there are eighteen poor law unions; five of these, however, include eighty parishes in the adjacent counties. Ecclesiastically the county, with that of Nottingham, forms the diocese of Lincoln, which is divided into the three archdeaconries of Lincoln, Stow, and Nottingham, the latter place giving title to a suffragan bishop without a see.

Education.—The educational resources of the county in 1881 embraced one theological and one training college, both at Lincoln, and fourteen endowed grammar schools at the following places:—Alford (founded 1565), Boston (1564), Bourn (1886), Caistor (1880), Donington (1701), Gainsborough (1689), Grantham (1528), Horncastle (1671), Lincoln (1588), Louth (1661), Moulton (1661), Spalding (1604), Spalding (1538), Spilsby (1660).

Population.—In 1881 the population of the county was 469,964 (266,014 males and 203,950 females); in 1871 it had been 419,245, and 486,809 in 1871. The figures are nine of the principal towns, in addition to the boroughs already given, are as follows:—Bourne (7121), Caistor (8798), Gainsborough (10,084), Glandford Bridge (3107), Horncastle (6190), Horncastle (4814), Spalding (4067), Spalding (5260), and Spilsby (7032).

History and Antiquities.—It is highly probable that the territory now forming Lincolnshire was first settled by a tribe of the Belgæ, who, however, at the time of the invasion by Cæsar, had become a mixed race with the real Britons. This territory was unaffected by Cæsar's first invasion, and even after the reduction of Britain by Claudius the Fenland remained intact. The county was conquered about 70 A.D., and formed part of the province of Flavia Cesariensis. The tribes which occupied Lincolnshire, according to Ptolemy, were the Coritani, who had Lindum and Rata (Leicester) for their towns. The date of the introduction of Christianity is uncertain, but we learn from Bede that in the year 626, St. Augustine of Cologne, Lindisfarne, which has been mistaken for London, attended the council of Arles (314). Under the Saxon kingdom of Mercia, Lindsey, which probably extended nearly or quite over the modern county of Lincoln, appears to have been a *seigniorial* state. Under Edwin of Northumbria, the conqueror of Mercia, Christianity was reintroduced by Paulinus of

York, and Bede tells us that Eadmund, the governor of Lincoln, was, with his household, among the first converted (628).

Early in 870 the Danes or Northmen landed at Humbleton near Gimsby, and ravaged Lindsey and the famous monastery of Haddesay on the Witham. Lincolnshire passed peacefully into the hands of the Danes about 877, and was included within the boundary of the "Danelage" of Danish jurisdiction as settled by the treaty of 878. Probably the greatest changes consequent upon the Danish invasion are, first, the supplanting of the Anglo-Saxon names of places by those of the Danish termination ending in *by*, which are numerous, and the substitution of the waperlake for the earlier division of the hundred, the ancient British laws and those of the Danes were otherwise not dissimilar. In time the two populations became amalgamated and came under the dominion of the Anglo-Saxon crown. The subsequent history of the county under the Normans is associated more or less with the city of Lincoln. In the civil war between Stephen and the empress Matilda a battle was fought near Lincoln in 1141. In 1174 the Isle of Axholme was the scene of the struggle between Roger de Mowbray, one of the adherents of Prince Henry, and the forces sent against him by his father Henry II. The issue was decided by the Lincolnshire men in favour of the king. In 1215 occurred King John's march across the county, when he lost all his baggage and jewels in the Fossebyke Wash on his way to Swineshead Abbey. In the reign of Edward IV Sir Robert Welles, at the head of 30,000 Lincolnshire men was defeated at Losecoat Field near Stamford, March 1470. At the suppression of the monasteries a rebellion broke out at Louth headed by Makenot, the last prior of the abbey of Balgates Oxney, October 1536. The prior was hanged, and the shrine for the tomb of the king to King Henry VIII was designated in a state paper as "one of the most brave and bestial of the whole realm." During the civil wars the county was the scene of numerous contests, the most famous of which was the battle at Gantham in 1648, won by Cromwell over the royalists. The advantage that was taken by the Femmen to destroy the efforts made to detain and enclose the remaining lands of Lincolnshire during this stormy period has been already noticed. Riots broke out at intervals, and were continued down to the middle of the 18th century.

Remains of British camps are found at Brixton, Torkington, Houghall, Rereby, and Well. Traces of Roman camps are found at Aldborough, Coston, Gainsborough, Geddely Hill near Holford, Holford, Holford, Holford, Holford, Holford, and York. The Roman roads are nearly perfect.—Eamne Street, on the east side of the Cliff hills, and the Fosseway running south-west from Lincoln. The crown of these remains is without doubt the famous Roman arch called the Newport Gate at Lincoln. Associated remains have been found at Denton, Holford, Lincoln, Scampton, and Winterton. Coins of the emperors Nero, Vespasian, and Julian have been found at Lincoln and Ancaster, and two Roman altars to the west of Stow.

There are remains of feudal castles at Boston, Lincoln, Sheaford, Somerton, Zettershall, and Torksey. The seats worthy of note (chiefly moated) are Appleby Hall, Aswarby Hall, Belton House, Blankney Hall, Brocklesby, Bulby House, Burghley House (near Stamford), Burton Hall, Casewick House, Denton Hall, Denton Hall, Hacketon Hall, Havenholme Priory, Lea Hall, Leadham House, Manby Hall, Newton House, Notton Hall, Romanby Hall, Notton Place, Notton Hall, Raby Grove, Somersby Park, Stourton, Syston Park, Thonock House, Tharby Hall, Uffington, and Willingham by Stow.

At the time of the suppression of the monasteries in the reign of Henry VIII. there were upwards of one hundred religious houses, and among the most famous of these some of the finest abbeys held by the Benedictines. The Gilbertines were a purely English order which took its rise in Lincolnshire, the canons following the Austin rule, the nuns and lay brothers that of the Cistercians. They generally lived in separate houses, but formed a community having a common church in which the services were divided by a longitudinal wall. These houses were at Avingham, Cister, Holland House, Lincoln, before the gate of which was erected the chief Eleanor Cross, Newstead in Lindsey, Somerby, the chief house of the order, founded by St Gilbert of Gant in 1139, Stamford (a college for students), and Welles. There were numerous of the order at Havenholme, Nun Ormsby, and Tuxford.

The following are a few of the most famous abbeys: (1) Balgates Oxney (Premonstratensian), founded 1164, for fourteen canons. The tower, decorated, with ascending piers with windows, and the east wall of the south wing remain. (2) The Benedictine Michel Abbey of Crowland founded 716, refounded in 948. The foundations of the new church in 1114 were laid on massive piles of oak. Part of the west front was repaired in 1255-81, with beautiful Early English sculpture of the legend of St Guthlac and saints, this, with the Perpendicular north-west tower, 1460-70, remain. (3) Swineshead Abbey (Cistercian), colonised from Furness in 1184 by eleven monks. (4) Thornton-upon-Humber Abbey (Black Canons), founded in 1189. There remain a fragment of the

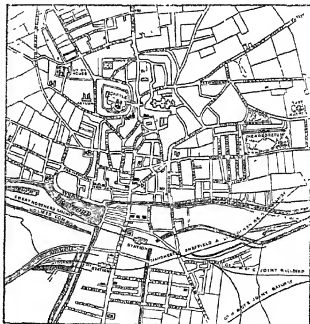
south wing of the transept, two sides of the decagonal chapter-house (1262), and the beautiful west gate-house, Early Perpendicular (1389-83), with an oval window on the east.

The general beauty of the parish churches of Lincolnshire is proverbial, but it is incorrect to suppose that they are equally good in every part of the county. In the Parts of Lindsey, though there are some of considerable beauty and interest, the churches can scarcely be considered above the average, several though small and mean present more or less features, particularly the well-known tower of St Peter, Barton-on-Humber, supposed to be of the Saxon period, and those of Gwile, Houghall, and Stow. Those of Gimsby and Wainfleet are a gem.

In the Parts of Kesteven the churches are not only elegant but well finished, built of excellent stone which abounds at Ancaster and near Stenford. The church of St Andrew Heckington is the best example of Middle Perpendicular architecture in the county, it is famed for its Easter sepulchre and fine sedilia. The largest and finest church in this division is doubtless that of St Wulfstan at Gantham, 200 by 87 feet, with three collateral naves, and steeple, 271 feet high, of the 11th century.

It is principally in the Parts of Holland that we are to look for the best churches in the county, they are not to be equalled by those of any other district in the kingdom, which is the more remarkable as the district is composed wholly of marsh land, and is without stone of any kind. It is highly probable that the churches of the south part of this district owe their origin to the munificence of the abbots of Crowland and Spalding. The earliest specimen of Norman architecture is that of Long Sutton, which has been called the counterpart of Christ Church, Oxford. St Mary and Nicholas at Spalding, 157 feet by 85, has the uncommon feature of a double aisle on each side of the nave, as well as a transept. The glory of the division of Holland is beyond question the church of St Botolph, Boston.

LINCOLN, the capital of the county of that name, as a city and county in itself, and is also a municipal and parliamentary borough. It is picturesquely situated on the summit and south slope of the limestone ridge of the Cliff range of hills which rises from the north bank of the river Witham, at its confluence with the Foss Dyke, to an altitude of 200 feet above the banks of the river. It is 132 miles north-west from London by road, and 138 miles by rail, 53° 15' N lat, 33° W long.



Plan of Lincoln

Lincoln is one of the most ancient and interesting cities in England. The ancient British town occupied the crown of the hill beyond the Newport or North Gate of the subsequent Roman town, the ancient earthworks and ditches of which are nearly continuous with the present boundaries of the parish of St John. The Roman town consisted of two parallelograms of unequal length, the first of which extended west from the Newport gate to a point

a little west of the castle keep. The second parallelogram extended due south from this point down the hill towards the Witham as far as Newland, and thence in a direction due east as far as Broad Street. Returning thence due north, it joined the south-east corner of the first and oldest parallelogram in what was afterwards known as the Minster yard, and terminated its east side upon its junction with the north wall in a line with the Newport gate. This is the oldest part of the town, and is named "above hill." After the departure of the Romans, the city walls were extended still further in a south direction across the Witham as far as the great bar gate, the south entrance to the High Street of the city; the junction of these walls with the later Roman one was effected immediately behind Broad Street. These three divisions comprise the boundaries of the municipal and parliamentary boroughs, which are enterminous. The "above hill" portion of the city is not well built, but consists of narrow irregular streets, some of which are too steep to admit of being ascended by carriages. The south portion, which is named "below hill," is much more commodious, and contains the principal shops and inns, with many elegant buildings and private residences. Here also are the Great Northern and Midland Railway stations.

The glory of Lincoln is its noble minster. As a study to the architect and antiquary this stands unrivalled, not only as the earliest purely Gothic building in Europe, but as containing within its compass every variety of style from the simple massive Norman of the west front, to the Late Decorated of the east portion. The building material is the colts and calcareous stone of Lincoln Heath and Haydock, which has the peculiarity of becoming hardened on the surface when tooled. In former days the cathedral had three spires, all of wood or leaded timber. The spire on the central tower was blown down in 1547. Those on the two western towers, 101 feet high, were removed in 1808; good representations of them will be found in the well-known views by Hollar and Buck. The ground plan of the first church, adopted from that of Rouen, was laid by Bishop Remigius in 1088, and the church was consecrated four days after his death, May 6, 1092; the central west front and the font are of this period. The approximate dates of the remaining portions of the fabric may be assigned as follows:—the three west portals and the Norman portion of the west towers above the screen to the top of the third story, about 1148; the nave, its aisles and the north and south chapels of the west end, completed 1220; the Early English portion of the west front, and the upper parts of the north and south wings, with pinnacles, turrets, 1225; the west porch of the main transept, 1250; the crossing, and lower part of the central tower, 1335; the upper part, 1307; the west door of the choir aisles, 1240. The south porch of the presbytery dates 1256. The east window, the finest of its style in England, 57 by 34 feet, dates 1358-55. The choir screens date 1280, the Easter sepulchre 1290. The gables and upper parts of the main transept, the parapets of the south side of the nave, south wing, and west front, and the screen in the south aisle, all date from 1335. The upper parts of the west towers date from 1355; their upper stories, the west windows and parapet of the galilee porch, and the chapel screens in the transept, 1450. The vaulted lantern of the central tower is 127 feet above the floor. The main transept has two fine rose windows; the one on the north called the Dean's Eye is 30 feet in diameter. The Bishop's Eye to the south is very fine Decorated (c. 1350). The roof screen is mainly a 1540.¹ The other buildings in

the close that call for notice are the chapter-house of ten sides, 60 feet diameter, 42 feet high, with a fine vestibule of the same height built in 1225, and the library, 104 by 17 feet, which contains a little museum. Among the most famous bishops were St. Hugh, who died 1200, Grosseteste, died 1253; Flemming, died 1431, founder of Lincoln College, Oxford, Smith, died 1521, founder of Brasenose, Oxford, Wake, and Gibson. Every stall has produced a prelate or cardinal; among those who have been cardinal members may be named Walter Mapes, Henry of Huntingdon, Polydore Vergil, W. Grocy, W. Outram, George Herbert, S. Pegg, V. Pegh, Cartwright, inventor of the power-loom, and O. Manning the topographer. Lincoln, the enormous diocese of which in early times extended from the Thames to the Humber, was one of the thirteen cathedrals of the old foundation served by secular canons.

History.—The name of Lincoln is a hybrid of Celtic and Latin. It appears in the Bavarian geographer in the form *Landina Colonia*, and in Bede as *Land-colina*. *Landum* is purely Celtic, and exactly describes the early British settlement as the "hill fort by the pool." *Landum Colonic* was founded on the site of what is now the castle and cathedral, about 100 A. D. It was besieged by Saxons in 514, and became one of the chief cities of Mercia. After being frequently ravaged by the Danes, Lincoln was recovered by Edmund I. in 1016. Lincoln Castle was built by William I. in 1066, which occasioned the removal of one hundred and sixty-six houses. Great and destructive fires occurred in 1110, 1128, and 1141. King Stephen besieged the emperor Matilda in the castle in 1140. Henry II. was crowned there in the following year, as was King Stephen at Christmas 1147. David, king of Scots, did homage to King John, 1201. Lincoln was captured by King John in 1216, and invested by the barons in 1217. The battle of Lincoln Fair took place in 1218. The city was sacked in 1260. John of Gaunt, earl of Lincoln, married there in 1396 Lady Swinford, Chaucer's sister-in-law; in virtue of his title he held the castle, but built himself a summer house in the lower part of the city. A parliament of Henry VI. met at Lincoln in 1456. The town was stormed by Earl Manchester on behalf of the Parliament in 1544.

Antiquities.—One of the most perfect specimens of genuine Roman architecture in England is the Newport or North Gate of Lincoln. It is sunk fully 11 feet below the present level of the street, and has two smaller arches on each side, the one to the west being concealed by an adjacent house. The Roman Ermine Street passes through this gate, and runs north from it for 11 or 12 miles as straight as an arrow. Many Roman coins, &c., have been found in the immediate vicinity of the gate. The other gates within the city worthy of notice are the Exchange Gate, a fine specimen of 13th century work, one of the bases of the north arch having upon it a carved representation of the crucifixion; Pottingate and Stonebow at the top of High Street, over which is the guildhall. The castle shows traces of Norman work, the foundations of which consisted of massive beams of wood and grouting. The hall of the old episcopal palace is 50 feet by 60 wide, and had two rows of grey marble pillars. The modern palace is at Risholme, 3 miles north of Lincoln. In the cloister garden are preserved a tessellated pavement and the sepulchral slab of a Roman soldier, the splendidly carved stone coffin lid of Bishop Remigius found there has recently been removed to the cathedral. The ancient conduits of St. Mary le Wigford, picturesque Gethin, and "the Greyfriars' goodly conduit" in the High Street, may also be noticed. The St. Mary's Guild near St. Peter's at Gowts is a fine specimen of Norman architecture, another fine relic of the domestic architecture of the period is the 3rd Henry's House, the windings of which are identical with those of the west portals of the cathedral (c. 1148). Near this is Dunstall, where the little Lincoln boy afterwards known as Little St. Hugh was crucified by Jews in August 1255. There were formerly three small prisons, five friaries, and four hospitals in or near Lincoln. The representatives of friaries over prisons of monks is explained by the fact that the cathedral was served by secular canons. The famous Bishop Grosseteste was the devoted patron of the friars, particularly the Franciscans, who were always in their day the town missionaries. There were fifty-two churches in the city before the Reformation, all the masses of which are preserved. Fourteen remain or have been rebuilt. There are fifteen benefices in the city, consisting of three rectories and twelve vicarages. There are fourteen Nonconformist places of worship.

¹ The dimensions of the cathedral internally are nave, 252 x 79-3 x 80 feet; choir, 158 x 82 x 73 feet; angle choir, which includes presbytery and lady chapel, 156 x 44 x 73 feet; main tran-

sept, 220 x 68 x 74 feet; choir transept, 156 x 44 x 73 feet. Externally the west front is 178 feet broad by 130 feet; the west towers are 206 feet high; the central tower, from which comes the town Great Tom of Lincoln (6 tone 8 cws.), is 262 feet high.

The charities comprise the new county hospital, general dispensary, lunatic asylum, penitentiary, home, and institute for nurses. The educational institutions comprise a theological college (formerly old county hospital), grammar school (formerly Grey-11108), blue coat school, training college for mistresses (Newport), St Martin's parochial schools, British schools (in Newland), Wesleyan school, and a school of art. Of other institutions may be named the Lincolnshire agricultural society, permanent library, mechanics' institute, county newsroom (above hill), city newsroom, and choral society. The remaining public buildings are the new corn exchange and masonic hall, county assembly-room and theatre in High Street. The public park is near the cattle market, and the racecourse beyond Newland. Population in 1811, 7000; in 1871, 26,768; in 1881, 37,612.

For the county and city of Lincoln see Wm. White, *History of Lincolnshire*, 1872; Sir C. H. J. Anderson, *Lincoln Pocket Guide*, 1880; J. P. Farnthorpe, *Geography of Lincolnshire*, 1872; Fred W. Wright, *Early English Church History*, 1876; Mr Wm. Dugdale, *Lincolnshire Antiquary*, 1675-82; J. Gough, *Parishes in Europe*, 1841; R. H. Miller and S. B. J. E. Smith, *The Fenland Past and Present*, 1879; Rev M. C. Wilcock, *Memoirs of Lincoln, 1866 and English Minutes*, 1879, 2 vols. (C. H. C.)

LINCOLN, a city of the United States, capital of Logan county, Illinois, is situated near Salt Creek, at the junction of three railways, 145 miles south-west of Chicago. It has fifteen churches, three banks, a high school, a telephone exchange, a coal-mine, two foundries, three flour-mills, five newspapers, and several grain elevators. It is the seat of Lincoln university (Cumberland Presbyterian) and of the State asylum for feeble-minded youth. A portion of the town dates from 1835, but the newer part was named in honour of Abraham Lincoln, and was incorporated in 1853. Population in 1880, 5639.

LINCOLN, a city of the United States, county seat of Lancaster county, Nebraska, and capital of the State. It is pleasantly situated about 50 miles west of the Missouri river, at the junction of several railroads, in the midst of a highly fertile and healthful region of undulating prairie, and near rich salt springs. Lincoln is the seat of the following State institutions—university, State prison, insane asylum, and home for the friendless. The prison and the asylum grounds, occupying several hundred acres, are 3 miles from the centre of the city, and 2 miles from each other. The United States Government has lately completed, at a cost of \$200,000, a massive building for collection of revenues, United States courts, and post-office. With its broad streets, its public park, and the State House and other grounds, the healthful ventilation of Lincoln is amply provided for. It has three daily papers, four banks, one of the largest printing and publishing houses west of the Mississippi, and several prosperous wholesale stores. Although but thirteen years old, it has a population (1880) of 15,003.

ABRAHAM LINCOLN

Copyright, 1882, by John G. Nicolay.

ABRAHAM LINCOLN (1809-1865), sixteenth president of the United States of America, was born in Hardin county, Kentucky, on February 12, 1809. His father, Thomas Lincoln, and his mother, Nancy Hanks, were both natives of Virginia, as was also his paternal grandfather, whose ancestors came from Berks county, Pennsylvania. When Lincoln was eight years of age his father moved to Indiana, in what is now Spencer county. The region was still a wilderness, and the boy grew up in pioneer life, dwelling in a rude log-cabin, and knowing but the primitive manners, conversation, and ambitions of sparsely settled backwood neighbourhoods. Schools were rare, and teachers only qualified to impart the merest rudiments of instruction. "Of course when I came of age I did not know much," wrote the future president; "still somehow I could read, write, and cipher to the rule of three, but that was all. I have not been to school since. The little advance I now have upon this store of education I have picked up from time to time under the pressure of necessity." In 1818

his mother died, and his father a year afterwards married again. When nineteen years of age Lincoln made a journey as a hired hand on a flatboat to New Orleans. In 1830 his father emigrated to Macon county, Illinois, and Lincoln aided in building the cabin, clearing a field, and splitting rails to fence it. The locality proved unhealthy, and general sickness made them resolve to abandon it. Being now twenty-one years of age, Lincoln hired himself to one Offutt, in Sangamon county, assisting him to build a flatboat and float it down the Sangamon, Illinois, and Mississippi rivers to New Orleans. Afterwards Offutt made him clerk of his country store at New Salem, this gave him moments of leisure to begin self-education. He borrowed a grammar and other books, and sought explanations from the village schoolmaster. Next year the Black Hawk Indian war broke out; Lincoln volunteered in one of the Sangamon county companies, and was elected captain. He was already a candidate for the Illinois legislature when this occurred; his printed address "To the people of Sangamon county" bears date March 9, 1832, and betokens talent and education far beyond mere ability to "read, write, and cipher." The Black Hawk campaign lasted about three months; Lincoln shared the hardships of camp and march, but was in no battle. He was defeated for the legislature that summer, being yet a comparative stranger in the county, but received a flattering majority in his own election precinct, where also, a little later, local friendship, disregarding politics, procured his appointment as postmaster of New Salem. The purchase and failure of a small country store having burdened him with debt, the county surveyor of Sangamon opportunely offered to make him one of his deputies. He qualified himself by study in all haste, and entered upon the practical duties of surveying farm lines, roads, and town sites. "This," to use his own words, "procured bread, and kept body and soul together."

The year 1834 had now arrived, and Lincoln was chosen one of the members of the Illinois legislature. He was re-elected successively in 1836, 1838, and 1840, after which he declined further nomination. At the two latter terms he received the complimentary vote of his party friends for speaker, they being in the minority. During the canvass of 1834 his political friend and colleague John T. Stuart, a lawyer in full practice, strongly encouraged him to study law, and lent him text-books to begin his reading. Lincoln followed his advice, and, working diligently, was admitted to the bar in the autumn of 1836. On April 15, 1837, he quitted New Salem, and removed to Springfield, which was then the county seat, but soon after became the capital of the State, to begin practice in partnership with his friend Stuart. His legislative experience was still further enlarged by his service of one term as representative to the Congress of the United States, to which he was elected in August 1846. He had become an eloquent and influential public speaker, and in several campaigns was on his party ticket as Whig candidate for presidential elector. Though to some extent still mingling in politics, Lincoln now for a period of about five years devoted himself more exclusively to the study and practice of law, his repeated successes drawing him into the most important cases.

In 1854 began the great slavery agitation by the repeal of the slavery prohibition of 1820, called the Missouri Compromise. Aroused to new activity by what he regarded a gross breach of political faith, Lincoln entered upon public discussions with an earnestness and force that by common consent gave him leadership of the opposition in Illinois, which that year elected a majority of the legislature. Thus would have secured his election to the United States senate, in the winter of 1854, to succeed Shields, &

Democrat, but four opposition members, of Democratic antecedents, refused to vote for Lincoln, who was yet called a Whig, and by their persistence compelled the election of Trumbull. The Republican party of Illinois was formally organized in 1856; the campaign resulted substantially in a drawn battle, the Democrats gaining a majority in the State for president, while the Republicans elected the governor and State officers. In 1858 the senatorial term of Douglas, author of the repeal of the Missouri compromise, was expiring, and he sought reelection. Lincoln, who had four years before successfully met him in public debate, was now by unanimous resolution of the Republican State convention designated as his rival and opponent. Yielding to the wish of his party friends, Lincoln challenged Douglas to a joint public discussion. The antagonists met in debate at seven designated points in the State, while they also separately addressed audiences in nearly every one of the hundred counties. At the November election the Republicans received a majority in the popular vote, but the Democrats, through a favourable apportionment of representative districts, secured a majority of the legislature, which re-elected Douglas. This remarkable campaign excited the closest attention from every part of the Union. Lincoln, addressing the convention which nominated him, June 16, 1858, opened the discussion with the following bold prophecy:—

"A house divided against itself cannot stand. I believe the Government cannot endure permanently half slave and half free. I do not expect the Union to be dissolved—I do not expect the house to fall—but I do expect it will cease to be divided. It will become all one thing or all the other. Either the opponents of slavery will arrest the further spread of it, and place it where the public mind shall rest in the belief that it is in course of ultimate extinction; or its advocates will push it forward, till it shall become alike lawful in all the States, old as well as new—North as well as South."

Lincoln's speeches in this campaign won him a national fame, which was greatly increased by several made in Ohio the following year, and especially by his Cooper Institute address in New York city, February 27, 1860. More than any contemporary statesman he had in the long six years' agitation insisted that, transcending the technical point of constitutional authority, or the problem of public policy, the deeper question of human right and wrong lay at the bottom of the slavery controversy.

The Republican national convention, which made "No Extension of Slavery" its principal tenet, met at Chicago, May 16, 1860. Seward was the leading candidate, but the more conservative delegates opposed him as being too radical, and uniting their forces nominated Lincoln, who was elected president of the United States after an unusually animated political campaign, November 6, 1860,¹ and inaugurated at Washington, March 4, 1861. Meanwhile a formidable movement, begun by South Carolina a month before the November election, and based on the slavery agitation, had carried the slave States South Carolina, Georgia, Alabama, Florida, Mississippi, Louisiana, and Texas into secession. A provisional government under the designation "The Confederate States of America," with Jefferson Davis as president, was organized by the seceding States, who seized by force nearly all the forts, arsenals, and public buildings within their limits. Great division of sentiment existed in the North, whether in this emergency acquiescence or coercion was the preferable policy. Lincoln's inaugural address declared the Union perpetual and acts of secession void, and announced the determination of the Government to defend its autho-

riety, and to hold forts and places yet in its possession. On the other hand, he disclaimed any intention to invade, subjugate, or oppress the seceding States. "You can have no conflict," he said, "without being yourselves the aggressors." Fort Sumter in Charleston harbour had been besieged by the secessionists since January, and, it being now on the point of surrender through starvation, Lincoln sent the besiegers official notice on April 8 that a fleet was on its way to carry provisions to the fort, but that he would not attempt to reinforce it unless the effort were resisted. The Confederates, however, immediately ordered its reduction, and after a thirty-four hours' bombardment the garrison capitulated, April 13, 1861.

With civil war thus provoked, Lincoln on April 15th by proclamation called 75,000 three months' militia under arms, and on May 4th ordered the further enlistment of 64,748 soldiers and 18,000 seamen for three years' service. He instituted a blockade of the Southern ports, took effective steps to extemporize a navy, convened Congress in special session, and asked for legislation and authority to make the war "short, sharp, and decisive." The country responded with enthusiasm to his summons and suggestions, and the South on its side was not less active. The Sumter bombardment rapidly developed and increased the limits of insurrection. Four additional slave States drifted into secession, the Unionists maintained ascendancy in Maryland, Kentucky, and Missouri, and succeeded in dividing Virginia. Minor engagements soon took place between the opposing forces; and on July 21, 1861, the first important battle was fought at Bull Run, and resulted in the defeat and panic of the Unionists.

The slavery question presented vexatious difficulties in conducting the war. Acute observers could not fail to note that its gigantic agencies were beginning to work in the direction of practical abolition. Congress in August 1861 passed an Act confiscating rights of slaveowners to slaves employed in hostile service against the Union. On August 31st General Fremont by military order declared martial law and confiscation against active enemies, with freedom to their slaves, in the State of Missouri. Believing that under existing conditions such a step was both detrimental in present policy and unauthorized in law, President Lincoln directed him to modify the order to make it conform to the Confiscation Act of Congress. Strong political factions were instantly formed for and against military emancipation, and the Government was hotly beset by antagonistic counsel. The Unionists of the border slave States were greatly alarmed, but Lincoln by his moderate conservatism held them to the military support of the Government. Meanwhile he sagaciously prepared the way for the supreme act of statesmanship which the gathering national crisis already dimly foreshadowed. On March 6, 1862, he sent a special message to Congress recommending the passage of a resolution offering pecuniary aid from the general Government to induce States to adopt gradual abolishment of slavery. Promptly passed by Congress, the resolution produced no immediate result except in its influence on public opinion. A practical step, however, soon followed. In April Congress passed and the president approved an Act emancipating the slaves in the District of Columbia, with compensation to owners—a measure which Lincoln had proposed when in Congress in 1849. Meanwhile slaves of loyal masters were constantly escaping to military camps. Some commanders excluded them altogether; others surrendered them on demand; while still others sheltered and protected them against their owners. Lincoln tolerated this latitude as falling properly within the military discretion pertaining to local army operations. A new case, however, soon demanded his official interference. On the 9th of May 1862 General

¹ The popular vote cast for electors stood—Lincoln, 1,866,462; Douglas, 1,876,157; Breckinridge, 847,988; Bell, 599,651. The official vote cast by the electors on December 5, 1860, and counted and declared by Congress on February 18, 1861, was—Lincoln, 180, Breckinridge, 72; Bell, 39; Douglas, 12.

Hunter, commanding in the limited areas gained along the southern coast, issued a short order declaring his department under martial law, and adding—"Slavery and martial law in a free country are altogether incompatible. The persons in these three States—Georgia, Florida, and South Carolina—hitherto held as slaves are, therefore, declared for ever free." As soon as this order, by the slow method of communication by sea, reached the newspapers, Lincoln (May 19) published a proclamation declaring it void; adding further, "Whether it be competent for me as commander-in-chief of the army and navy to declare the slaves of any State or States free, and whether at any time or in any case it shall have become a necessity indispensable to the maintenance of the Government to exercise such supposed power, are questions which under my responsibility I reserve to myself, and which I cannot feel justified in leaving to the decision of commanders in the field. These are totally different questions from those of police regulations in armies or camps." But in the same proclamation Lincoln recalled to the public his own proposal and the assent of Congress to compensate States which would adopt voluntary and gradual abolishment. "To the people of these States now," he added, "I most earnestly appeal. I do not argue. I beseech you to make the argument for yourselves. You cannot, if you would, be blind to the signs of the times." Meanwhile the anti-slavery sentiment of the North constantly increased. During June Congress by express Act prohibited the existence of slavery in all territories outside of States. On July 12th the president called the representatives of the border slave States to the executive mansion, and once more urged upon them his proposal of compensated emancipation. "If the war continues long," he said, "as it must if the object be not sooner attained, the institution in your States will be extinguished by mere friction and abrasion—by the mere incidents of the war. It will be gone, and you will have nothing valuable in lieu of it." While Lincoln's appeal brought the border States to no practical decision, it served to prepare public opinion for his final act. During the month of July his own mind reached the virtual determination to give slavery its *coup de grace*, and he wrote and submitted to his cabinet the draft of an emancipation proclamation substantially as afterward issued. Serious military reverses constrained him for the present to withhold it, while on the other hand they served to increase the pressure upon him from anti-slavery men. Horace Greeley having addressed a public letter to him complaining of "the policy you seem to be pursuing with regard to the slaves of the rebels," the president replied August 22, saying, "My paramount object is to save the Union, and not either to save or destroy slavery. If I could save the Union without freeing any slave, I would do it; if I could save it by freeing all the slaves, I would do it; and if I could do it by freeing some and leaving others alone, I would also do that." Thus still holding back violent reformers with one hand, and leading up halting conservatives with the other, he on September 13 replied among other things to an address from a delegation. "I do not want to issue a document that the whole world will see must necessarily be inoperative like the pope's bull against the comet. . . . I view this matter as a practical war measure, to be decided on according to the advantages or disadvantages it may offer to the suppression of the rebellion. . . . I have not decided against a proclamation of liberty to the slaves, but hold the matter under advisement."

The year 1862 had opened with important Union victories. Grant captured Forts Henry and Donelson, and won the battle of Shiloh. Burnside took possession of Roanoke island on the North Carolina coast. The

famous contest between the new ironclads "Monitor" and "Merrimack" ended in the Confederate vessel being beaten back, crippled, and ultimately destroyed. Farragut with a wooden fleet ran past the twin forts St Philip and Jackson, compelled the surrender of New Orleans, and gained control of the lower Mississippi. These successes extended from January to April. The succeeding three months brought disaster and discouragement to the Union army. McClellan's campaign against Richmond was made abortive by his bad generalship, and compelled the withdrawal of his army. Pope's army, advancing against the same city by another line, was beaten back upon Washington in defeat. The tide of war, however, once more turned in the defeat of Lee's invading army at South Mountain and Antietam in Maryland on the 14th and 17th of September, compelling him to retreat.

With public opinion thus ripened by alternate defeat and victory, President Lincoln on September 22, 1862, issued his preliminary proclamation of emancipation, giving notice that on the 1st of January 1863, "all persons held as slaves within any State or designated part of a State the people whereof shall then be in rebellion against the United States shall be then, thenceforward, and for ever free." In his message to Congress on the 1st of December following, he again urged his plan of gradual, compensated emancipation "as a means, not in exclusion of, but additional to, all others for restoring and preserving the national authority throughout the Union." On the 1st day of January 1863 the final proclamation of emancipation was duly issued, designating the States of Arkansas, Texas, Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, and certain portions of Louisiana and Virginia, as "this day in rebellion against the United States," and proclaiming that, in virtue of his authority as commander-in-chief, and as a necessary war measure for suppressing rebellion, "I do order and declare that all persons held as slaves within said designated States and parts of States are and henceforward shall be free," and pledging the executive and military power of the Government to maintain such freedom. The legal validity of these proclamations was never pronounced upon by the national courts; but their decrees gradually enforced by the march of armies were soon recognized by public opinion to be practically irrevocable. Such dissatisfaction as they caused in the border slave States died out in the stress of war. The systematic enlistment of negroes and their incorporation into the army by regiments, hitherto only tried as exceptional experiments, were now pushed with vigour, and, being followed by several conspicuous instances of their gallantry on the battlefield, added another strong impulse to the sweeping change of popular sentiment. To put the finality of emancipation beyond all question, Lincoln in the winter session of 1863-64 strongly supported a movement in Congress to abolish slavery by constitutional amendment, but the necessary two-thirds vote of the House could not then be obtained. In his annual message of December 6, 1864, he urged the immediate passage of the measure. Congress now acted promptly: on January 31, 1865, that body by joint resolution proposed to the States the 13th amendment of the federal constitution, providing that "neither slavery nor involuntary servitude, except as a punishment for crime, whereof the party shall have been duly convicted, shall exist within the United States or any place subject to their jurisdiction." Before the end of that year twenty-seven out of the thirty-six States of the Union (being the required three-fourths) had ratified the amendment, and official proclamation made December 19, 1865, declared it duly adopted.

The foreign policy of President Lincoln, while subordinate in importance to the great questions of the civil war,

nevertheless presented several difficult and critical problems for his decision. Towards the close of 1861 the arrest by Captain Wilkes of two Confederate envoys proceeding to Europe in the British steamer "Trent" seriously threatened peace with England. Public opinion in America almost unanimously sustained the act; but Lincoln, convinced that the proceeding had been unlawful, promptly, upon the suggestion of England, ordered the liberation of the prisoners. A still broader foreign question grew out of Mexican affairs, when events culminating in the setting up of Maximilian of Austria as emperor under protection of French troops demanded the constant watchfulness of the United States. Lincoln's course was one of prudent moderation. France voluntarily declared that she sought in Mexico only to satisfy injuries done her and not to overthrow or establish local government or to appropriate territory. The United States Government replied that, relying on these assurances, it would maintain strict non-interference, at the same time openly avowing the general sympathy of its people with a Mexican republic, and that "their own safety and the cheerful destiny to which they aspire are intimately dependent on the continuance of free republican institutions throughout America." In the early part of 1863 the French Government proposed a mediation between the North and the South. This offer President Lincoln declined to consider, Seward replying for him that it would only be entering into diplomatic discussion with the rebels whether the authority of the Government should be renounced, and the country delivered over to dissension and anarchy.

The civil war gradually grew to dimensions beyond all expectation. By January 1863 the Union armies numbered near a million men, and were kept up to this strength till the end of the struggle. The Federal war debt eventually reached the sum of \$2,700,000,000. The fortunes of battle were somewhat fluctuating during the first half of 1863, but the beginning of July brought the Union forces decisive victories. The reduction of Vicksburg and Port Hudson, with other operations, restored complete control of the Mississippi, severing the Southern Confederacy. In the east Lee had the second time marched his army into Pennsylvania to suffer a disastrous defeat at Gettysburg, on July 1st to 3d, though he was able to withdraw his shattered forces south of the Potomac. At the dedication of this battlefield as a soldiers' cemetery in November, President Lincoln made the following oration, which has taken permanent place as a classic in American literature:—

"Four score and seven years ago our fathers brought forth on this continent a new nation conceived in liberty and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting-place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. But, in a larger sense, we cannot dedicate, we cannot consecrate, we cannot hallow this ground. The brave men, living and dead, who struggled here have consecrated it far above our poor power to add or detract. The world will little note nor long remember what we say here, but it can never forget what they did here. It is for us the living rather to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion—that we here highly resolve that these dead shall not have died in vain, that this nation under God shall have a new birth of freedom, and that government of the people, by the people, for the people, shall not perish from the earth."

In the unexpected prolongation of the war, volunteer enlistments became too slow to replenish the waste of armies, and in 1863 the Government was forced to resort

to a draft. The enforcement of the conscription created much opposition in various parts of the country, and led to a serious riot in the city of New York on July 13. President Lincoln executed the draft with all possible justice and forbearance, but refused every importunity to postpone it. It was made a special subject of criticism by the Democratic party of the North, which was now organizing itself on the basis of a discontinuance of the war, to endeavour to win the presidential election of the following year. Mr Vallandigham of Ohio, having made a violent public speech against the war and military proceedings, was arrested by General Burnside, tried by military commission, and sentenced to imprisonment; a writ of *habeas corpus* was refused, and the sentence was changed by the president to transportation beyond the military lines. By way of political defiance the Democrats of Ohio nominated Vallandigham for governor. Prominent Democrats and a committee of the Convention having appealed for his release, Lincoln wrote two long letters in reply discussing the constitutional question, and declaring that in his judgment the president as commander-in-chief in time of rebellion or invasion holds the power and responsibility of suspending the privilege of the writ of *habeas corpus*, but offering to release Vallandigham if the committee would sign a declaration that rebellion exists, that an army and navy are constitutional means to suppress it, and that each of them would use his personal power and influence to prosecute the war. This liberal offer and their refusal to accept it counteracted all the political capital they hoped to make out of the case; and public opinion was still more powerfully influenced in behalf of the president's action, by the pathos of the query which he propounded in one of his letters:—"Must I shoot the simple-minded soldier boy who deserts, while I must not touch a hair of a wily agitator who induces him to desert?" When the election took place in Ohio, Vallandigham was defeated by a majority of more than a hundred thousand.

Many unfounded rumours of a willingness on the part of the Confederate States to make peace were circulated from time to time to weaken the Union war spirit. To all such suggestions, up to the time of issuing his emancipation proclamation, Lincoln announced his readiness to stop fighting and grant amnesty, whenever they would submit to and maintain the national authority under the constitution of the United States. Certain agents in Canada having in 1864 intimated that they were empowered to treat for peace, Lincoln, through Greeley, tendered them safe conduct to Washington. They were by this forced to confess that they possessed no authority to negotiate. The president thereupon sent them, and made public, the following standing offer:—

"To whom it may concern

"Any proposition which embraces the restoration of peace, the integrity of the whole Union, and the abandonment of slavery, and which comes by and with an authority that can control the armies now at war against the United States, will be received and considered by the Executive Government of the United States, and will be met by liberal terms on substantial and collateral points, and the bearer or bearers thereof shall have safe conduct both ways.

"ABRAHAM LINCOLN."

"July 18, 1864."

A noteworthy conference on this question took place near the close of the civil war, when the strength of the rebellion was almost exhausted. F. P. Blair, senior, a personal friend of Jefferson Davis, acting solely on his own responsibility, was permitted to go from Washington to Richmond, where, after a private and unofficial interview, Davis in writing declared his willingness to enter a conference "to secure peace to the two countries." Report being duly made to President Lincoln, he wrote a note consenting to receive any agent sent informally "with

a view of securing peace to the people of our common country." Upon the basis of this latter proposition three Confederate commissioners finally came to Hampton Roads, where President Lincoln and Secretary Seward met them, and on February 3, 1865, an informal conference of four hours' duration was held. Private reports of the interview agree substantially in the statement that the Confederates proposed a cessation of the civil war, and postponement of its issues for future adjustment, while for the present the belligerents should unite in a campaign to expel the French from Mexico, and to enforce the Monroe doctrine. President Lincoln, however, declined the ensnaring alliance, and adhered to the instructions he had given Seward before deciding to personally accompany him. These formulated three indispensable conditions to adjustment:—first, the restoration of the national authority throughout all the States; second, no receding by the executive of the United States on the slavery question; third, no cessation of hostilities short of an end of the war, and the disbanding of all forces hostile to the Government. These terms the commissioners were not authorized to accept, and the interview ended without result.

As Lincoln's first presidential term of four years neared its end, the Democratic party gathered itself for a supreme effort to regain the ascendancy lost in 1860. The slow progress of the war, the severe sacrifice of life in campaign and battle, the enormous accumulation of public debt, arbitrary arrests and suspension of *habeas corpus*, the rigour of the draft, and the proclamation of military emancipation furnished ample subjects of bitter and vindictive campaign oratory. A partisan coterie which surrounded McClellan loudly charged the failure of his Richmond campaign to official interference in his plans. Vallandigham had returned to his home in defiance of his banishment beyond military lines, and was leniently suffered to remain. The aggressive spirit of the party, however, pushed it to a fatal extreme. The Democratic National Convention adopted (August 29, 1864) a resolution declaring the war a failure, and demanding a cessation of hostilities, it nominated McClellan for president, and instead of adjourning *sine die* as usual, remained organized, and subject to be convened at any time and place by the executive national committee. This threatening attitude, in conjunction with alarming indications of a conspiracy to resist the draft, had the effect to thoroughly consolidate the war party, which had on June 8 unanimously renominated Lincoln. At the election held November 8, 1864, Lincoln received 2,216,076 of the popular votes, and McClellan but 1,808,725, while of the presidential electors 212 voted for Lincoln and 21 for McClellan. Lincoln's second term of office began March 4, 1865.

While this political contest was going on the civil war was being brought to a decisive close. Grant, at the head of the army of the Potomac, followed Lee from before Washington to Richmond and Petersburg, and held him in siege to within a few days of final surrender. Sherman, commanding the bulk of the Union forces in the Mississippi valley, swept in a victorious march through the heart of the confederacy to Savannah on the coast, and thence northward to North Carolina. Lee evacuated Richmond April 2, and was overtaken by Grant and compelled to surrender his entire army April 9, 1865. Sherman pushed Johnston to a surrender April 26. This ended the war, the submission of scattering detachments following soon after.

Lincoln being at the time on a visit to the army, entered Richmond the day after its surrender. Returning to Washington, he made his last public address on the evening of April 11, devoted mainly to the question of reconstructing loyal governments in the conquered States. On the

evening of April 14 he attended Ford's theatre in Washington. While seated with his family and friends absorbed in the play, John Wilkes Booth, an actor, who with others had prepared a plot to assassinate the several heads of government, went into the little corridor leading to the upper stage-box, and secured it against ingress by a wooden bar. Then stealthily entering the box, he discharged a pistol at the head of the president from behind, the ball penetrating the brain. Brandishing a huge knife, with which he wounded Colonel Rathbone who attempted to hold him, the assassin rushed through the stage-box to the front and leaped down upon the stage, escaping behind the scenes and from the rear of the building, but was pursued, and twelve days afterwards shot in a barn where he had concealed himself. The wounded president was borne to a house across the street, where he breathed his last at 7 A.M., April 15, 1865.

In 1842 he had married Mary Todd, also of Kentucky, who bore him four children. Only one son, Robert T. Lincoln, survives, who is at this date (1882) secretary of war of the United States.

President Lincoln was of unusual stature, 6 feet 4 inches, and of spare but muscular build, he had been in youth remarkably strong and skilful in the athletic games of the frontier, where, however, his popularity and recognized impartiality often made him an umpire than a champion. He had regular and propensities features, dark complexion, broad high forehead, prominent cheek bones, grey deep-set eyes, and bushy black hair, turning to grey at the time of his death. Abstemious in his habits, he possessed great physical endurance. He was almost as tender-hearted as a woman. "I have not willingly planted a thorn in any man's bosom," he was able to say. His patience was mechanical. He had naturally a most cheerful and sunny temper, was highly social and sympathetic, loved pleasant conversation, wit, anecdote, and laughter. Beneath this, however, ran an undercurrent of sadness, he was occasionally subject to hours of deep aliveness and introspection that approached a condition of trance. In manner he was simple, direct, free of the least affectation, and entirely free from awkwardness, oddity, or eccentricity. His mental qualities were—a quick analytic perception, strong logical powers, a tenacious memory, a liberal estimate and tolerance of the opinions of others, ready intuition of human nature; and perhaps his most valuable faculty was rare ability to dress himself in all feeling or passion in weighing motives of persons or problems of state. His speech and diction were plain, terse, forcible. Relating anecdotes with appreciative humour and fascinating dramatic skill, he used them freely and effectively in conversation and argument. He loved manliness, truth, and justice. He despised all trickery and selfish greed. In arguments at the bar he was so far from his opponent that he frequently appeared to comede away his client's case. He was ever ready to take blame on himself and bestow praise on others. "I claim not to have controlled events," he said, "but confess plainly that events have controlled me." The Declaration of Independence was his political chart and inspiration. He acknowledged a universal equality of human rights. "Certainly the negro is not our equal in colour," he said, "perhaps not in many other respects; still, in the right to put into his mouth the bread that his own hands have earned, he is the equal of every other man white or black." He had unchanging faith in self-government. "The people," he said, "are the rightful masters of both congresses and courts, not to overthrow the constitution, but to overthrow the man who perverts this constitution." Yielding and accommodating in non-essentials, he was inflexibly firm in a principle or position deliberately taken. "Let us have faith that right makes might," he said, "and in that faith let us to the end struggle to our duty as we understand it." The emancipation proclamation once issued, he reiterated his purpose never to retract or modify it. "There have been men base enough," he said, "to promise to me to return to slavery our black warriors of Fort Hudson and Olustee, and thus win the respect of the masters they fought. Should I do so, I should deserve to be damned as time and eternity. Come what will, I will keep my faith with friend and foe." Benevolence and forgiveness were the very basis of his character; his world-wide humanity is aptly embodied in a phrase of his second inaugural:—"With malice toward none, with charity for all." His nature was deeply religious, but he belonged to no denomination; he had faith in the eternal justice and boundless mercy of Providence, and made the golden rule of Christ his practical creed. History must accord him a rare sagacity in guiding a great people through the perils of a mighty revolution, an admirable singleness of aim, a skilful discernment and courageous seizure of the golden moment to free

his nation from the incubus of slavery, faithful adherence to law and conscientious moderation in the use of power, a shining personal example of honesty and purity, and finally the possession of that subtle and indelible magnetism by which he subordinated and directed dangerously disturbed and perverted moral and political forces to the restoration of peace and constitutional authority to his country, and the gift of liberty to four millions of human beings. Architect of his own fortune, rising with every opportunity, mastering every emergency, fulfilling every duty, he not only proved himself pre-eminently the man for the hour, but the signal benefactor of posterity. A statesman, ruler, and liberator civilization will hold his name in perpetual honour. (J. G. N.)

LINDAU, a town in the government district of Swabia and Neuburg, Bavaria, and the central point of the transit trade between that country and Switzerland, is situated on two islands off the north-eastern shore of Lake Constance, in 47° 34' N. lat., 9° 43' E. long. The town is a terminus of the Voralberg Railway, and of the Munich-Lindau line of the Bavarian State Railway, and is connected with the mainland both by a wooden bridge and by a railway embankment of stone erected in 1853. There are Roman Catholic and Lutheran churches, a royal chateau, an old town-hall, classical, commercial, and industrial schools, and also manufactories for surgical and musical instruments, a fishery, and a fine harbour provided with a lighthouse and much visited by steamers from Constance and other places on the lake. Opposite the custom-house is a bronze statue of king Maximilian II., erected in 1856. The trade is chiefly in grain, fruit, wine, cherry-brandy, fish, cheese, and lard. In January 1882 the population was about 3350.

On the site which the town now occupies there is believed to have been formerly an ancient Roman camp, *Castrum Tiberi*. Authentic records of Lindau date back to the end of the 9th century. It was 1681 joined the Smallpox league, and in 1647 was unfortunately besieged by the Swedes. From 1726 to 1808 it was a free imperial town. In 1804 it passed to Austria, and in 1806 to Bavaria.

LINDLEY, JOHN (1799–1885), botanist, was born on February 6, 1799, at Catton near Norwich, where his father, George Lindley, author of *A Guide to the Orchard and Kitchen Garden*, owned a nursery garden. He was educated at Norwich grammar school, and early manifested a taste for the studies in which he afterwards gained distinction. His first publication, in 1819, a translation of the *Analyses du Fruit* of Richard, was followed in 1820 by an original *Monographia Rosarum*, with descriptions of new species, and drawings executed by himself, and in 1821 by *Monographia Digitalium*, and by "Observations on Pomaceae" contributed to the *Transactions of the Linnean Society*. Shortly afterwards he went to London, where he was engaged by London to write the descriptive portion of the *Encyclopædia of Plants*. In the course of his labours on this undertaking, which was completed in 1829, and of which the "botanical merits" are in the preface assigned by the editor to Lindley, he became thoroughly convinced of the superiority of the "natural" system of Jussieu, as distinguished from the "artificial" system of Linnaeus followed in the *Encyclopædia*; the conviction found expression in *A Synopsis of British Flora*, arranged according to the *Natural Order* (1829), and in *An Introduction to the Natural System of Botany* (1830). In 1829 Lindley, who since 1822 had been assistant secretary to the Horticultural Society, was appointed to the chair of botany in University College, London; he lectured also on botany from 1831 at the Royal Institution, and from 1836 at the Botanic Gardens, Chelsea. During his professorate of more than thirty years he wrote many scientific and popular works, besides contributing largely to the *Botanical Register*, of which he was editor for many years, and to the *Gardener's Chronicle*, in which he had charge of the horticultural department from 1841. He became a fellow of the Royal, Linnean, and Geological Societies, and had

the honour of being admitted to a large number of foreign scientific bodies. He resigned his chair in 1860, and died of apoplexy at Turnham Green on November 1, 1885.

Besides those already mentioned, the works of Lindley include *An Outline of the First Principles of Horticulture* (1832), *An Outline of the Structure and Physiology of Plants* (1838), *A Natural System of Botany* (1836), *The Florist's Guide of Great Britain* (the joint work of Lindley and Hutton, 1831–37), *Flora Medica* (1838), *The Vegetable Kingdom* (1846), *Theory of Horticulture* (2d ed., 1856), *Risks of Horticulture* (1859), *Decorative Botany* (1856), *Ladies' Botany*, a School Botany, the volume *Botany in the Library of Useful Knowledge*, and most of the botanical articles in the *Fanny Cyclopædia*. See BOTANY, vol. iv. p. 81.

LINDSEY, THORPHILUS (1723–1808), an English theological writer, was born in Middlewich, Cheshire, on June 20, 1723, was educated at the Leeds Free School, and in 1741 entered St John's College, Cambridge, of which, after graduating with distinction, he became a fellow in 1747. For some time he held a curacy in Spitalfields, London, and from 1754 to 1756 he travelled on the Continent in the capacity of tutor to the young duke of Northumberland. On his return he was presented to the living of Kirkby-Wisak in Yorkshire, and after exchanging it for that of Piddletown in Dorsetshire he in 1763 removed to Cattamk in Yorkshire. Meanwhile he had begun to entertain anti-Trinitarian views, and to be troubled in conscience about their inconsistency with the creed he had repeatedly subscribed; since 1769 the intimate friendship of Priestley had served to foster his scruples, and in 1771 he united with Archdeacon Blackburne (his father-in-law), Jebb, Wyvell, and Law in preparing a petition to parliament with the prayer that clergymen of the church, and graduates of the universities, might be relieved from the burden of subscribing to the thirty-nine articles, and "restored to their undoubted rights as Protestants of interpreting Scripture for themselves." After two hundred and fifty signatures to the document had, with six months of vast effort on Lindsey's part, been obtained, it was, in February 1772, rejected in the House of Commons by the majority of two hundred and seventeen to seventy-one, a adverse vote was repeated in the following year, and in the end of 1773, seeing no prospect of obtaining within the church the relief which his conscience demanded, Lindsey resigned his vicarage and took leave of a warmly attached congregation. In April 1774 he began to conduct a Unitarian service in a room in Essex Street, Strand, London; four years later he removed to a chapel built for him in the same street. Here he continued to labour till 1795, when he resigned his charge in favour of Disney, who like himself had left the established church, and had become his colleague. His active interest in the Unitarian movement continued, however, until his death, which took place on November 3, 1808.

Lindsey's chief work is *An Historical View of the State of the Unitarian Doctrine and Worship from the Reformation to our own Times*, 1783, in it he claims, amongst others, Barret, Tillotson, S. Clarke, Hoadly, and Sir L. Newton for the Unitarian view. His other publications, mostly occasional, include *Apology on Resigning the Vicarage of Cattamk* (1774), and *Sermon to the Apology* (1776); *The Book of Common Prayer reformed according to the plan of the late Dr Samuel Clarke*, 1774; *Dissertations on the Prophecy of St John's Gospel and on praying to Jesus Christ*, 1779; *Finalist's Protestation*, 1788; *Conversations upon Christian Holiness*, 1792; and *Conversations on the Divine Government, showing that everything is from God, and for good to all*, 1802. Two volumes of *Sermons*, with appropriate prayers annexed, were published posthumously in 1810; and a volume of *Memories*, by Thomas Belsham, appeared in 1812.

LINEN MANUFACTURES. Under this term are comprehended all yarns spun and fabrics woven from flax fibre. The cultivation and preparation of the fibre, and its treatment till it reaches the market as a commercial product, are dealt with under FLAX, vol. ix. p. 293.

From the earliest periods of human history till almost the close of the 18th century the linen manufacture was

one of the most extensive and widely disseminated of the domestic industries of European countries. The preparation and spinning of yarn gave occupation to women of all classes; and the operations of weaving employed large numbers of both sexes. The industry was most largely developed in Russia, Austria, Germany, Holland, Belgium, the northern provinces of France, and certain parts of England, in the north of Ireland, and throughout Scotland, and in these countries its importance was generally recognized by the enactment of special laws, having for their object the protection and extension of the trade. The inventions of Arkwright, Hargreaves, and Crompton in the latter part of the 18th century, benefiting as they did, almost exclusively, the art of cotton spinning, and the unparalleled development of that branch of textile manufactures, largely due to the ingenuity of these inventors, gave the linen trade as it then existed a fatal blow. Domestic spinning, and with it hand-loom weaving, immediately began to shrink; a large and most respectable section of the operative classes in western Europe found their employment dwindling away, and the wages they earned from their diminished labour insufficient to ward off starvation. The trade which had supported whole villages and provinces entirely disappeared, and the linen manufacture, in attenuated dimensions and changed conditions, took refuge in special localities, where it resisted, not unsuccessfully, the further assaults of cotton, and, with varying fortunes, rearranged its relations in the community of textile industries. The linen industries of the United Kingdom were the first to suffer from the aggression of cotton; more slowly the influence of the rival textile travelled across Continental countries; and even to the present day, in Russia, and in other regions remote from great commercial highways, the domestic manufacture of flanne holds its place almost as it has done from the earliest period. In 1810 Napoleon I., with a view partly to promote Continental linen industries, and partly to strike a blow at the great British manufacture of cotton, issued a proclamation offering a reward of one million francs to any inventor who should devise the best machinery for the spinning of flax yarn. Within a few weeks thereafter Philippe de Girard patented in France important inventions for flax spinning by both dry and wet methods. His inventions, however, did not receive the promised reward, and were indeed neglected in his native country. In 1815 he was invited by the Austrian Government to establish a spinning mill at Hirtenberg near Vienna, which was run with his machinery for a number of years, but ultimately it failed to prove a commercial success. In the meantime, however, English inventors, stimulated rather than daunted by the success of cotton machinery, had applied themselves to the task of adapting machines to the preparation and spinning of flax. The foundation of machine spinning of flax was laid by John Kendrew and Thomas Porthouse of Darlington, who, in 1787, secured a patent for "a mill or machine upon new principles for spinning yarn from hemp, tow, flax, or wool." These machines, imperfect as they were, attracted much notice, and were introduced in various localities both in England and Scotland into mills fitted specially for flax spinning. By innumerable successive improvements and modifications, the invention of Kendrew and Porthouse developed into the perfect system of machinery with which, at the present day, spinning-mills are furnished; but progress in adapting flax fibre for mechanical spinning, and linen yarn for weaving cloth by power-loom, was much slower than in the corresponding case of cotton.

The implements used in the preparation of linen yarn in ancient and modern times, down to the end of the 18th century, were of the most primitive and inexpensive

description. Till comparatively recent times, the sole spinning implements were the spindle and distaff. The spindle, which is the fundamental apparatus in all spinning machinery, was nothing more nor less than a round stick or rod of wood about 12 inches in length, tapering towards each extremity, and having at its upper end a notch or slit into which the yarn might be caught or fixed. In general, a ring or "whorl" of stone or clay was passed round the upper part of the spindle to give it momentum and steadiness when in rotation. The distaff, or rock, was a rather longer and stronger bar or stick, around one end of which, in a loose coil or ball, the fibrous material to be spun was wound. The other extremity of the distaff was carried under the left arm, or fixed in the girdle at the left side, so as to have the coil of flax in a convenient position for drawing out to yarn. A prepared end of yarn being fixed into the notch, the spinner, by a smart rolling motion of the spindle with the right hand against the right leg, threw it out from her, spinning in the air, while, with the left hand, she drew from the rock an additional supply of fibre which was formed into a uniform and equal strand with the right. The yarn being sufficiently twisted was released from the notch, wound around the lower part of the spindle, and again fixed in the notch at the point insufficiently twisted; and so the rotating, twisting, and drawing out operations went on till the spindle was full. So persistent is an ancient and primitive art of this description that to the present day, in remote districts of Scotland,—the country where machine spinning has attained its highest development,—spinning with rock and spindle is yet practised,¹ and, rude as these implements are, yarn of extraordinary delicacy, beauty, and tenacity has been spun by their agency. The first improvement on the primitive spindle was found in the construction of the hand-wheel, in which the spindle, mounted in a frame, was fixed horizontally, and rotated by a band passing round it and a large wheel, set in the same framework. Such a wheel became known in Europe about the middle of the 16th century, but it appears to have been in use for cotton spinning in the East from time immemorial. At a later date, which cannot be fixed, the treadle motion was attached to the spinning wheel, enabling the spinner to sit at work with both hands free, and the introduction of the two-handed or double-spindle wheel, with flyers or twisting arms on the spindles, completed the series of mechanical improvements effected on flax spinning till the end of the 18th century. The common use of the two-handed wheel throughout the rural districts of Ireland and Scotland is a matter still within the recollection of middle-aged people; but spinning wheels are now seldom seen.

The modern manufacture of linen divides itself into two branches, spinning and weaving, to which may be added the bleaching and various finishing processes, which, in the case of many linen textures, are laborious undertakings and important branches of industry.

Flax, when received into the mills, has to undergo a train of preparatory operations before it arrives at the stage of being twisted into yarn. The whole operations in yarn manufacture comprise (1) heckling, (2) preparing, and (3) spinning.

Heckling.—This first preparatory process consists not only in combing out, disentangling, and laying smooth and parallel the separate fibres, but also serves to split up and separate into their ultimate filaments the strands of fibre which, up to this point, have been agglutinated together. The heckling process was, until recent times, done by the hand; and it was one of fundamental importance, requiring the exercise of much dexterity and judgment. The

¹ See Dr Arthur Mitchell's *The Past in the Present*. Edinburgh, 1886.

broken, unravelled, and short fibres, which separate out in the heckling process, form tow, an article of much inferior value to the spinner, and the proportion of tow made in the process of hand-heckling varies according to the skill and knowledge of the heckler. A good deal of hand-heckling is still practised, especially in Irish and Continental factories, and it has not been found practicable, in any case, to entirely dispense with a rough preparation of the fibre by hand labour. In heckling by hand, the heckler strikes a handful or "stick" of rough flax, winds the top end round his hands, and then, spreading out the root end as broad and flat as possible, by a swinging motion dashes the fibre into the teeth or needles of the rougher or "ruffer" heckle. The rougher is a board plated with tin, and studded with spikes or teeth of steel about 7 inches in length, which taper to a fine sharp point. The heckler draws his stick several times through this tool, working gradually up from the roots to near his hand, till in his judgment the fibres at the root end are sufficiently combed out and smoothed. He then seizes the root end and similarly treats the top end of the stick. The sticks, as finished, are carefully piled up in a regular manner, keeping each handful separate for convenience of future treatment. The same process is again repeated on a similar tool, the teeth of which are 5 inches long, and much more closely studded together, and for the finer counts of yarn a third and a fourth heckle may be used, of still increasing fineness and closeness of teeth. In dealing with certain varieties of the fibre, for fine spinning especially, the flax is, after roughing, broken or cut into three lengths—the top, middle, and root ends. Of these the middle cut is most valuable, being uniform in length, strength, and quality. The root end is more woody and harsh, while the top, though fine in quality, is uneven and variable in strength. From some flax of extra length it is possible to take two short middle cuts, and, again, the fibre is occasionally only broken into two cuts according to the judgment and requirement of the manufacturer. Flax so prepared is known as "cut line" in contradistinction to "long line" flax, which is the fibre unbroken. The subsequent treatment of line, whether long or cut, does not present sufficient variation to require further reference to these distinctions.

In the case of heckling by machinery, the flax is first roughed and arranged in sticks, as above described under hand heckling. Considerable variations are presented in the construction of heckling machines, but the general principles of those now most commonly adopted, such as the machines of Combe, of Horner, or of Cotton, &c., are identical. These are known as vertical sheet heckling machines (fig. 1), their essential features being a set of endless leather bands or sheets *f, g* revolving over a pair of rollers *e, e* in a vertical direction. These sheets are crossed by iron bars, to which heckle stocks, furnished with teeth, are secured. The heckle stocks on each separate sheet are of one size and gauge, but each successive sheet in the length of the machine is furnished with stocks of increasing fineness, so that the heckling tool at the end where the flax is entered is the coarsest, while that to which the fibre is last submitted has the smallest and most closely set teeth. Thus the whole of the endless vertical revolving sheet presents a continuous series of heckle teeth, and the machines are furnished with a double set of such sheets revolving face to face, so close together that the pins of one set of sheets intersect those on the opposite stocks. Overhead, and exactly centred between these revolving sheets, is the head or holder channel *a*, from which the flax hangs down while it is undergoing the heckling process on both sides. The flax is fastened in a holder *b*, consisting of two heavy flat plates of iron, between which it is spread

and tightly screwed up. The holder is 11 inches in length, and the holder channel is fitted to contain a line of six, eight, or twelve such holders, according to the number of separate bands of heckling stocks in the machine. The head or holder channel has a falling and rising motor, by which it first presents the ends and gradually more and more of the length of the fibre to the heckle teeth, and, after dipping down the full length of the fibre exposed, it slowly rises and lifts the flax clear of the heckle stocks. By a reciprocal motion the whole of the holders are then moved forward one length, that at the last and finest set of stocks is thrown out, and place is made for filling in an additional holder at the beginning of the series. Thus with a six-tool heckle, or set of stocks, each holder full of flax from beginning to end descends

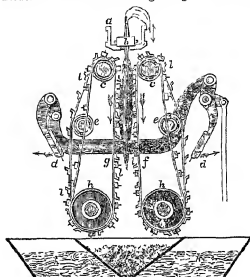


FIG. 1.—Section of Combe's Heckling Machine.

into and pass from the heckle teeth six times in travelling from end to end of the machine. The root ends being thus first heckled, the holders are shot back along an inclined plane, the iron plates unclamped, the flax reversed, and the top ends are then submitted to the same heckling operation. The tow made in the heckling process is cleared from the heckle teeth, as they revolve, by doffers *l, l*, which in travelling upwards are, by passing over special guide rollers *e, e*, projected out from the line of the heckle teeth. The doffers themselves are cleared by fixed combs *d, d*, and the tow falling down is collected in troughs *k, k* on each side of the machine. Tow, which is a much less valuable substance than dressed line, undergoes a somewhat different preparing process, and is used only for the lower numbers of yarn.

Preparing.—The various operations in this stage have for their object the proper assortment of dressed line into qualities fit for spinning the different counts or sizes of yarn for which it may be suitable, and the drawing out of the fibres to a perfectly level and uniform continuous ribbon or sliver, containing throughout an equal quantity of fibres in any given length. From the heckling the now smooth, glossy, and clean sticks are taken to the sorting room, where they are assorted into different qualities by the "line sorter," who judges by both eye and touch the quality and capabilities of the fibre. So sorted, the material is passed to the spreading and drawing frames, a series or system of machines all similar in construction and effect. The essential features of the spreading frame are—(1) the feeding cloth or creasing sheet, which delivers the flax to (2) a pair of "feed and jockey" rollers, which pass it on (3) to the gill frame or fallers. The gill frame con-

ists of a series of narrow heckle bars, with short closely studded teeth, which travel between the feed rollers and the drawing or "boss and pressing" rollers to be immediately attended to. They are, by an endless screw arrangement, carried forward at the rate at which the flax is delivered to them, and when they reach the end of their course they fall under, and by a similar screw arrangement are brought back to the starting point; and thus they form an endless moving level toothed platform for carrying away the flax from the feed rollers. The drawing rollers grip the fibre as it leaves the gill, and, as they revolve much more rapidly than the feeding rollers, the fibre is drawn out through the gill teeth say to twenty or thirty times the length it had on the feeding board, and is consequently reduced to a silver or louse ribbon of correspondingly greater tenacity. The silver from the drawing frame is delivered into a tin can which holds 1000 yards, and the machine automatically rings a bell when that length is delivered. From the spreading frame the cans of silver pass to the drawing frames, where from four to twelve silvers combined are passed through feed rollers over gills, and drawn out by drawing rollers to the thickness of one. A third and fourth similar doubling and drawing may be embraced in a preparing system, so that the number of doublings the flax undergoes, before it arrives at the roving frame, may amount to from one thousand to one hundred thousand, according to the quality of yarn in progress. Thus, for example, the doublings on one preparing system maybe $6 \times 12 \times 12 \times 12 \times 6 = 82,944$. The silvers delivered by the last drawing frame are taken to the roving frame, where they are singly passed through feed rollers and over gills, and, after drafting to sufficient tenacity, slightly twisted by flyers and wound on bobbins, in which condition the material—termed "rove" or "rovings"—is ready for the spinning frame.

The preparation of tow for spinning differs in essential features from the processes above described. Tow from different sources, such as scutching tow, heckle tow, &c., differs considerably in quality and value, some being very impure, filled with woody shives, &c., while other kinds are comparatively open and clean. A preliminary opening and cleaning is necessary for the dirty machined tow, and in general thereafter they are passed through two carding engines called respectively the breaker and the finisher cards till the shives from their processes are ready for the drawing and roving frames. In the case of fine clean tows on the other hand, passing through a single carding engine may be sufficient. The processes which follow the carding do not differ materially from those followed in the preparation of rove from fine flax.

Spinning.—The spinning operation, which follows the roving, is done in two principal ways, called respectively dry spinning and wet spinning, the first being used for the lower counts or heavier yarns, while the second is exclusively adopted in the preparation of fine yarns up to the highest counts manufactured. The spinning frame does not differ in principle from the throstle spinning machine used in the cotton manufacture (see COTTON, vol. VI. p. 495). The bobbins of flax rove are arranged in rows on each side of the frame (the spinning frames being all double) on pins in an inclined plane A (fig. 2). The rove passes downwards through an eyelet or guide *l* to a pair of nipping rollers *p, p*, between which and the final drawing rollers *c, c*, placed in the case of dry spinning from 18 to 22 inches lower down, the fibre receives its final draft while passing over and under cylinders *d* and guide-plate *g*, and attains that degree of tenacity which the finished yarn must possess. From the last rollers the now attenuated material, in passing to the flyers *f*, receives the degree of twist which compacts the fibres into the round hard cord which constitutes spun yarn; and from the flyers it is wound on the more slowly rotating spool *e* within the flyer arms, centred on the spindle *S*. In wet spinning the general sequence of operations is the

same, but the rove, as unwound from its bobbin, first passes through a trough of water heated to about 120° Fahr; and, moreover, the interval between the two pairs of rollers in which the drawing out of the rove is accomplished is very much shorter.

The influence of the hot water on the flax fibre appears to be that it softens the gummy principle which binds the separate cells together, and thereby allows the elementary cells to be drawn out without breaking the continuity of the fibre, and further it makes a finer, smoother, and more uniform strand than can be obtained by dry spinning. The extent to which the original strick of flax as laid on the feeding roller for (say) the production of a 50 lea yarn is, by doublings and drawings, extended, when it reaches the spinning spindle, may be stated thus—35 times on spreading frame, 15 times on first drawing frame, 15 times on second drawing frame, 14 times on third drawing frame, 15 times on roving frame, and 10 times on spinning frame, in all 16,537,500 times its original length, with $8 \times 12 \times 16 = 1536$ doublings on the three drawing frames. That is to say, 1 yard of heckled line fed into the spreading frame is spread out, mixed with other fibres, to a length of about 9400 miles of yarn. In the case of fine yarns, by the additional drawings given, the doublings and elongations are very much greater.

The next operation is reeling from the bobbins into hanks. By Act of Parliament, throughout the United Kingdom the standard measure of flax yarn is the "lea," called also in Scotland the "cut" of 300 yards. The flax is wound or reeled on a reel having a circumference of 90 inches ($3\frac{1}{2}$ yards) making "a thread," and one hundred and twenty such threads form a lea. The grist or quality of all fine yarns is estimated by the number of leas in a pound, thus "50 lea" indicates that there are 50 leas or cuts of 300 yards each in a pound of the yarn as denominated. With the heavier yarns in Scotland the quality is indicated by their weight per "spindles" of 48 cuts or leas, thus "3 lb tow yarn" is such as weighs 3 lb per spindle, equivalent to "16 lea."

The hanks of yarn from wet spinning are either dried in a loft with artificial heat, or, in rural localities, exposed over ropes in the open air. When dry they are twisted back and forward to take the wiry feeling out of the yarn, and made up in bundles for the market as "grey yarn." English and Irish spinners make up their yarns into "bundles" of 20 hanks, each hank containing 10 leas; Scotch manufacturers, on the other hand, adhere to the spindle containing 4 hanks of 12 cuts or leas.

Commercial quantities of yarn range from about 6 lb tow yarns (8 lea) up to 160 lea line yarn. Very much finer yarn up even to 400 lea may be spun from the system of machines found in many

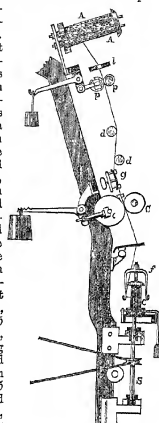


FIG. 2—Section of Dry Spinning Frame

It is only in Ireland that the linen industries during the above period have exhibited a healthy expansion. To that country alone the following figures apply —

	1828	1861	1870	1880
Number of factories	112	217	312	—
" spindles	268,000 (1828)	670,000	667,000 (1871)	911,000
" power looms	2,631	4,938	14,509	21,153

The number of flax spindles and power-looms in the European factories in 1881 is given in the *Annual Report of the Irish Flax Supply Association* as follows:—

	Spindles	Power- Looms		Spindles	Power- Looms
Ireland	879,916	21,177	Russia	160,000	8,000
Scotland	265,262	16,756	Italy	69,328	722
Denmark	199,596	4,061	Switzerland	9,000	—
France	470,000	22,000	Holland	7,700	1,200
Austria-Hungary	100,440	600	Sweden	9,610	88
Germany	113,467	8,000	Spain	30,235,624	2,713,129
Belgium	223,140	6,755			1,000

In all these returns no account is taken of the hand-loom in use, although in most of the Continental districts hand loom weaving is more common than weaving by power.

The amount and declared value of the exports of linens, linen yarn, &c., from the United Kingdom at intervals extending over fifty years is thus stated from official sources:—

Year	Linen Manufactures	Thread, &c.	Yarns
	Yards	Value in £	Value in £
1831	60,283,909	2,400,613	61,803
1841	95,721,761	3,184,597	111,261
1851	123,108,723	3,822,859	124,491
1861	118,892,469	3,671,131	103,773
1871	226,467,477	5,911,463	202,581
1881	179,884,800	5,185,490	280,350
			16,582,500
			2,087,173

The principal consumers of British linen manufactures are indicated in the following table, showing the exports for the year 1881:—

Country	Yards	Value in £	Yarns
	Yards	Value in £	Value in £
United States	11,090,000	2,544,910	—
Spanish West Indies	10,085,000	447,053	—
Australia	13,326,200	404,017	—
Germany	4,480,000	269,218	2,476,800
British North America	6,381,000	326,287	800,165
France	3,718,000	171,924	1,627,200
Holland	758,300	21,241	2,488,100
Belgium	—	—	1,629,800
Spain and Corsica	—	—	126,619
Other countries	54,720,000	1,689,477	9,651,600
Total	168,845,500	4,868,839	13,285,500
To which add —			
Denmark, checked and printed	4,400,000	161,118	—
France	3,308,000	163,972	—
Sweden and silk	—	—	2,857,100
Thread for sewing	—	—	202,584
Unenumerated	—	—	240,220
Total linen manufactures	179,884,800	5,165,059	—
" yarn, thread, &c.	—	1,737,482	—
" value of exports	—	6,902,541	—

(J. P. A.)

LING (*Molva vulgaris*), a fish of the cod-fish family (*Gadidae*), readily recognized by its long body, two dorsal fins (of which the anterior is much shorter than the posterior), single long anal fin, separate caudal fin, a barbel on the chin, and large teeth in the lower jaw and on the palate. Its usual length is from 3 to 4 feet, but larger individuals of 5 or 6 feet in length, and some seventy pounds in weight, have been taken. The ling is found in the North Atlantic, from Spitzbergen and Iceland southwards to the coast of Portugal. Its proper home is the German Ocean; especially on the coasts of Norway, Denmark, Great Britain, and Ireland it occurs in great abundance, generally at some distance from the land, in depths varying between 50 and 100 fathoms. During the winter months it approaches the shores, when great numbers are caught by means of long lines. On the American side of the ocean it is less common, although generally distributed along the south coast of Greenland, and on the banks of Newfoundland. This fish is one of

the most valuable species of the cod-fish family, a certain number are consumed fresh, but by far the greater portion are prepared for exportation to various countries on the Continent (Germany, Spain, Italy). They are either salted and sold as "salt-fish," or split from head to tail and dried, forming, with similarly prepared cod and cod-fish, the article of which during Lent immense quantities are consumed in Germany and elsewhere under the name of "stock-fish." Also the oil is frequently extracted from the liver and used by the poorer classes of the coast population for the lamp or as medicine.

LING. See HEATH.

LINGARD, JOHN (1771–1851), the Roman Catholic historian of England, was born of humble parentage at Winchester on February 5, 1771. His intellectual abilities began to manifest themselves at a very early age, and in 1783 he was sent to the English college at Douay, where he continued until shortly after the declaration of war by England (1793). For some time after his return to England he lived as tutor in the family of Lord Stourton, but in October 1794 he settled along with seven other former members of the old Douay college at Crook Hall near Durham, where on the completion of his theological course he became vice-president of the reorganized seminary. In 1795 he was ordained priest, and soon afterwards undertook the charge of the chairs of natural and moral philosophy. In 1808 he accompanied the community of Crook Hall to the new and more commodious buildings at Ushaw, Durham, but in 1811, after declining the presidency of the college at Maynooth, he withdrew to the secluded mission at Hornby in Lancashire, where for the rest of his life he found the leisure which his literary pursuits demanded. In 1817 he visited Rome, where he made some researches in the Vatican Library, and also negotiated some business connected with the English college. In 1831 Pope Pius VII. created him doctor of divinity and of canon and civil law, and in 1835 Leo XII. said to have made him cardinal *in petto*. He died at Hornby on July 17, 1851.

Lingard was the author of a considerable number of occasional and ephemeral writings of an unwelcome controversial character. He also wrote *The Antiquities of the Anglo-Saxon Church* (1806), of which a third and greatly enlarged edition appeared in 1845 under the title *The History and Antiquities of the Anglo-Saxon Church, containing an account of its origin, government, doctrines, worship, revenues, and clerical and monastic institutions*, but the work with which his name is chiefly associated is *A History of England, from the first invasion by the Romans to the commencement of the reign of William III.*, which appeared originally in 8 vols. at intervals between 1819 and 1830. Three successive subsequent editions had the benefit of extensive revision by the author, a fifth edition in 10 vols. 8vo appeared in 1849, and a sixth, with life of the author by Tierney prefixed to vol. i, in 1854–56. Soon after its appearance it was translated into French, German, and Italian. It is a work of ability and research, and, though Cardinal Wiseman certainly claimed too much for its author when he called him "the only impartial historian of our country," yet the candid and dispassionate student will always find it profitable to learn from the pages of Lingard the aspects which the events of English history presented to the mind of an able and intense Roman Catholic in the earlier decades of the 19th century.

LINKÖPING, a city of Sweden, the see of a bishop, and the chief town of the province of East Gothland, is situated in a fertile plain 21 miles by rail south-west of Stockholm, and communicates with Lake Roxen (3 mile to the north) and the Gata and Kinda canals by means of the now navigable Sångån. Most of the houses are of wood. The cathedral (1160–1499), a Romanesque building with a Gothic choir, is, next to the cathedral of Upsala, the largest church in Sweden, and, since the cathedral of Trondheim has lost so many of its treasures, presents the richest variety of objects of interest to the student of medieval art in the country. In the church of St. Lawrence, also called the Church of the Estates, are some paintings

fishments, apart from those mentioned in connexion with the town, being grist-mills, distilleries, chemical works, glass works, spade and shovel works, and a pottery.

The climate of the county hardly differs from that of the western portion of Midlothian. The annual rainfall, however, is somewhat greater, and is a fifth more than that of East Lothian: for the twenty-one years ending 1880 the mean at Linlithgow was 31·76 inches, while at East Linton (east of Haddington) it was 26·52.¹

Linlithgow is classed as a mixed agricultural and pastoral county, the agricultural element, however, preponderates largely, though the area of permanent pasture has been increasing. It is calculated that of the total area of 81,114 acres about 20,000 acres consist of the best sorts of clay (carae, &c.), 22,700 of clay on a cold bottom, 9600 of loam, as much of light gravel and sand, 14,000 of moorland and high rocky ground, and 1500 of peat. Only a very small part of the arable land remains unenclosed; the parish of Livingston, which in the beginning of last century was nearly covered with heath and juniper, is now all under rotation. Bathgate and Torphichen contain patches of peat moss and swamp. In Carnden and Dalmealy, and generally along the coast, the soil is light and early, though in some parts it varies so much that no single term is applicable to any considerable area. According to the agricultural returns for 1881, the corn crops occupied 17,847 acres, green crops 7261, clover and grass under rotation 12,980, permanent pasture (exclusive of heath or mountain land) 21,330. Oats are the most important of the cereals, 10,318 acres, and barley comes next with 4574 acres; increase on the 8757 acres of 1856. Wheat has been steadily losing ground, while 1856 showed 4643 acres, 1881 gives only 1450. Means, which used to occupy about 1000 acres, are now reduced to 655. An increasing area is devoted to clover and grasses for hay; but on the other hand the turnip area has been considerably reduced—5143 acres in 1856, 3801 in 1881. The extent of land under potatoes has slightly increased,—3023 acres for 1881, 2355 being the average for 1856–75. Cattle breeding is not much attended to, but a considerable number of animals are bought and fattened, and dairy farming is largely prosecuted, the fresh butter and cream being sent mainly to Edinburgh, but also to Newcastle, &c. Very little cheese is made. As a sheep-farming county Linlithgow stands very low—the returns giving 17,605 head in 1881, 28,070 in 1856. But few horses are bred, and the number of those in the county has remained wonderfully steady for the last fifty years. Hags have grown greatly fewer—2166 in 1866, and only 1442 in 1881.

The average extent of the farms is 108 acres, rather less than in Midlothian, of the total 542 more than 200 do not exceed 50 acres, and only 85 rise above 600. Very little of the land is rented at more than 28 per acre, an average of 25 to 28, 10s. for the best districts, of 80s. to 85s. for medium soils, and 15s. to 25s. for the worst land, will not be wide of the mark. "The leases of the arable lands are almost invariably for nineteen years, and grass lands are usually let annually by public auction, though in some instances they are taken for a period of three or five years."²

Though it is only in the neighbourhood of the principal manor-houses that large stretches of wood exist, the county as a tree-growing district rises considerably above the average for Scotland,—the woodland area being returned as 4899 acres in 1881, or one-sixteenth of the whole (Edinburgh shows one-twentieth). The finest woods are those of Hopetoun (where the beech avenues are especially noted), Newliston, Kinnell, and Dalmealy. Much of the old timber has been recently cut down, but replanting has been vigorously prosecuted.

The valued rent of the county in 1649 was £78,027 Scots, or about £2652 sterling. In 1806 the real rent was £51,018 sterling, and in 1811, £48,745. The value of railways, the valuation was £180,198 in 1876–77, and £216,011 in 1881–82. In the beginning of the century the county was practically in the hands of between thirty and forty landowners (Trotter). According to the Government returns for 1872–73, the total number of owners was 1555, of which 287 possessed upwards of 1 acre. The proprietors holding estates above 2000 acres were as follows:—Earl of Hopetoun, 11,870 acres; Earl of Rosebery, 5680; Sir William Ballie of Polkennet, 4320; Duke of Hamilton's Trustees, 3604; Lord Carlisle, 2295; William Cowan of Lumbry, 2281; Robert H. J. Stewart of Chanayfield, 2028; Dundas's Trustees, 2052.

Hopetoun House, the seat of the earl of Hopetoun, and the grandest mansion in the county, occupies a fine position between Queensferry and Blackness. Begun about 1696 by Sir William Bruce of Kinross, and completed long afterwards by Mr Adam, it practically occupies the site of the old castle of Abercorn, which

was taken from the Douglas family by James II. in 1455. Dalmealy Park (east of Rosebery) lies about 1½ mile west of Armond, the neighbouring ruins of Barnbougle Castle, an ancient seat of the Mowbrays, have been incorporated with a modern building. Almondell House (earl of Buchan) is situated on the Almond, not far from Mid Calder. Kinnell, a now deserted residence of the dukes of Hamilton, associated with memories of Colonel Latham and Dugald Stewart, is a short distance to the south-west of Bo'ness. On a trap rock jutting out into the fish strands Blackness Castle, now used as a powder magazine, but once one of the "keys of the kingdom, with a busy little port under its protection. Naby Castle (often called West or Seaton Naby), one of the resting places of Queen Mary, is now a mere ruin. Newliston (now owned by T. A. Hog) was for many years the residence of Lord Stair, who first introduced the field cultivation of cabbage, and is said to have laid out the woods according to the plan of the battle of Dettingen. Dundas Castle was the original seat of the Dundas family. Paterson recalls the memory of Walter Smeaton, author of the *Collections concerning the Works, &c. of the Church of Scotland*, and Philipstoun that of John Dunbar, another Scottish ecclesiastical lawyer. Kinnevel was the birthplace and family mansion of Patrick Hamilton.

There are two royal burghs in the county—Linlithgow and Queensferry, and, besides the towns Bathgate, Borrowstonness or Bo'ness, Arnamdale, a number of thriving villages.

The Union Canal connecting the Forth and Clyde Canal with Edinburgh passes along the central valley, and crosses the Almond and Avon by bridges designed by Thomas Telford. The North British Railway has two lines between Edinburgh and Glasgow, which pass through the county as Linlithgow and Bathgate respectively. Queensferry and Bo'ness are both connected with the system by branch-lines, and Bathgate is a junction of some importance.

The population of West Lothian has increased from 17,844 in 1801 to 48,196 (22,482 males and 25,714 females) in 1881. The greatest increase (3801) took place in the decennial period 1851–1861, the least (606) in 1811–21. The females were in excess of the males in every census down to 1841; since then the preponderance has been on the other side. The total population was 23,291 in 1801, 26,879 in 1811, 30,044 in 1821, 33,945 in 1831, and 40,965 in 1871.

Traces of the prehistoric occupation of the county are fairly numerous. On Bowden Hill is an earthenware connected by Mr Glaister and others with the Arturian contest. On Carraprie may be seen the remains of a circular building of unknown but early origin, and at Kippis is a cromlech now surrounded by circles of stones. Stone cists have been discovered at Carlewa, Dalmealy, Newliston, &c. Near Invernoon is a vast accumulation of shells considered by several geologists to be a natural bed, but claimed by antiquaries as an artificial mound, either a kitchen midden or a heap for the manufacture of lime (see David Grove, *Proc. St. Soc. of Ant.*, 1870–71). The Wall of Antoninus lies for a considerable distance within the county, and is believed to give origin to the names Carnden and Walton (see an account of a detailed exploration of the wall in *Fieldian*, 1877, pp. 1023–25). A fine legionary tablet was discovered at Brighams in 1869 (*Proc. St. Soc. of Ant.*, vol. viii.). Roman camps can be distinguished in several places.

At Torphichen* are the remains of a preceptory of the Knights of St John of Jerusalem, partly used as a parish church. The churches of Torphichen, Torcross, Kirkstoun, Uphall, and South Queensferry are of early origin,—Romanesque and Norman Gothic.

LINLITHGOW, the county town of the above county, and a royal and parliamentary burgh, situated in the central valley, 18 miles by rail from Edinburgh, consists almost exclusively of a single street running east and west along both sides of the highway; gardens behind the houses stretch down to the lake or climb the lower slopes of the rising grounds, on which a considerable number of suburban residences have been erected. In the early part of the century the general aspect of the street was antique and picturesque, but the greater proportion of the frontage has been rebuilt or modernized. Apart from the palace and the contiguous church of St Michael, the only edifices of any note are an ancient towerlike building near the railway station, which tradition regards as a mansion of the Knights Templars, the town-house (1688), and the county courts (1865). "Linlithgow for wells" is a proverbial expression; and the cross well in the public

¹ For earlier notices of rainfall, &c., see Trotter's *Agriculture of West Lothian*.

² See Thomas Farrall, in *Trans. of Highland and Agric. Soc. of Scotland*, 1877.

* See Abstract of the Charters . . . in the *Charterology of Torphichen* (ed. 1890).

square in front of the town-house is a striking piece of grotesque carved work in stone, originally erected, it is believed, in the reign of James V, but rebuilt in 1807. The burgh school goes back to the pre-Reformation times. Shoemaking and tanning are the leading industries; but a large distillery and (in the neighbourhood) two paper mills, glue works, and a soap factory add considerably to the business of the place. Linen bleaching is altogether a thing of the past. A grain market is held every Friday. The riding of the marches of the burgh is still performed annually by the magistrates and trades. The population of the burgh was 2282 in 1792-93, 3843 in 1861, 3690 in 1871, and 3913 in 1881.

Linthgow Palace is by general consent the finest ruin of its kind in Scotland. Heavy but effective, the somber walls rise above the green knolls of the promontory which divides the lake into two nearly equal portions. In plan it is almost square (168 by 174 feet), enclosing a court (91 by 88 feet), in the centre of which stands the ruined fountain used as a model for that erected in front of Holyrood Palace. At each corner there is a tower with an unusual spiral staircase,—that on the north-west angle being crowned by a little octagonal turret known as "Queen Margaret's Bower," from the tradition that it was there that the consort of James IV. sat and watched for his return from Flodden. The oldest portion of the building is probably the west side, whose massive masonry, hardly broken by a single window, is supposed to date in part from the time of James III., but the larger part of the south and east sides belong to James V., about 1535, and the north side was rebuilt in 1610-20. Of James V.'s portion, which is architecturally the richest, the main apartments are the Lyon chamber or parliament hall, and the chapel royal. The grand entrance approached by a drawbridge, was on the east side, above the gate way are still some weather-worn remains of rich allegorical designs, once resplendent with colour. A few yards to the south of the palace is the church of St. Michael, a Gothic (Scottish Decorated) building (180 feet long including the tower) probably founded in the 12th century, but mainly built in the 15th century. The central west front steeple was till 1821 topped by a crown like that of St. Giles, Edinburgh.

Linthgow (wrongly identified with a Roman Lindum) was a royal burgh with a castle and an endowed church as far back as the reign of David I. Edward I., who had encamped there the night before the battle of Falkirk (1295), wintered at Linthgow in 1301, and next year built "a pale (castle) well and strong," which in 1318 was captured by the Scots through the assistance of William Bannock or Bannock and his famous bay-cart. Later in the century (1369) the customs of Linthgow yielded more than those of any other chief town except Edinburgh; and the burgh was taken along with Lanark to supply the place of Berwick and Roxburgh in the court of the Four Burghs (1368). Robert II. granted it a charter of immunities, the oldest still preserved, in 1384. The palace becoming a favourite residence of the kings of Scotland, and often forming part of his marriage settlement of their consorts (Mary of Guelders, 1449; Margaret of Denmark, 1468; Margaret of England, 1608), as frequently mentioned in Scottish history, James V. was born within its walls in 1512, and his daughter Mary, December 7, 1542. In 1570 the Regent Murray was assassinated in the High Street by Hamilton of Bothwellhaugh. In 1600 the title earl of Linthgow was bestowed on Alexander, Lord Livingston, by James VI., who after his accession to the English throne retained an affection for the palace, and visited it again in 1617. The university of Edinburgh took refuge at Linthgow from the plague in 1645-46; and in the same year the national parliament, which had often sat in the palace, was held there for the last time. The public burning of the Covenant (1661), the passing of Prince Charles through the town in 1746, and the burning of the palace by Hawley's dragoons in 1746 are the chief remaining facts in the local annals. Most of the privileges which Linthgow enjoyed have dropped away. The rise of Bonness gave the last blow to the prosperity of its port at Blackness; its burgh lands have all been sold; and, after gaining its case three times in the Court of Session, it was deprived (1859) by the House of Lords of any claim to levy bridge toll and custom from the Edinburgh and Glasgow Railway.

Besides the *Statist. Account of Scotland*, see Sir Robert Sibbald's *Hist. of the Shire of Linthgow and Shirlintown*, Edinburgh, 1710; Penny, *Hist. Account of Linthgowshire*, Edinburgh, 1838, extracted from *Chambers's Encyclopedia*; J. Trotter, *General View of Agriculture of W. Lothian*, Edinburgh, 1794, new and enlarged edition, 1810; J. G. Colville, *The Palace of Linthgow and the Parish of Drumclog*, Edinburgh, 1794; James Colville, *The Royal Palace of Linthgow*, with architectural plan, Edinburgh, 1840; George Wallace, *Hist. of the Town and Palace of Linthgow*, Linthgow, 1844, 1870.

² See Billings's *Antiquities*; Colville's monograph; and *Characteristics of Old Church Architecture of Scotland*, 1861.

LINNÆUS (1707-1778). Carl von Linné, better known under his earlier name of Carolus Linnaeus, was born 13th May 1707, o.s., at Råshult, in the parish of Stenbrohult, in the province of Småland, Sweden.² His parents were Nils Linnaeus, the minister, afterwards pastor, of the parish, and Christina, the daughter of Broderusius, the previous incumbent; Carl, the subject of our notice, being their eldest child. When only four years old he was much impressed with his father's conversation with some of his people concerning the properties and names of certain of the local plants of economic value; from that time he constantly asked his father about the quality and nature of every plant he met with, often asking more than his father could answer, at other times, having forgotten the information previously given him, he was threatened with a refusal to answer his queries unless he promised to remember what he was told. To this early discipline Linnaeus afterwards ascribed his tenacious memory, which, added to his extreme sharpness of sight, laid the foundations of his eminence as a reforming naturalist.

His formal education began in 1714, when he was put under the private tuition of Telandier, and three years later he entered the primary school at Wexiö. In 1719 he was committed to the care of Gabriel Hok, who afterwards married his pupil's sister Anna Maria, this preceptor had greater skill as a teacher than his predecessors, and was less severe; still he was unable to overcome the distaste the youth had acquired for ordinary scholastic studies. During his last years at school Linnaeus took advantage of the greater liberty then allowed him to ramble in search of plants.

In 1724 he passed from the school to the gymnasium, carrying with him the same dislike for all those studies which his father considered necessary for admission to holy orders, his father's intention being to bring up his son in his own profession. Botany, a science at that time entirely neglected, almost wholly engrossed his attention; he formed a small library of the few Swedish writers who had treated of plants, which he was constantly poring over, although unable to comprehend all he found in their volumes.

In 1726 his father came to Wexiö, hoping to hear a good report of the two years' study of his son, but, whilst there was no complaint as regards his moral deportment, his progress in the prescribed studies had been so unsatisfactory that his father was recommended to apprentice him to a tailor or shoemaker, in preference to giving him a learned education, for which he was evidently unfitted. The old clergyman, deeply grieved at this poor return for his struggles to keep his son at school during the previous twelve years, went to visit Dr Rothman, a medical practitioner and lecturer on physics in the town, to consult him regarding a bodily ailment from which he was suffering. In the course of conversation he mentioned his mortification at his son's dullness, when Rothman expressed his confident belief that he could end the troubles of both father and son, and that Carl, though extremely backward in theological studies, would yet distinguish himself in medicine and natural history. Rothman further offered to board and lodge Carl during the twelvemonth more which must be passed in the gymnasium. A short time after this, Rothman gave his pupil a course of private instruction in physiology with great success, the young man acquiring himself excellently on examination. His tutor also gave

² The new style being then in process of gradual adoption in Sweden, the year 1704 was regarded as a common year in that country, consequently the true date of Linnaeus's birth, according to our present reckoning, was 23d May 1707, the commonly received date, 24th May, being an error due to supplanting the calendar in Sweden and Russia at that time to be identical.

him hints as to the proper manner of studying plants, and directed his attention to Tournefort's system of arrangement, which was founded on the differences in the flowers.

He proceeded to the university of Lund in 1737, bearing a deviously worded testimonium from Nils Krok, the rector of the gymnasium, to the effect that shrubs in a garden may disappoint the cares of the gardener, but if transplanted into different soil may prosper, therefore the bearer was sent to the university, where, perchance, he might find a more propitious climate. His former preceptor Hok kept back this doubtful recommendation, and presented Linnæus to the rector and dean as his own private pupil, thus procuring his matriculation.

Whilst studying here, Linnæus lodged at the house of Dr. Kilian Stobæus, afterwards professor of medicine, and physician to the king, who possessed an excellent museum of minerals, shells, birds, and dried plants, the methods of preservation here adopted were as a revelation to the young student, and taught him how to prepare his own acquisitions. Stobæus suffered greatly from ill-health, he was also lame, and one-eyed, but he was an amiable and extremely able man, having a large practice among the wealthier classes in the province of Skåne. Linnæus was sometimes called upon to assist the physician by writing the prescriptions, but as he wrote a bad hand, he was frequently sent away again. In those days physicians wrote legibly.

A German student named Koulas also lodged with Stobæus, and amongst the indulgences he enjoyed was that of access to the library of his landlord; with his fellow-student Linnæus formed a close friendship, and in return for instruction in the physiology which Linnæus had learned of Dr. Rothman, Koulas supplied him with volumes from the book-shelves of Stobæus, which were read by him stealthily at night. The mother of Stobæus, who was old and wakeful, noticed that there was constantly a light in Linnæus's room, and, being afraid of fire, decried her son to repenting the young man for his carelessness. Two nights afterwards, Stobæus went into Linnæus's chamber at eleven o'clock, expecting to find him asleep, but was astonished to find him poring over books. He was forced to confess whence these were obtained, and was at once ordered to bed; but the next morning, being further questioned, he was granted full liberty to use the library, and perfect familiarity was accorded by the doctor, who, having no children, held out hopes of making the young student his heir.

Whilst botanizing in the spring of 1738, Linnæus was attacked by what he considered to be a venomous animal, afterwards named by him *Furva infernalis*, in allusion to the torment and danger he suffered from it; after his recovery, he passed the summer at his father's house in Småland. Here he again met Rothman, who strongly advised him to quit Lund and to go to Upsala, where he would find greater facilities for the prosecution of his medical studies, and possibly obtain some scholarship to eke out his scanty means. Linnæus adopted his patron's advice, and started for Upsala with a sum of £8 sterling, that being all he was to expect from his parents. At this sort of learning his slender funds were soon exhausted, being young and unknown, he found no means of earning money by lecturing or teaching; he became dependent on chance generosity for a meal, and had to repair his shoes with folded paper. He could not well return to Lund, for Stobæus had taken offence at his departing without consulting him, and, besides, the journey required money which he did not possess.

In the autumn of this year, 1739, Linnæus was engaged intently examining some plants growing in the academical garden, when a venerable clergyman asked him what he

was studying, whether he understood botany, whence he came, and how long he had been busied in the study. After being questioned at length, he was requested to follow his companion home; there he discovered him to be Dr. Olaf Celsius, professor of theology, at that time working at his *Herobotanicon*, which saw the light nearly twenty years later. When the professor saw Linnæus's collections he was still more impressed, and, finding him necessitous, he offered him board and lodging, he afterwards admitted him to close intimacy, and allowed him the free use of his rich library. The temporary adjuncts of the faculty of medicine being incompetent, Linnæus, by the recommendation of Celsius, was able to get some private pupils, and thereby to assume a more creditable appearance.

At this time there was only one medical student who distinguished himself by diligence in study, and that was Peter Artedius, who afterwards styled himself Artedi. A close friendship sprang up between the two young men, they studied in concert, and vied with each other in their attainments, with perfect good temper, though of very diverse dispositions. Linnæus was sovereign in ornithology, entomology, and botany, Artedi reserving to himself the umbelliferous plants, fishes, and amphibia. A silence, almost total, prevailed in the university at this time on topics of natural history; during his whole curriculum Linnæus did not hear a single public lecture delivered on anatomy, botany, or chemistry.

During this period of intense receptivity, he came upon a critique which ultimately led to the establishment of his artificial system of plant classification. This was a review of Vaillant's *Sermo de Structura Florum*, Leyden, 1718,¹ a thin quarto in French and Latin, it set him upon examining the stamens and pistils of flowers, and becoming convinced of the paramount importance of these organs, he formed the idea of basing a system of arrangement upon them. Another work by Wallin, *Päqors förvar, sive Nuptia Alborum Diseratatio*, Upsala, 1729, having fallen into his hands, he drew up a short treatise on the sexes of plants, and showed it to Dr. Celsius, who put it into the hands of the younger Olaf Rudbeck, at that time professor of botany in the university. In the following year Rudbeck, whose advanced age compelled him to lecture by deputy, appointed Linnæus his adjunct; in the spring of 1730, therefore, the latter began his lectures, and was accompanied by many pupils on his botanical excursions. The academic garden was entirely remodelled under his auspices, and furnished with many rare species, he being now in a position to direct the gardener, whereas in the year before he had actually solicited appointment to the vacant post of gardener, which was refused him on the ground of his capacity for better things.

His evenings were now devoted to the preparation of his epoch-making books, which were issued several years afterwards in the Netherlands. His position at the university having become unpleasant, he readily undertook to explore the little known country of Lapland, at the cost of the Academy of Sciences of Upsala. He started thence on May 12, 1732 o.s., carrying all his luggage on his back, journeying at first on horseback along the road skirting the coast to Umeå, thence by boat up the river to Lyckeel within the Arctic Circle, penetrating to what he terms Olycksmyran (i.e., the unlucky marsh) in spite of the melting of the ice, which made travelling in that part almost impossible. Unable to penetrate farther into the interior, he returned to Umeå, still skirting the sea-shore by Fittå to Luleå. From this latter place he made a lone excursion to the north-west by Jockmoock and Qvickjock;

¹ This work has a serious mistake on both title pages; it is corrected in the errata, but the correction seems to have escaped the notice of every bibliographer.

then, crossing the mountain range, he came out upon the coast of Finmark. He retraced his steps to Luleå, and at Celix he learned the art of assaying "in two days and a night," continuing his journey through Torné, and the eastern coast of the gulf of Bothnia to Åbo, where he rested eight days, and finally reached Upsala by sea. The distance traversed in this tour was upwards of 4600 English statute miles, the cost of his journey is given at 112 silver dollars, or less than £25 sterling. His own account of the journey was published in English by Sir J. E. Smith, under the title *Lachenis Lapponica*, in 1811, the scientific results were published in his *Flora Lapponica*, Amsterdam, 1737. In 1733 Linnæus was engaged in teaching the method of assaying ores, and hoped to be allowed to lecture on botany; but a quarrel broke out between a rival, Rosen, and himself, the former having, by private influence, contrived to get a prohibition put on all private lectures on medicine in the university. Linnæus, enraged at finding his livelihood thus cut off, went so far as to draw his sword upon Rosen, but was prevented from harming his antagonist. At this juncture the governor of Dalecarlia invited Linnæus to travel through his province, as he had done through Lapland. Whilst on this journey he lectured at Fahlun to large audiences; Brouallus, the chaplain there, afterwards bishop of Åbo, now strongly urged Linnæus to go abroad and take his degree of M.D. at a foreign university, by which means he could afterwards settle where he pleased. Linnæus, having become attached to the eldest daughter of Dr Moré or Moræus, left Sweden in 1735 to seek his fortune in the manner stated, and to return to claim her hand.

He travelled by Lübeck and Hamburg; detecting a seven-headed hydra to be a fabrication at the latter, he was obliged to quit the town in haste to avoid the wrath of its possessor. From Altona he went by sea to Amsterdam, staying there a week; he then proceeded to Harderwyk, where he went through the requisite examination, and defended his thesis on the cause of intermittent fever. His scanty funds were now nearly spent, but he passed on through Haarlem to Leyden; there he called on Gronovius, who, returning the visit, was shown the *Systema Naturæ* in MS., and was so greatly astonished at it that he sent it to press at his own expense. The first edition was in eight folio sheets; the subsequent editions were in 8vo; and the twelfth immensely enlarged edition appeared during the author's lifetime. This famous system, which, artificial as it was, substituted order for confusion, largely made its way on account of the lucid and admirable laws, and comments on them, which were issued almost at the same time. See BOTANY, vol. iv. p. 80. Boerhaave, whom Linnæus saw after waiting eight days for admission, recommended him to Burman at Amsterdam, where he stayed a twelvemonth, living at the house of the professor. While there he issued his *Fundamenta Botanica*, an unassuming small octavo, which has exercised immense influence. The wealthy banker Clifford having invited Linnæus to visit his magnificent garden at Hartecamp, he remained there, living like a prince, but working most assiduously in the garden and library, both of which were kept up without regard to cost. His *Flora Lapponica* was now printed, containing a description of the genus *Linnaea*, by his friend Gronovius; he selected this plant to bear his name, from a similarity, as he thought, between it and himself. Whilst living with Clifford, Linnæus met with his old fellow-student Artedi, who was quite destitute, having spent all his money in London; Linnæus introduced him to Seba, then working at fishes, Artedi's chief object of study; he worked hard at describing them, until only six remained undescribed, when he unfortunately fell into a canal at night, and was drowned.

Linnæus persuaded Clifford to redeem the manuscript, and he published it as a memorial of his deceased friend.

In 1736 Linnæus visited England. He was warmly recommended by Boerhaave to Sir Hans Sloane, but the old collector seems to have received him coldly. A better reception awaited him at Oxford, where Dr Shaw welcomed him cordially, Dillenius, the professor of botany there, was icy at first, but afterwards thawed completely, kept him a month, and even offered to share the emoluments of the chair with him. At Chelsea he saw Philip Miller, and took some plants thence to Clifford; but certain other stories which are current about Linnæus's visit to England are of very doubtful authenticity.

On his return to the Netherlands he completed the printing of his *Genæa Plantarum*, a volume which must be considered the starting point of modern systematic botany, Tournefort formed many genera, but Linnæus was the first to circumscribe them. During the same year, 1737, Linnæus finished arranging Clifford's collection of plants, living and dried; these were described in the *Hortus Cliffortianus*, a folio illustrated with engravings by Ehret; this book was entirely written in nine months. During the compilation he used to "amuse" himself with drawing up the *Critica Botanica*, also printed in the Netherlands. But this strenuous and unremitting labour told upon him, the atmosphere of the Low Countries seemed to oppress him beyond endurance, he resented all Clifford's entreaties to remain with him, and started homewards.

Van Royen managed to detain him a year at Leyden, to help in rearranging the garden, thereby offending Clifford, whom he had quitted on the plea of hastening back to Sweden. Linnæus now published his *Classis Plantarum*, and almost at the same time appeared Van Royen's *Hortus Leydenæ* and Gronovius's *Flora Fervicina*, both of these being drawn up on the Linnæan system. In 1738 Boerhaave pressed Linnæus to accept a post at Surinam; he declined this for himself, but passed it on to Johan Bartsch of Königsberg, a member with himself of a select club of naturalists at Leyden. Bartsch ultimately fell a victim to the climate of that colony.

While residing at Leyden Linnæus was warned that one of his acquaintances was endeavouring to supplant him in the affections of Sara Moré; he intended to set out at once, but was attacked by ague before he could start. Clifford, hearing of this, took Linnæus to his own house again, and would not suffer him to depart until he was sufficiently well. His complete recovery, however, did not take place until he had gained the higher country of Brabant, where in one day he felt himself entirely renovated. He continued his journey to Paris, where he visited Antoine and Bernard de Jussieu, botanizing with the latter. Abandoning all notion of returning through Germany, he went to Rouen, sailed for Sweden, and landed at Helsingborg.

Linnæus established himself in September, 1738, as physician in Stockholm, but, being unknown as a medical man, no one at first cared to consult him, a great change from the attention paid to him abroad; he himself declared "that, had he not been in love, he would certainly have left his native country." By degrees he found patients, was then appointed naval physician at Stockholm, with minor appointments, and was married on the 26th June 1739.

Early in 1740 Hædbeck died, and Roberg resigned; the chairs of botany and medicine at Upsala being thus vacant, Rosen and Linnæus were chosen respectively to fill them. The former rivals afterwards agreed to exchange professorships to their mutual benefit; in 1741, previous to this exchange, Linnæus travelled through Olund and Gothland, by command of the state, publishing his results in *Öländska och Gothländska Resa*, 1745. The index to this volume shows the first employment of trivial names in nomenclature.

Henceforward his life was a continuous course of prosperity, his time being taken up by teaching and the preparation of other works. In the year 1745 he issued his *Flora Suecica* and *Flora Suecica*, the latter having occupied his attention during fifteen years; afterwards, two volumes of observations made during journeys in Sweden, *Waldgäta Resa*, Stockholm, 1747, and *Skånska Resa*, Stockholm, 1751. He examined the collections made many years before in Ceylon by Harmsen, the full publication taking place in his *Flora Zeylanica*, Stockholm, 1747. In 1748 he brought out his *Hortus Upsalensis*, showing that he had added eleven hundred species to those formerly in cultivation in that garden. In 1750 his *Philosophia Botanica* was given to the world; it consists of a commentary on the various axioms he had published in 1735 in his *Fundamenta Botanica*, and was dictated to his pupil Löffling, while the professor was confined to his bed by an attack of gout so violent as to threaten his life; he attributed his recovery to eating plentifully of wood-strawberries, a regimen he afterwards carefully observed. A much slighter attack in the following year was mainly cured by the pleasure caused by Kalm bringing home many new plants from Canada.

He catalogued the Queen's Museum at Drottningholm, and the King's at Ulriksdal, but the most important work of this period of his life is unquestionably his *Species Plantarum*, Stockholm, 1753,—a second edition being issued in 1762. In this volume the trivial names are fully set forth; although they had been previously shadowed forth by Linnæus and others, yet to him belongs the merit of establishing the use of a single epithet in addition to the generic name. In the same year Linnæus was created knight of the Polar Star, the first time a scientific man had been raised to that honour in Sweden.

In 1755 he was invited by the king of Spain to settle in that country, with a liberal salary, and full liberty of conscience, but he declined on the ground that whatever merits he possessed should be devoted to his country's service; Löffling was sent instead, but died within two years. He was enabled now to purchase the estate of Söfs and Hammarby; at the latter he built his museum of stone, to guard against loss by fire. His lectures at the university drew men from all parts of the world; the normal number of students at Upsala was five hundred, whilst he occupied the chair of botany there it rose to fifteen hundred. In 1761 a patent of nobility was granted, antedated to 1757, from which time Linnæus was styled Carl von Linné; his arms were those now borne by the Linnæan Society of London. To his great delight the tea plant was introduced alive into Europe in 1763; this year also his son Carl was allowed to assist his father in his professional duties, and to be trained as his successor.¹ At the age of sixty Linné's memory began to fail; an apoplectic attack in 1774 greatly weakened him; two years after he lost the use of his right side; and he died

10th January 1778, of an ulceration of the bladder. He was buried in the cathedral of Upsala, with every token of universal regret.

In person Linnæus was described as of medium height, with large limbs, brown piercing eyes, and acute vision, and quick-tempered. He was accustomed to sleep five hours in summer and ten in winter. He lived simply, acted promptly, and noted down his observations at the moment. His handwriting was peculiar, and not very easy to read, copies of his own books were interleaved and copiously annotated, every new discovery being posted into its proper place at once, so that new editions were readily prepared when wanted.

With his arrangement seems to have been a passion, he delighted in devising classifications, not only did he systematise the three kingdoms of nature, but even drew up a treatise on the *Genera Morborum*. He found biology a chaos; he left it a cosmos. When he appeared upon the scene, new plants and animals were the source of daily discovery in increasing numbers, due to the increase of trading facilities, he devised schemes of arrangement by which these acquisitions might be sorted provisionally, until their natural affinities should have become clear. He made many mistakes, but the honour due to him for having first enunciated the true principles for defining genera and species, and his uniform use of trivial names, will last so long as biology itself endures. His style is terse and laconic; he methodically treated of each organ in its proper turn, he had a special term for each, the meaning of which did not vary, so that the term did not suggest two ideas at once. The reader cannot doubt the author's intention; his sentences are business-like, and to the point. The omission of the verb in his descriptions was an innovation, and gave an abruptness to his language which was foreign to the writing of his time, but it probably by its succinctness added to the popularity of his works.

By his force of character he shifted the scientific centre of gravity during his life to a small town in Sweden, he was constantly receiving presents and praise from crowds of correspondents in every civilized country and in every station of life, hence it is not surprising that this universal homage should have bred the vanity which disfigures the latter part of his life.

No modern naturalist has impressed so strong an own character with greater force upon his pupils than did Linnæus. He imbued them with his own intense acquisitiveness, reared them in an atmosphere of enthusiasm, trained them to close and accurate observation, and then dispatched them to various parts of the globe. His students being drawn from many quarters, he had an extensive acquaintance, and fell victims to fatigue and unkindly climates, but there was no lack of successors. With these young enthusiasts their master's love was like a gospel; they were eager to extend the knowledge of it, and to contribute to its melioration.

The published works of Linnæus amount to more than one hundred and eighty, including the *Amoenitas Academica*, for which he provided the material, revising them also for press; corrections in his handwriting may be seen in the Banksian and Linnæan Society's libraries. His correspondence was wide and copious. Some of his letters have been published, but the bulk of them remains inédit. Many works remain in MS.; some have lately been published, such as the *Flora Dalecarlica*, and the *Svenska Arbeten*, both edited by Dr Ewald Ahring; those which were issued during the author's life are enumerated by Dr Pulteney in his *General View of the Writings of Linnæus*. (B. D. J.)

LINNELL, JOHN (1792-1882), a richly gifted English painter, was born in London on the 16th of June 1792. His father being a carver and gilder, Linnell was early brought into contact with artists, and when he was ten years old he was already drawing and selling his portraits in chalk and pencil. His first artistic instruction was received from Benjamin West, and he spent a year in the house of John Varley the water-colour painter, where he had William Hunt and Mulready as fellow pupils, and made the acquaintance of Shelley, Godwin, and other men of mark and individuality. In 1808 he was admitted a student of the Royal Academy, where he obtained medals for drawing, modelling, and sculpture. He was also trained as an engraver, and executed a transcript of the Burial of Saul, one of Varley's most impressive pictures. In after life he frequently occupied himself with the burin, publishing, in 1834, a series of outlines from Michelangelo's frescos in the Sistine chapel, and, in 1840, superintending the issue of a selection of places from the pictures in Buckingham Palace, one of them, a Titian landscape, being mezzotinted by himself. At first he supported himself mainly by miniature painting, and by the execution of

¹ Carl von Linné the younger, the elder son of the distinguished naturalist, was born at Fahlun, 20th January 1741. Delicate in constitution, he seemed to be oppressed with his father's reputation and his having to support it. He published two decades of new plants, and three dissertations, contributing also some descriptions to the first edition of *Aiton's Hortus Kewensis*, at the time of his visit to England. He died unmarried at Upsala, 1st November 1788, and his only brother Johan having died in infancy, the succession became extinct in the male line. His mother sold the collections and books of father and son to Dr J. E. Smith, the first president of the Linnæan Society of London. When Smith died in 1828, a subscription was raised to purchase the herbarium and library for the Society, whose property they now remain. Smith sold the collection of minerals in 1796, and added many insects to the Linnæan types, but the herbarium is practically in the same state as when the elder Linné himself last used it. The manuscripts of most of his publications, and the letters he received from his contemporaries, are likewise in the possession of the Society.

larger portraits, such as the likenesses of Mulready, Whately, Peel, and Carlyle. Several of his portraits he engraved with his own hand in line and mezzotint. He also painted many subjects like the St John Preaching, the Covenant of Abraham, and the Journey to Emmaus, in which, while the landscape background is usually prominently insisted upon, the figures are yet of sufficient size and importance to supply the title of the work. But it is mainly in connexion with his long series of paintings of pure landscape that his name is known to the public. When he was only seventeen, his *Removing Timber* carried off the fifty-guinea prize offered by the British Institution for the best landscape, and for many years Linnell was a regular contributor to the exhibitions of that body, and to those of the Royal Academy and the Society of Painters in Oil and Water Colours. His works commonly deal with some scene of typical uneventful English landscape, which is made impressive by a gorgeous effect of sunrise or sunset. They are full of true poetic feeling, and are rich and glowing in colour. His art proved exceptionally remunerative; he was able to command very large prices for his pictures, and about 1850 he purchased a property at Redhill, Surrey, where he resided till his death, on the 20th of January 1882, surrounded by his children—two of them artists like himself—and his children's children, and painting with unabated power till within the last few years of his life. His leisure was greatly occupied with a study of the Scriptures in the original, and he published several pamphlets and larger treatises of Biblical criticism. Among his literary productions are a work on *The Mirroring of the Scripture the Old and New Testament*, 1856; *The Lord's Day the Day of the Lord*, 1869; a pamphlet on *The Ascension Sacrifice of the Old Testament*, 1864; and one on *The Royal Academy a National Institution*, 1869. A word should be said regarding Linnell's connexion with William Blake. He was one of the best friends and kindest patrons of the great visionary artist. He gave him the two largest commissions he ever received for single series of designs—£160 for drawings and engravings of *The Inventions to the Book of Job*, and a like sum for those illustrative of Dante.

LINNET, Anglo-Saxon *Linnet* and *Linnet-weige*, whence seems to have been corrupted the old Scottish "Luntquib," and the modern northern English "Lintwhite,"—originally a somewhat generalized bird's name, but latterly specialized for the *Pringilla cannabina* of Linnaeus, the *Linota cannabina* of recent ornithologists. This is a common and well-known song-bird, frequenting almost the whole of Europe south of lat. 64°, and in Asia extending to Turkestan. In Africa it is known as a winter visitant to Egypt and Abyssinia, and is abundant at all seasons in Barbary, as well as in the Canaries and Madeira. Though the fondness of this species for the seeds of flax (*Linum*) and hemp (*Cannabis*) has given it its common name in so many European languages,¹ it feeds largely, if not chiefly, in Britain on the seeds of plants of the order *Compositae*, especially those growing on heaths and commons. As these waste places have been gradually brought under the plough, and improved methods of cultivation have been applied to all arable land, in England and Scotland particularly, the haunts and means of subsistence of the Linnet have been slowly but surely curtailed, and hence of late years its numbers have undergone a very visible diminution throughout Great Britain, and its diminution has also been aided by the detestable practice of netting it in spring—for it is a popular cage-bird—so popular indeed as to require no special description. According to its sex, or the season of the year, it is known as the Red, Grey, or Brown Linnet,

and by the earlier English writers on birds, as well as in many localities at the present time, these names have been held to distinguish at least two species; but there is now no question among ornithologists on this point, though the conditions under which the bright crimson-red colouring of the breast and crown of the cock's spring and summer plumage is donned and doffed may still be open to discussion. Its intensity seems due, however, in some degree at least, to the weathering of the brown fringes of the feathers which hide the more brilliant hue, and it is to be remarked that in the Atlantic islands examples are said to retain their gay tints all the year round, while throughout Europe there is scarcely a trace of them visible in autumn and winter; but, beginning to appear in spring, they reach their greatest brilliancy towards midsummer; and it is also to be remarked that they are never assumed by examples in confinement. The Linnet begins to breed in April, the nest being generally placed in a bush at no great distance from the ground. It is nearly always a neat structure composed of fine twigs, roots, or bents, and lined with wool or hair. The eggs, often six in number, are of a very pale blue marked with reddish or purplish brown. Two broods seem to be commonly brought off in the course of the season, and towards the end of summer the birds—the young of course greatly preponderating in number—collect in large flocks and move to the sea-coast, whence a large proportion depart for more southern latitudes. Of these emigrants some return the following spring, and are invariably recognizable by the more advanced state of their plumage, the effect presumably of having wintered in countries enjoying a brighter and hotter sun.

Nearly allied to the foregoing species is the Twite, so named from its ordinary call-note, or Mountain-Linnet, the *Linota flavirostris*, or *L. montium* of ornithologists, which can be at once distinguished by its yellow bill, longer tail, and reddish-tawny throat. This bird never assumes any crimson on the crown or breast, but the male has the rump at all times tinged more or less with that colour. In the breeding-season it seems to affect exclusively hilly and moorland districts from Herefordshire northward, in which it partly or wholly replaces the common Linnet, but is very much more local in its distribution, and, except in the British Islands and some parts of Scandinavia, it only appears as an irregular visitant in winter. At that season it may, however, be found in large flocks in the low-lying countries, and as regards England even on the sea-shore. In Asia it seems to be represented by a kindred form, *L. brevirostris*.

The REDPOLS (*g.n.*) form a little group placed by many authorities in the genus *Linota*, to which they are unquestionably closely allied, but in this work they may be considered later; and, as before stated (FISCHER, vol. xi. p. 192), the Linnets seem on the other hand to be related to the birds of the genus *Leucosticte*, the species of which, in number uncertain, inhabit the northern parts of North-West America and of Asia. The most recent list of the birds of the former country by Mr Ridgway (*Bull. U. S. Nat. Museum*, No. 21, 1881) includes four species and one local race, of which there is need here to mention only *L. lephrocois*. It is generally of a chocolate colour, tinged on some parts with pale crimson or pink, and has the crown of the head silvery-gray. Another species, *L. arctos*, was formerly said to have occurred in North America, but its proper home is in the Kurile Islands or Kamchatka. This has no red in its plumage. The birds of the genus *Leucosticte* seem to be more terrestrial in their habit than those of *Linota*, perhaps from their having been chiefly observed where trees are scarce; but it is possible that the mutual relationship of the two groups is more apparent than real. Allied to *Leucosticte* is *Montifringilla*,

¹ E.g., French, *Linette*; German, *Hänfling*; Swedish, *Hänfling*.

to which belongs the Snow-Finch of the Alps, *M. nivalis*, so often mistaken by travellers for the Snow-Bunting, *Plectrophenax nivalis*.

LINOLEUM is a kind of floor-cloth, invented and introduced by Mr F. Walton, who in 1860 obtained a patent for its manufacture. It consists of a preparation of linseed oil and ground cork intimately mixed and spread in a uniform layer over a sheet of rough jute canvas. Under the name of kamptulicon, a material similar in appearance and properties, but in which prepared india-rubber took the place of oxidized linseed oil, was in use to a limited extent previous to the introduction of linoleum; the latter material, however, was found to possess several advantages; among others it had the merit of comparative cheapness as against kamptulicon, which it entirely supplanted. Linoleum also became a formidable competitor with the old form of oil floor-cloth, and on the expiry of Mr Walton's patent the manufacture of the new material was very generally taken up in Kirkcaldy, the principal seat of the floor-cloth trade. In the hands of Messrs Michael Nairn & Co., who were the first to introduce the floor-cloth industry into Scotland, the machinery used for making linoleum has been improved in important respects, and the ingenuity and resource of Mr Walton, the original patentee, have discovered several new adaptations and modifications of his original invention.

The making of linoleum involves three distinct preliminary operations—(1) the oxidation of the linseed oil, (2) the grinding of the cork, and (3) the weaving of the jute canvas backing. Of these operations the oxidation of the oil is the most peculiar and distinctive. The linseed oil is first boiled with litharge in the way practised for preparing ordinary boiled oil (see **LINSEED**), and it is next oxidized by exposure, in exceedingly thin films, to the influence of air. To secure the exposure of sufficient surfaces of oil to the atmosphere, a large lofty apartment is hung with sheets or continuous webs of calico cloth, which are allowed to depend from near the roof into troughs or tanks on the floor. These webs of calico are kept sufficiently far apart to allow free circulation of air between them. They are daily drenched with boiled oil by allowing it to trickle down from the top over their entire surface, the distribution being effected by a special arrangement of movable tanks and tubs. It will be seen that an enormous surface of oil can thus be exposed within a comparatively limited space. The influence of oxygen on the oil films is facilitated by the blowing of heated air into the chamber so as to keep up a continual circulation; and the activity of the process is unpleasantly manifested by the extremely acid odour which is evolved by the oil. Day by day the thickness of the coating of oxidized oil increases, and when a deposit of about half an inch has been accumulated, the drenching is stopped. The product, now ready for being withdrawn, forms firm translucent sheets of a countchou-like substance having a straw yellow colour, possessed of a certain amount of elasticity, and communicating no oily stain to paper. These sheets are now torn into small pieces and reduced to a uniform plastic mass by means of powerful crushing rollers, after which the material is placed in a close boiler with the addition of certain proportions of kauri gum, resin, and ochre, amber, or other pigment, according to the ground-colour desired. The boiler is heated by steam, and the entire mass, being thoroughly incorporated by means of stirrers, is run into a shallow trough, from which, after cooling and solidifying, it is taken in large slabs. These are piled up awaiting future use, and when required for manufacturing purposes they are cut into blocks about the size of an ordinary brick.

Ground cork, which is the second essential constituent of linoleum, may be made from cork cuttings and scraps;

but, the supply of such material being unequal to the demand, bala cork, of secondary quality as imported, is very largely used. It is first broken to pieces about the size of a nut, the fragments are fed into the hopper of a mill;

and the cork passes thence between a pair of ordinary millstones in which it is reduced to a meal-like condition, in exactly the same way as wheat is ground to flour. The product is sifted, and the insufficiently ground portions are returned to be passed again through the mill. In the grinding of the cork great care is necessary to prevent iron, stone, or other hard foreign material from getting into the mill, as such substances, causing sparks between the stones, readily give rise to explosions in air so laden with fine dust as that of the mill necessarily is.

In the making of the jute backing the only notable feature is the great width of the loom, in which webs 12 feet broad are woven by Messrs Nairn. The maximum width of that produced by other makers, however, has hitherto been 6 feet.

The actual preparation of linoleum floor-cloth in the factory of Messrs Nairn is conducted in a continuous series of operations by machinery which has been patented by that firm. The bricks of oxidized oil and the requisite proportion of cork are thrown into a hopper, where they are thoroughly mixed in a kind of pug mill, whence the mixture is shot forward in a tube, at the open end of which it is sliced off in thin crumbling masses by a revolving knife. Spread out in thin sheets, it passes from this between a series of steam-heated rollers, from the last of which it is scratched off by a circular drum covered with sharp steel points, and falls in a fine shower into a feeding box the whole width of the linoleum to be made. From this feeding box the mixture is uniformly delivered on the surface of the canvas, which here meets it, and passing immediately between powerful smooth rollers, the semi-plastic mixture is firmly squeezed on the surface of, and rendered adherent to, the rough open canvas which forms its back. The distance between the upper and lower compressing roller determines the thickness of the linoleum, three standard thicknesses being recognized, viz., $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{5}{8}$ parts of an inch. Linoleum of the thickness of $\frac{1}{2}$ of an inch is also made for public libraries and reading-rooms on account of its perfect noiselessness. It only remains to coat or waterproof the raw canvas back with oil paint, and the floor-cloth is finished as plain linoleum. The printing of patterns in various colours on its surface is done as described under **FLOOR-CLOTH**, vol. ix. p. 329. Corticine is a form of linoleum, in which the oil is oxidized by chemical agents.

Recently a method of ornamenting linoleum with patterns in the form of tiles or tesserae, the colour of each tile going right through to the canvas or sufficiently deep for constant wear, has been devised and patented by Mr C. F. Leake. The patentee proposes to use canvas first covered with a thin linoleum coating. This he brings on a table on which are a series of moulds corresponding with the coloured tile pattern required. Into each mould is put the required quantity of properly-coloured granulated linoleum material, which is compressed into solid tiles by the descent of plungers. The part covered by the pattern is carried forward and powerfully squeezed between hydraulic rams, the tiles being thus made smooth, homogeneous, and firmly adherent, while in the meantime the moulds are being filled and a new set of tiles prepared in the first stage of the operation. Mr Walton, the original patentee of linoleum, has developed a preparation of oxidized oil and cork or other thickening material embossed with patterns for wall decorations under the name of "Lancaster Walton." (J. P.A.)

—**LINSEED** is the seed of the common flax or flint, *Linum catharticum*, from which also the well-known fibre flax is obtained. The plant itself is figured and described under **FLAX**, vol. ix. p. 263. The fruit of the flax plant consists of a globose capsule which splits into five cocci, each containing two seeds. These seeds, the linseed of commerce, are of a lustrous brown colour externally, and a

compressed and elongated oval form, with a slight beak or projection at one extremity. The brown testa contains, in the outer of the four coats into which it is microscopically distinguishable, an abundant secretion of mucilaginous matter; and it has within it a thin layer of albumen, enclosing a pair of large oily cotyledons. The seeds when placed in water for some time become coated with glutinous matter from the exudation of the mucilage in the external layer of the epidermis; and by boiling in sixteen parts of water they exude sufficient mucilage to form with the water a thick pasty decoction. The cotyledons contain the valuable linseed oil referred to below. Linseed grown in tropical countries is much larger and more plump than that obtained in temperate climes, but the seed from the colder countries, on the other hand, yields a finer quality of oil. Pluckiger and Hanbury found that six seeds of Sicilian linseed, thirteen of Black Sea, and seventeen of Archangel linseed weighed respectively one gram. The average composition of linseed may be fairly represented by the following analysis by Dr Thomas Anderson:—albuminous substances, 24.44; oil, 34.00; gum sugar and cellulose, 30.73; ash, 3.33; water, 7.50. Linseed is cultivated and secured as a crop in all European flax-growing countries, where the seed is probably not less valuable than the fibre. It is also obtained from Egypt and India, being cultivated in the latter country solely on account of the seed.

Apart from its value as a source of oil, and for sowing, linseed is not a product of much economic importance. It formed an article of food among the Greeks and Romans, and it is said that the Abyssinians at the present day eat it roasted. The oil is to some extent used as food in Russia, and in parts of Poland and Hungary. Linseed meal, partly on account of its bland oily constitution, is a valuable material for poultices. At one time the crushed seeds were the officinally recognized cataplasmic material, but the readiness with which that preparation became rancid through the oxidation of its abundant oil frequently rendered it a dangerous application for open sores. The *lini farina* of the pharmacopoeia is now the powdered meal of the cake left after expression of the oil, with a proportion of olive oil added when about to be used. An infusion of linseed under the name of "linseed tea" is a popular diluent in bronchial and other inflammatory affections. The abundant mucilage in linseed meal makes it a most useful material for luting stoppers in chemical jars, and other such joints in glass-work. Linseed cake, the marc left after the expression of the oil, is a most valuable feeding substance for cattle. According to a recent analysis by Dr Voelcker (*Journ. Roy. Agric. Soc.*, 2d ser., vol. xvii, p. 659) it contains in 100 parts—oil, 10.90; albuminous compounds, 24.56; mucilage, sugar, and digestible fibre, 31.97; woody fibre, 11.47; ash, 6.20; moisture, 14.90.

Linseed is subject to extensive and detrimental adulterations, resulting not only from careless harvesting and cleansing, whereby seeds of the flax dodder and other weeds and grasses are mixed with it, but also from the direct admixture of cheaper and inferior oil seeds, such as wild rape, mustard, sesame, poppy, &c., the latter adulterations being known in trade under the generic name of "beffum." In 1884, owing to the serious aspect of the prevalent adulteration, a union of traders was formed under the name of the "Linseed Association," the members of which bind themselves to give compensation for all adulterations in excess of 4 per cent. of foreign matter. Highly adulterated linseed is, however, still very common outside the field of operations of the Linseed Association.

The quantity of linseed imported into the United Kingdom during the year 1881 was 1,829,888 quarters, of a value of £4,595,051. About one-half of this amount, 927,059 quarters, valued at £2,249,877, came from the East Indies, and the imports from Russia, amounting to 728,953 quarters, valued at £1,664,720, account for the greater part of the remainder.

Linseed Oil, the most valuable and characteristic of the series of drying oils, is obtained by expression from the seeds, with or without the aid of heat. Preliminary to

the operation of pressing, the seeds are crushed between a pair of revolving rollers, and ground to a fine meal under heavy edge stones on a stone bed. For the extraction of the fine quality of oil known as cold-drawn the meal is, without further preparation, filled into woollen or canvas bags and enclosed in horse-hair envelopes for pressure, either in a Dutch mill worked by means of wedges and falling stampers or in a screw press, or, what is now more prevalent, in a special form of hydraulic press. The oil so obtained is of a clear yellow colour, and is comparatively devoid of odour and taste. The cake left by cold pressure is again ground up, heated in a steam kettle to about 212° Fahr., and while hot submitted to further pressure, which results in the exudation of a less pure oil of a brownish-yellow colour. In general practice, cold-drawn oil is little prepared; the linseed after grinding is submitted to a high heat, whereby the mucilage in the epidermis is destroyed, and the oil flows more freely; and in many crushing establishments the oil is obtained by a single operation under the press. The yield of oil from different classes of seed varies, but from 23 to 28 per cent. of the weight of the seed operated on should be obtained. A good average quality of seed weighing about 322 lb per quarter has been found in practice to give out 109 lb of oil.

Commercial linseed oil has a peculiar rather disagreeable sharp taste and smell; its specific gravity is given as varying from 0.928 to 0.963, and it does not solidify under the influence of very low temperature. It is soluble in 32 parts of alcohol, sp. gr. 0.82, in 6 parts of boiling alcohol, and in 1.6 of ether. By saponification it yields about 95 per cent. of fatty acids, principally linoleic acid ($C_{18}H_{32}O_2$), a body peculiar to the drying oils, and by treatment with oxide of lead about nine-tenths of the resulting lead salt is found to be linoleate of lead. The oil may be perfectly bleached by treatment with a solution of green sulphate of iron, with repeated shaking and exposure to the light for a period of four to six weeks. Exposed to the air in thin films, linseed oil absorbs oxygen and forms a resinous semi-elastic caoutchouc-like mass, oxynoleic acid, $C_{17}H_{30}O_2$. The oil, when boiled with small proportions of litharge and minium, undergoes the process of resinification in the air with greatly increased rapidity. Sacc found by boiling 2500 grains of raw oil for ten minutes with 30 grains each of litharge and minium, and weighing after twenty-four hours exposure to the atmosphere, that the oil had lost only 60 grains. A second sample he boiled till there was a loss of 5 per cent. in weight, when the product assumed the consistency of molasses; and a third portion boiled to a loss of 12 per cent. became a caoutchouc-like mass. The first of these products he found dried, on exposure, to a fine transparent varnish; the second did not resinify after fifteen days' exposure; and the atmosphere had no effect on the third portion. The weight of the film of the first after complete resinification was increased 50 per cent. through absorption of oxygen, and the rate at which absorption took place was much influenced by heat.

To these physical properties the varied industrial applications of linseed oil are principally due. Its most important use is certainly found in the preparation of oil paints and varnishes. By painters both raw and boiled oil are used, the latter not only forming the principal medium in oil painting, but also serving separately as the basis of all oil varnishes. Boiled oil is prepared in a variety of ways—that most common being by heating the raw oil in an iron or copper boiler, which, to allow for frothing, must only be about three-fourths filled. The boiler is heated by a furnace, and the oil is brought gradually to the point of ebullition, at which it is maintained for two hours, during which time moisture is driven off, and the sassa and froth which accumulate on the surface are led out. Then by slow degrees a proportion of "dryers" is added—usually equal weights of litharge and minium being used to the extent of 8 per cent. of the charge of oil; and with these a small proportion of amber is generally thrown in. After the addition of the dryers the boiling is continued two or three hours;

the fire is then suddenly withdrawn, and the oil is left covered up in the boiler for ten hours or more. Before sending out, it is usually stored in settling tanks for a few weeks, during which time the uncombined dryes settle at the bottom as "floats." Besides the dryes already mentioned, acetate of lead, beate of manganese, binucle of manganese, sulphate of zinc, and other bodies are used. The theory of the influence of boiling and of the addition of these bodies on lincos oil is not well understood. By lincos it was suggested that they simply removed the mangalicious and other foreign constituents of the oil which by their presence interrupted the action of oxygen, but by Chevalier and others the opinion was held that the chemicals used, by giving up oxygen to the oil, thereby induce a more rapid and energetic absorption from the air. However this may be, it does not appear at least that boiling is essential for the production of that active condition of the oil, as it may also be induced by treatment of cold raw oil with lead acetate and other agencies. Boiled oil is now very largely used in the manufacture of lincos floor-cloth. See LINCOS.

Lincos oil is also the principal ingredient in painting and lithographic inks. The oil for ink-making is prepared by heating it in an iron pot up to the point where it takes lincos fire spontaneously or can be ignited with any flaming substance. After the oil has been allowed to lincos for some time according to the consistency the warmth desired, the pot is covered over, and the product when cooled forms a viscid, tenacious substance which in its most concentrated form may be drawn into threads. By boiling this viscus with dilute nitric acid vapours of acrolein are given off, and the substance gradually becomes a solid non-adhesive mass the same as the ultimate oxidation product of both raw and boiled oil.

Lincos oil is subject to various falsifications, chiefly through the addition of cotton-seed, rape-seed, and hemp-seed oils, and iron oil and mineral oils also are not infrequently added. Except by smell, by change of specific gravity, and by determination of drying properties, these falsifications are difficult to detect. (J. F. A.)

LINUS is one of a numerous class of heroe figures in Greek legend, of which other examples may be found under HYACINTHUS, ADONIS. The connected legend is always of the same character: a beautiful youth, fond of hunting and rural life, the favourite of some god or goddess, suddenly perishes by a terrible death in spite of the heavenly love that would fain protect him. In some cases nothing is known to us with certainty beyond the mythological figure, but in many cases the religious background from which the legend stands out in relief has been preserved to us; in such cases we see that an annual ceremonial, everywhere of the same enthusiastic character, commemorated the legend. At Argos this religious character of the Linus myth was best preserved. The secret child of Psamathe by the god Apollo, Linus is exposed, nursed by sheep, and torn in pieces by the sheep-dogs. Every year in the festival *Amis* or *Cynophontis*, the women of Argos mourned for Linus and propitiated Apollo, who in revenge for his child's death had sent a plague on the Argive children. The grave of Linus, like that of Hyacinthus at Amyclae, was shown at Argos, at Thebes, at Chalcis, and probably at other places. The enthusiasm and *abandon* which characterized the similar festivals over Greece, Asia Minor, and Syria prove that it was part of the nature worship which spread in various forms by different roads and at different periods from the East into Greece. The songs of lamentation which accompanied the festival strongly impressed the Greeks, and it is most probable that the Phoenician words *as lena*, *as lena*, which formed the burden of the Adonis songs, originated the Greek words *Linus* and *Adonis*. The Linus song is frequently mentioned in Greek literature, Homer, *Il.*, xviii. 569, Pind., *Fr.* 139 (Bergk), &c., the tragic poets often use the word *Adonis* as the refrain in mournful songs, and Euripides calls the custom Phrygian (*Or.* 1380). In Phrygia the mythic correspondent of Linus is called *Lutyses*. There can be no doubt that Linus, Adonis, Menenius, Narcissus, &c., are personifications of the life and bloom of nature suddenly slain by the hot sun of summer, while with the religious mourning over the catastrophe of nature were intertwined the ideas of life in relation to death, of good and evil, and so on. The religious side of the Linus myth seems hardly to have

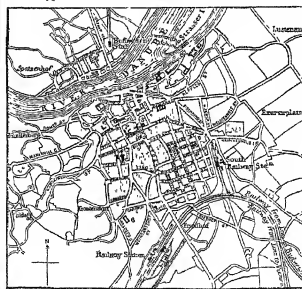
existed in Greece outside of Argos; in Thebes, which also was a chief home of the legend, Linus was a hero of song and music. In this form he has passed into literature, e.g., Virgil, *Ed.*, vi. 67. He is conceived as the inventor of musical methods, especially of the *Opispos*, a kind of lament; this idea was expanded in various ways, particularly by the Alexandrian poets, and finally he was, after the analogy of Musaeus, transformed into a composer of prophecies and legends.

See Duguchi, *Die Adonis Klage* und des Linos Lied, &c.

LINUS, one of the saints of the Gregorian canon, was, according to the *Breviarium Romanum*, the immediate successor of Peter in the see of Rome. He was a native of Volterra, who had attained a high degree of sanctity, and by his prevailing faith was able, not only to cast out devils, but to raise the dead. He wrote an account of the *res gestae* of Peter, especially of his controversy with Simon Magus.

He was beheaded by the orders of the ungrateful consul Saturninus, whose daughter he had freed from demonic possession, after a pontificate of eleven years two months and twenty-three days. The authorities for the statement that Linus was leaving Peter out of account, the earliest president of the Roman Church, are very early (Irenaeus, *Adv. Haer.*, iii. 3, 3; Euseb., *H. E.*, iii. 2, 13), and that these actually was a presbyter of that name may be gathered from 2 Tim. iv. 21. According to Tertullian, however (*De Praxico*, 32), Peter appointed Clement to be his successor. The genuineness of the alleged epitaph of Linus found in Rome is now no longer maintained, and the two books on the martyrdom of Peter and Paul, which pass under his name, must therefore be regarded as apocryphal and late.

LINZ, capital of Upper Austria, and see of a bishop, in 48° 19' N lat., 14° 16' E. long., lies upon the right bank of the Danube, 88 miles west of Vienna, at the junction of the Kaiserin-Elizabeth Western Railway with a line from Prague and Budweis. The market-town of Urfaulr, on the opposite side of the river, is connected with the city



by an iron bridge 700 feet in length, constructed in 1873. Linz possesses two cathedrals, one dating from 1670, and another, dedicated to the Immaculate Conception, commenced in 1802, and still unfinished, a Lutheran (1846) and several Roman Catholic churches, the new synagogue opened in 1877, and many religious houses. The old

Landeshaus, or House of the Estates (1562), the Bibliotheca Publica (1768), now (1832) containing 34,000 volumes, the Museum Francisco-Carolinum (1834), and a state theatre (1803) may also be noticed, with the episcopal and archiepiscopal palaces, and the castle now used as barracks. There are many educational establishments, including the theological diocesan lyceum, a new gymnasium and normal schools, and several hospitals and asylums. The principal manufactures are of tobacco (in 1880 employing 787 hands, and producing 23,266,000 cigars and 1850 tons of tobacco), and boot-varnish and blacking (2500 cwt.), the last chiefly exported to Hungary and Italy. Two breweries in 1881 produced 1,781,328 gallons of beer, and the other industries include iron-boat-building, and the manufacture of locomotives and agricultural implements. Trade and commerce are facilitated by the river. About forty-six thousand passengers embark or disembark at the steamboat landing stage, and the imports and exports there amount together to about 600,000 cwt. annually. There is a considerable traffic in woollen goods, carpets, linen fabrics, thread, prepared leather, iron wares, and salt. Cattle and meat markets are held twice a week. The Volkfest, a popular fair held generally every second September, is much resorted to by strangers. The surrounding country is highly picturesque. On the 31st December 1880 the population (exclusive of the garrison, 2799) was 36,116, or with the suburbs of Waldegg (1204) and Lustenau (1668) 38,888, chiefly Roman Catholics.

Linz is believed to stand on the site of the Roman station *Lentium* or *Lentia*. The authentic history of Linz cannot be traced further back than 799. In 1140 it was purchased from Gottschalk, count of Kyrburg, by Leopold IV., margrave of Austria, in 1524 it first received municipal rights, and in 1490 became the capital of the province above the Enns. Of various attacks which Linz from time to time successfully resisted the most notable was that by the insurgent peasants under Stephen Fadinger, 21st and 22d July 1626, when the suburbs were laid in ashes. As Linz (18th December 1645) peace was concluded between the emperor Ferdinand III. and the Transylvanian prince Rákóczy (see HUNGARY, vol. xii p. 370). During the siege of Vienna in 1688 the castle at Linz was the residence of Leopold I. The triple deliverance of Linz from fire, and pestilence was commemorated by Charles VI., in 1725, by the erection of a marble monument known as Trinity Column. In 1741, during the war of the Austrian succession, Linz was taken by the troops of the elector of Bavaria, but on the 23d January 1742 it was recovered by the Austrians. The bishopric was established by Pope Pius VI. in 1784. On the 15th of August 1800 many of the principal buildings were destroyed by fire. On the 17th May 1809 an Austrian force was defeated near the city in an engagement with Saxon and Wurtemberg troops. The chain of outlying forts, thirty-two in number, now abandoned, and to a great extent demolished, was constructed between 1823 and 1838 under the direction of Archduke Maximilian d'Este. A general assembly of the Catholic Union for Germany was held here 24th to 26th September 1850. Tramways were introduced in 1880, and a new line of railway through the Kremsthal was completed as far as Kremsmünster in 1881.

See the anonymous *Führer auf der Kremsthalbahn, mit Beschreibung von Linz, Linz, 1881*, the *Statistische Bericht über Österreich von Linz, 1881*, vol. ii p. 248-253; the official *Ergebnisse über die Volkszählung in Linz, Linz, 1881*; F. Kerschbamer, *Die Geschichte von Linz, Linz, 1876*, and G. H. Helm, *Linz und seine Umgebungen*, 2d ed., Linz, 1888.

LION. From the earliest historic times few animals have been better known to man than the lion. Its geographical habitat made it familiar to all the races among whom human civilization took its origin, and its strongly marked physical and moral characteristics have rendered it proverbial, perhaps to an exaggerated degree, and have in all ages afforded favourite types for poetry, art, and heraldry.

The literature of the ancient Hebrews abounds in allusions to the lion; and the almost incredible numbers that are stated to have been provided for exhibition and destruction in the Roman amphitheatres (as many as six hundred on a single occasion by Pompey, for example) show how abundant these animals must have been within accessible distance of the capital of the world.

The geographical range of the lion was once far more extensive than at present, even within the historic period covering the whole of Africa, the south of Asia, including Syria, Arabia, Asia Minor, Persia, and the greater part of northern and central Hindustan, and also the south-eastern portion of Europe, as shown by the well-known story told by Herodotus of the attacks by lions on the camels which carried the baggage of the army of Xerxes on its march through the country of the Thracians in Macedonia. The very circumstantial account of Herodotus shows that the animal at that time ranged through the country south of the Balkans, through Roumania to the west of the river Caran, and through Thessaly as far south as the Gulf of Lepanto and the Isthmus of Corinth, having as its western boundary the river Potamo and the Pindus mountains. The whole of the evidence relating to the existence of lions in Europe, and to their retreat from that continent shortly before the commencement of the Christian era, has been collected in the article on "*Felis spelæa*" in Boyd Dawkins and Sanford's *British Pleistocene Mammalia*, 1868. Fossil remains attest a still wider range, as it is shown in the same work that there is absolutely no osteological or dental character by which the well-known cave lion (*Felis spelæa* of Goldfuss), so abundantly found in cave deposits of the Pleistocene age, can be distinguished from the existing *Felis leo*. There are also remains found in North America of an animal named *Felis atrox* by Leidy, which the paleontologists just quoted attribute to the common lion; but, as they are very fragmentary, and as the specific characters by which most of the *Felidae* are distinguished are more dependent on external than on anatomical conformation, this determination cannot be so absolutely relied upon.

At the present day the lion is found in localities suitable to its habits, and where not exterminated (as it probably was in Europe) by the encroachments of man, throughout Africa from Algeria to the Cape Colony, and in Mesopotamia, Persia, and some parts of the north-west of India. According to Blanford, lions are still very numerous in the reedy swamps bordering the Tigris and Euphrates, and also occur on the west flanks of the Zagros mountains and the oak-od ranges near Shiraz, to which they are attracted by the immense herds of swine which feed on the acorns. The lion nowhere exists in the table-land of Persia, nor is it found in Baluchistan. In India it appears now to be confined to the province of Kathiawar in Gujerat, though within the present century its range extended through the north-west parts of Hindustan, from Bahawalpur and Sind to at least the Jumna (about Delhi), southward as far as Khândesh, and in Central India through the Sagur and Nerbudda territories, Bundelkhand, and as far east as Palamau. It was extirpated in Harijána about 1824. One was killed at Rhyli, in the Dumah district, Sagur and Nerbudda territories, so late as in the cold season of 1847-48; and about the same time a few still remained in the valley of the Sind river in Kotah, Central India (Blyth).

The great variations in external characters which different lions present, especially in the colour and the amount of mane, has given rise to the idea that there are several species, or at all events distinct varieties peculiar to different localities. It was at one time supposed, on the authority of Captain Walter Smee,² that the lion of Gujerat differed essentially from that of Africa in the absence of mane, but subsequent evidence has not supported this view, which was probably founded upon young specimens having been mistaken for adults. Lions from that district as well as from Babylonia, which have lived in the gardens of the London Zoological Society, have had as

¹ *Zoology and Geology of Eastern Persia*, 1876.

² *Transactions of the Zoological Society*, vol. i. p. 135, 1838.

fully developed manes as any other of the species. Mr F C Selous¹ has shown that in South Africa the so-called black-maned lion and others with yellow scanty manes are found, not only in the same locality, but even among individuals of the same parentage.

The lion belongs to the very natural and distinctly defined group constituting the genus *Felis* of Linnæus (for the characters and position of which see article MAMMALIA), a genus held by Pallas and other philosophical naturalists as a model of what a genus ought to be, although recent writers have divided and subdivided it into as many as thirteen sections, on each of which a new generic term has been imposed. Among these sections is one containing the largest members of the group, and differing from the others in the well-marked anatomical character that the anterior cornu of the hyoid arch is but little ossified, and by the less important one that the pupil of the eye when contracted is a circular hole, instead of a vertical slit as in the cat. The lion agrees with the tiger and the leopard in these respects, but differs from them in its uniform style of colouring, and from all the other *Felids* in the arrangement of its hairy covering, the hair of the top of the head, chin, and neck, as far back as the shoulder, being not only very much longer, but also differently disposed from the hair elsewhere, being erect or directed forwards, and so constituting the characteristic ornament called the mane. There is also a tuft of elongated hairs at the end of the tail, one upon each elbow, and in most lions a copious fringe along the

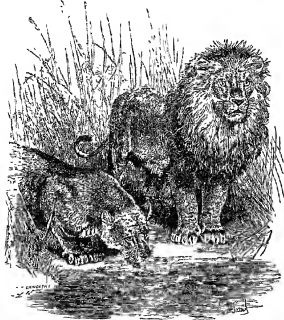


FIG 1—Lion and Lioness, after a Drawing by Wolf in Elliot's Monograph of the *Felids*

middle line of the under surface of the body, wanting, however, in some examples.² It must, however, be observed that these characters are peculiar to the adults of the male sex only, and that, even as regards their coloration, young lions show indications of the darker stripes and mottlings so characteristic of the greater number of the members of the genus, just as the young of nearly all the

plain-coloured species of deer show for a time the light-coloured spots which are met with in the adults of only some of the species. The usual colour of the adult lion is yellowish-brown, but it may vary from a deep red or chestnut brown to an almost silvery grey. The mane, as well as the long hair of the other parts of the body, sometimes scarcely differs from the general colour, but it is usually darker and not unfrequently nearly black. The mane begins to grow when the animal is about three years old, and is fully developed at five or six.

In size the lion is only equalled or exceeded by the tiger among the existing *Felids*, though both species present great variations, the largest specimens of the latter appear to surpass the largest lions. A full-sized South African lion, according to Selous, measures slightly less than 10 feet from nose to tip of tail, following the curves of the body. Haris gives 10 feet 6 inches, of which the tail occupies 3 feet. The lioness is about a foot less.

The internal structure of the lion, except in slight details, resembles that of the other *Felids*, the whole organization being that of an animal modified to fulfil, in the most perfect degree yet attained, an active, predaceous mode of existence. The teeth especially exemplify the carnivorous

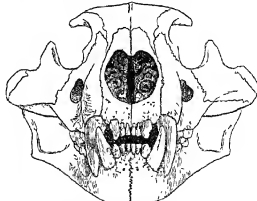


FIG 2—Front View of Skull of Lion

type in its highest condition of development. The most important function they have to perform, that of seizing and holding firmly animals of considerable size and strength, violently struggling for life, is provided for by the great, sharp-pointed, and sharp-edged canines, placed wide apart at the angles of the mouth, the incisors between them being greatly reduced in size and kept back nearly to the same level, so as not to interfere with their action. The jaws are short and strong, and the width of the zygomatic arches, and great development of the bony ridges on the skull, give ample space for the attachment of the powerful muscles by which they are closed. In the molar series of teeth the sectorial or scissor-like cutting function is developed at the expense of the tubercular or grinding, there being only one rudimentary tooth of the latter form in the upper jaw, and none in the lower. They are, however, sufficiently strong to break bones of large size. The dental formula is expressed as follows—incisors 3, canines 1, premolars 3, molars 4 = 16; total, 30. The tongue is long and flat, and remarkable for the development of the papillæ of the anterior part of the dorsal surface, which (except near the edge) are modified so as to resemble long, compressed, recurved, horny spines or claws, which, near the middle line, attain the length of one-fifth of an inch. They give the part of the tongue on which they occur the appearance and feel of a coarse rasp, and serve the purpose of such an instrument in cleaning the flesh from the bones of the animals on which the lion feeds. The vertebral

¹ A Hunter's Wanderings in Africa, 1881, p. 256.

² Mr Selous, whose opportunities for obtaining evidence upon this subject were very large, says that in the region of South Africa, between the Zambezi and the Limpopo rivers, he never saw a lion with any long hair under the body, and that the manes of the wild lions of this district are far inferior in development to those commonly seen in menageries in Europe.

column is composed of seven cervical, thirteen dorsal, seven lumbar, three sacral, and about twenty-six caudal vertebrae. The clavicles are about 3 inches in length, embedded loosely in the muscles, and not directly connected either with the sternum or the scapula. The limbs are digitigrade, the animal resting upon round soft pads or cushions covered with thick, naked skin, one on the under surface of each of the principal toes, and one larger one of trilobed form, behind these, under the lower ends of the metacarpal and metatarsal bones, which are placed nearly vertically in ordinary progression. The fore feet have five toes, of which the third and fourth are nearly equal and longest, the second being slightly and the fifth considerably shorter. The first or pollex (corresponding to the human thumb) is much shorter than the others, and does not reach to the ground in walking. The hind feet have only four toes, the third and fourth being the longest, the second and fifth somewhat shorter and nearly equal. The first or hallux (or great toe) is represented only by a rudimentary metatarsal bone. The claws are all very large, strongly compressed, very sharp, and exhibit the retractile condition in the highest degree, being drawn backwards and upwards into a cutaneous sheath by the action of an elastic ligament so long as the foot is in a state of repose, but exerted by muscular action when the animal strikes its prey. By this remarkable piece of animal mechanism their edges and points are always kept sharp and un worn.

The habits of the lion in a state of nature are fairly well known from the united observations of numerous travellers and sportsmen who have explored those districts of the African continent in which it is still common. It lives chiefly in sandy plains and rocky places interspersed with dense thorn-thickets, or frequents the low bushes and tall rank grass and reeds that grow along the sides of streams and near the springs where it lies in wait for the larger herbivorous animals on which it feeds. Although it is occasionally seen abroad during the day, especially in wild and desolate regions, where it is subject to but little molestation, the night is, as in the case of so many other predaceous animals, the period of its greatest activity. It is then that its characteristic roar is chiefly heard, as thus graphically described by Gordon Cumming:—

"One of the most striking tones connected with the lion is his voice, which is extremely grand and peculiarly striking. It consists at times of a low deep moaning, repeated five or six times, ending in faintly audible sighs; at other times he startles the forest with loud, deep-toned, solemn roars, repeated in quick succession, each increasing in loudness to the third or fourth, when his voice dies away in five or six low muffled sounds very much resembling distant thunder. At times, and not infrequently, a troop may be heard, roaring in concert, one assuming the lead, and two, three, or four more regularly taking up their parts, like persons singing a catch. Like our Scottish stag at the rutting season, they roar loudest in cold frosty nights; but on no occasions are their voices to be heard in such perfection, or so intensely powerful, as when two or three troops of strange lions approach a fountain to drink at the same time. When this occurs, every member of each troop sounds a bold roar of defiance at the opposite parties, and when one roars, all roar together, and each seems to vie with his comrades in the intensity and power of his voice. The power and grandeur of these nocturnal concerts is inconceivably striking and pleasing to the hunter's ear."

"The usual pace of a lion," C. J. Andersson¹ says, "is a walk, and, though apparently rather slow, yet, from the great length of his body, he is able to get over a good deal of ground in a short time. Occasionally he trots, when his speed is not inconsiderable. His gallop—or rather succession of bounds—is, for a short distance, very fast,—nearly or quite equal to that of a horse. Indeed, unless the steed has somewhat the start when the beast charges, it will be puzzled to escape. Many instances are on record of horsemen who have incautiously approached too near to

the lion, prior to firing, who have been pulled down by him before they could get out of harm's way. Happily, however, the beast soon tires of the exertion of galloping, and unless his first succeeds he, for the most part, soon halts and beats a retreat." "The lion, as with other members of the feline family," the same writer tells us, "seldom attacks his prey openly, unless compelled by extreme hunger. For the most part he steals upon it in the manner of a cat, or ambushes himself near to the water, or a pathway frequented by game. At such times he lies crouched upon his belly in a thicket until the animal approaches sufficiently near, when, with one prodigious bound, he pounces upon it. In most cases he is successful, but should his intended victim escape, as at times happens, from his having miscalculated the distance, he may make a second or even a third bound, which, however, usually prove fruitless, or he returns disconcerted to his hiding-place, there to wait for another opportunity." His food consists of all the larger herbivorous animals of the country in which he resides,—buffaloes, various kinds of antelopes, zebras, giraffes, or even young elephants or rhinoceroses, though the adults of these latter he dare not attack. In cultivated districts the cattle, sheep, and even human inhabitants are never safe from his nocturnal ravages. He appears, however, as a general rule, only to kill when hungry or attacked, and not for the mere pleasure of killing, as with some other carnivorous animals. He, moreover, by no means limits himself to animals of his own kind, but, according to Selous, often prefers eating game that has been killed by man, even when not very fresh, to taking the trouble to catch an animal himself. All books of African travel and sport abound with stories, many of which are apparently well authenticated, of the lion's prodigious strength, as exemplified by his being able to drag off a whole ox in his mouth to a long distance, even leaping fences and dykes with it.

The lion appears to be monogamous, a single male and female continuing attached to each other irrespectively of the pairing season. At all events the lion remains with the lioness while the cubs are young and helpless, and assists in providing her and them with food, and in educating them in the art of providing for themselves. The number of cubs at a birth is from two to four, usually three. They are said to remain with their parents till they are about three years old. The following account by an eyewitness gives a good idea of lion family life:—

"I once had the pleasure of, unobserved myself, watching a lion family feeding. I was encamped on the Black Umfolosi in Zululand, and towards evening, walking out, about half a mile from camp, I saw a herd of zebra galloping across me, and when they were nearly 200 yards off, I saw a yellow body flash towards the leader, and saw him fall beneath the lion's weight. There was a tall tree about 60 yards from the place, and anxious to see what went on, I stalked up to it, while the lion was still too much occupied to look about him, and climbed up. By this time quite killed the beautifully striped animal, but instead of proceeding to eat it, he got up and roared vigorously, until there was an answer, and in a few minutes a lioness, accompanied by four whelps, came trotting up from the same direction as the zebra, which no doubt she had been to drive towards her husband. They formed a fine picture, as they all stood round the carcass, the whelps tearing it and biting it, but unable to get through the tough skin. Then the lion lay down, and the lioness driving her offspring before her did the same 4 or 5 yards off, upon which he got up, and commencing to eat, had soon finished a hind-leg, retiring a few yards on one side as soon as he had done so. The lioness came up next and tore the carcass to shreds, bolting huge mouthfuls, but not objecting to the whelps eating as much as they could find. There was a good deal of snarling and growling among these young lions, and occasionally a stand-up fight for a minute, but their mother did not take any notice of them, except to give them a smart blow with her paw if they got in her way. . . . There was now little left of the zebra but a few bones, which hun-

¹ *The Lion and the Elephant*, 1878, p. 19.

² Hon. W. H. Drummond, *The Large Game and Natural History of South and South-East Africa*, 1875, p. 278.

died of vultures were circling round waiting to pick, while almost an equal number hopped awkwardly about on the ground within 50 or 60 yards of it, and the whole lion family walked quietly away, the lioness leading, and the lion, often turning his head to see that they were not followed, bringing up the rear.

Though not strictly gregarious, lions appear to be sociable towards their own species, and often are found in small troops, sometimes consisting of a pair of old lions, with their nearly full-grown cubs, but occasionally of adults of the same sex; and there seems to be good evidence that several lions will associate together for the purpose of hunting upon a preconceived plan. As might be supposed, their natural ferocity and powerful armature are sometimes turned upon one another, combats, often mortal, occur among male lions under the influence of jealousy; and Andersson relates an instance of a quarrel between a hungry lion and lioness over the carcase of an antelope which they had just killed, and which did not seem sufficient for the appetite of both, ending in the lion not only killing, but even devouring his mate. Old lions, whose teeth have become injured with constant wear, often become "man-eaters," finding their easiest means of obtaining a subsistence in lurking in the neighbourhood of villages, and dashing into the tents at night and carrying off one of the sleeping inmates. Lions differ from most of the smaller *Felida* in never climbing trees, indeed, as mentioned before, they are rarely found in forests.

With regard to the character of the lion, those who have had opportunities of observing it in its native haunts differ greatly. The exaggerated accounts of early writers as to its courage, nobility, and magnanimity have led to a reaction, which causes some modern authors to speak of it in language quite the reverse, and to accuse it of positive cowardice and all kinds of meanness. Livingstone goes so far as to say, "nothing that I ever learned of the lion could lead me to attribute to it either the ferocious or noble character ascribed to it elsewhere," and he adds that its roar is not distinguishable from that of the ostrich. Of course these different estimates depend to a great extent upon the particular standard of the writer, and also upon the circumstances that lions, like other animals, undoubtedly show considerable individual differences in character, and behave differently under varying circumstances. They are certainly not so reckless as to be entirely devoid of the instinct of self-preservation, and if one, perhaps satiated with a good meal the night before, unexpectedly disturbed in the day time, will occasionally retreat when confronted, even by an unarmed man, that is scarcely a reason for assigning cowardice as one of the characteristics of the species. The latest authority, Selous, while never denying the daring courage of the lion when hungry or provoked, and vindicating the awe-inspiring character of the roar of several lions in unison, when heard at close quarters, as the grandest sound in nature, says with regard to its outward aspect:—

"It has always appeared to me that the word 'majestic' is singularly inapplicable to the lion in its wild state, as when seen by daylight he always has a stealthy furtive look that entirely does away with the idea of majesty. To look majestic a lion should hold his head high. Thus he seldom does. When walking he holds it low, lower than the line of his back, and it is only when he first becomes aware of the presence of man that he sometimes raises his head and takes a look at the intruder, usually lowering it immediately, and trotting away with a growl. When at bay, standing with open mouth and glaring eyes, holding his head low between his shoulders, and keeping up a continuous low growling, twitching his tail the while from side to side, no animal can look more unpleasant than a lion, but there is then nothing majestic or noble in his appearance."

Notwithstanding this evidently truthful description of the animal when seen under what may be called unfavourable circumstances, no one with an eye for beauty can contemplate the form of a fine specimen of a lion, at all

events in a state of repose, even though in the confinement of a menagerie, without being impressed with the feeling that it is a grand and noble-looking animal. (W. H. F.)

LIPARI ISLANDS. These islands, which take their name from the largest and most populous member of the group, are situated to the north of the eastern half of Sicily, between 38° 20' and 38° 55' N. lat., and 14° 15' and 15° 15' E. long. The seven principal islands are Lipari, Salina, Vulcano, Stromboli, Panara, Filicudi, and Alicudi; besides which there are ten islets, some of them mere rocks, the remains of a great central volcano now submerged. The total population of the islands in 1871 was 18,400, and the area is less than 50 square miles. They were known to the ancients as the *Hephestiades* or *Vulcani insulae*, from their supposed connexion with Vulcan, the *Liparenæ*, from their mythical king Lipara, and the *Æolus insulae*, from Æolus, who was said to have married the daughter of Lipara, and to have succeeded to the kingdom. Lipara, the chief island, was colonized in the 6th century B.C. by Onidians and Rhodians, who rapidly spread to the adjacent islands of Hiera and Didyma. The new settlers maintained their independence in spite of the attacks of the Tyrrhenian pirates, but they later became subject successively to the Athenians, Carthaginians, and Romans. In the Middle Ages the Saracens took possession of the islands, but they were expelled by the Normans in the 11th century. Finally Ferdinand the Catholic annexed them to Sicily.

Lipari has an area of about 11 square miles, with a population of 12,000. It is mountainous in character, and consists of tuffs and lavas, and of highly siliceous volcanic products such as quartz-trachyte, pumice, and obsidian. The great central cone, Monte Sant' Angelo (1952 feet), is the ruin of an extinct volcano, as is also Monte Chirica (1978 feet), while Campo Bianco or Monte Pelato (1500 feet) is a mountain of white pumice, breached by an outflow of vitreous lava. Hot springs exist in various parts of the island, the most important being those of San Calogero, mentioned by Diodorus Siculus, and situated about 6 miles from the town. The water, which possesses a temperature of 198° Fahr., contains free carbonic acid and sulphuretted hydrogen, together with carbonates of calcium and magnesium, and chlorides of calcium and sodium. The chief town, which stands on the eastern point of the island, is quite modern, and contains no objects of interest. The cathedral and several other churches are within the precincts of the castle, and they are presided over by a bishop and thirty-two canons. The castle is used as a prison for some four hundred malefactors, sent from various parts of Italy. The island is governed by a delegate, subject to the prefect of Messina. The soil is fertile, and a considerable trade is carried on by a number of merchants who export currants, figs, pumice stone, and malmsey wine. Water is scarce owing to the great porosity of the soil.

Six miles to the south of Lipari is the island of Vulcano, anciently known as *Hiera*, *Vulcania*, and *Thersia*. In early times it was a very active volcano; and it is described by Thucydides, Aristotle, and Callias as being frequently in a state of violent eruption. In the 3d century B.C. the smaller island of Vulcanoello was upheaved from the sea. The present crater was probably formed during the eruption of 1786, from which time the volcano remained in a quiescent state till the autumn of 1873, when it commenced to discharge clouds of vapour, showers of sand, and large stones. Blue and green flames were also seen to issue from rifts in the floor of the crater. When visited by the writer in 1879, the volcano had again relapsed into the solfatare stage, and it had recently been purchased by a Scotch firm for £8000, for the purpose of extracting alum, boracic

acid, and sulphur from the numerous products which line the sides and cover the floor of the crater. A number of volcanic minerals have been obtained from Vulcano; the most remarkable perhaps was that lately analysed by Professor Cosca of Turin, which was found to contain seven non-metallic elements and eight metals, among them the rare bodies thallium, cesium, and rubidium. The highest point of Vulcano—a portion of the old crater ring—has an altitude of 1601 feet.

A little more than 20 miles to the north-north-east of Lipari, the cone of Stromboli rises from the sea to a height of 3022 feet. It is of special interest to the vulcanologist from the fact that it is the only example in Europe of a volcano in a state of constant activity, and also because, from an elevated point above the crater (which is at the side of the cone below the summit), it is possible, when the wind blows away from the observer, to sit for hours and watch the operations going on within the crater. Such observations, carried out in 1783 by Spallanzani, made him the father of modern vulcanology, and furnished some of the most important data upon which the science is founded. The mountain is mentioned as early as the 4th century A.C.

Between Stromboli and Lipari there is a group of islets representing portions of the crater ring of a great volcano, the largest of which, *Panara (Fisera)*, is 7 miles in circuit, and contains about 200 inhabitants. It produces wheat, oil, and wine. *Salina (Diaplia)*, 3 miles to the north-west of Lipari, has an area of 10 square miles, and consists of two volcanic cones rising respectively to the height of 3185 and 2821 feet. The island contains nearly 6000 inhabitants, who are mainly employed in cultivating the vines, which produce a fine malvasia wine. The cone of *Pilichou* rises to a height of 2698 feet, some 10 miles to the west of Salina, while at an equal distance further west is *Alonchi*, the most westerly member of the Lipari group. It is partly cultivated, and is inhabited by about 500 fishermen and shepherds.

Good maps of the Lipari Islands have been published by the Italian Government. The best general account of the islands is still that of Admiral Smyth (*Italy and its Islands*, 1824), while Professor J. W. Judd has exhaustively discussed their geology in the pages of the *Geological Magazine* for 1876. (G. F. R.)

LIPETSK, a district town of Russia, in the government of Tamboff, 95 miles west of the chief town of the government, and 23 miles north-west of Gryazi railway junction, at the confluence of Lyssnoy Voronezh and Lipovka rivers. The town is built of wood, and the streets are unpaved, but it is a commercial centre of some importance. There are several beetroot-sugar and leather works, tallow melting houses, and distilleries. There is a brisk business at the weekly fairs, and the merchants carry on active trade in horses, cattle, tallow, skins, and honey, sent by rail to the northern provinces, and in timber, shipped down to the province of the Don Cossacks. The Lipetsk mineral springs came into repute in the time of Peter I., who caused them to be surrounded by galleries, and laid down three gardens; they continue to attract visitors during the summer. Lipetsk received municipal institutions in 1779. Population 14,500.

LIPPE is the name of a territory in north-western Germany, now divided into two small sovereign principalities, but formerly united under the same ruler. The name is derived from the river Lippe, which rises in the Teutoburgian Forest, and flows into the Rhine at Wesel.

LIPPE proper, also called **LIPPE-DIEMOLD**, is bounded on three sides by the Prussian province of Westphalia, and on the E. and N.E. by Hanover, Pyrmont, and Hesse-Cassel. It also possesses three small enclaves in Westphalia. Its area is about 450 square miles. The greater part of the surface is mountainous, especially towards the south, where it is intersected by the Teutoburgian Forest. The chief rivers are the Weser, which crosses the north extremity of the principality, and its affluents the Werre, Exter, Kalle, and Emmer. The forests of Lippe are among the finest in Germany, and

produce abundance of excellent timber. The valleys contain a considerable amount of good arable land, the tillage of which occupies the greater part of the inhabitants. The principal crops are corn, flax, and rape. Cattle, sheep, and swine are also reared, and the "Sennar" breed of horses is celebrated. The industries of Lippe are almost confined to a little yarn-spinning and linen-weaving. Its trade is also considerable; but, besides agricultural products, timber, meerscham pipes, and starch are exported. The brine springs of Salzdalen produce about 1500 tons of salt annually. In 1880 the population amounted to 120,216 souls, upwards of 95 per cent. of whom were Calvinists (Reformed Church), the remainder being Lutherans, Roman Catholics, and Jews. Education is provided for by two gymnasia and numerous other efficient schools. The principality contains seven small towns, the chief of which are Detmold, the seat of government, and Lemgo. The present constitution was granted in 1836, and is modified by a new election law of 1876. It provides for a representative chamber of twenty-one members, whose functions are mainly consultative. For electoral purposes the population is divided into three classes, rated according to taxation, each of which returns seven members. The estimated revenue in 1881 was £49,200, and the expenditure £50,850. The public debt amounts to nearly £60,000. Lippe has one vote in the German Reichstag, and also one vote in the Federal Council. Its military forces form a battalion of the 6th Westphalian infantry.

II. SCHAUMBURG-LIPPE, or LIPPE-BUCKEBURG, to the north of Lippe-Detmold, consists of the western half of the old county of Schaumburg, and is surrounded by Westphalia, Hanover, and the Prussian part of Schaumburg. The northern extremity of the principality, which is 175 square miles in extent, is occupied by a lake named the Steinhuder Meer. The southern part is mountainous, but the remainder consists of a fertile plain, producing abundant crops of cereals and flax. Besides husbandry, the inhabitants practise yarn spinning and linen-weaving, and the coal-mines of the Buckeburg, on the south-eastern border, are very productive. The great bulk of the population, which in 1880 amounted to 85,374, are Lutherans. The capital is Buckeburg, and Stadthagen is the only other town. Under the constitution of 1868 there is a legislative diet of fifteen members, ten of whom are elected by the towns and rural districts and three by the nobility, clergy, and educated classes, while the remaining two are nominated by the prince. Schaumburg-Lippe sends one deputy to the Federal Council, and has one vote in the Reichstag. It contributes a battalion of riflemen to the imperial army. The budget of 1881-82 showed an estimated revenue of £25,750, which was balanced by the expenditure. The public debt is about £18,000.

History—The district now named Lippe was inhabited in the earliest times of which we have any record by the Cherusci, whose leader Arminius annihilated the legions of Varus in the Teutoburgian Forest (A.D. 9). It was afterwards occupied by the Saxons, and was subdued by Charlemagne. The founder of the present reigning family, one of the most ancient in Germany, was Bernard I. (1129-58), who received a grant of the territory, till then called the county of Haholt, from the emperor Lothar, and assumed the title of lord of Lippe. Bernard VIII., who with his people embraced the tenets of the Reformation in 1556, was the first to style himself count of Lippe. In 1613 Lippe was divided among the three sons of Simon VI., the lines formed by two of whom still exist, while the third (Buke) became extinct in 1709.

Lippe-Detmold was the patrimony of the eldest son, whose descendants became princes of the empire in 1786. In 1809 it joined the Confederation of the Rhine, and in 1813 the German Confederation. Under the present government of the Princess Pauline (1807-20) the little country enjoyed great prosperity. Her son, Paul Alexander Leopold, ruled in the same spirit, and in 1886 granted the charter of rights on which the government is now based. In 1843 Lippe entered the German Customs Union

(Zollverein), and in 1806 it threw in its lot with Prussia and joined the North German Confederation.

Philip, the youngest son of Simon VI (see above), received but a scanty share of his father's possessions, but in 1640 he inherited a large part of the countship of Schaumburg, including Bückeburg, and adopted the title of count of Schaumburg-Lippe. The ruler of this territory became a sovereign prince in 1807. In 1866 the prince at first sided with Austria, but afterwards entered the German Confederation.

For further information consult Falkmann, *Beitrag zur Geschichte des Fürstentums Lippe, 1849*; Schickhaus, *Das Fürstentum Lippe-Deimold in geo-graphischer, statistischer, und geschichtlicher Beziehung, 1856*; *Erinnerungen aus dem Leben der Fürstin Pauline*; in *Sybil's Historische Zeitschrift* (H. 1861).

LIPPI, the name of three celebrated Italian painters.

L. FRA FILIPPO LIPPI (1412-1469), commonly called Lippo Lippi, one of the most celebrated painters of the Italian quattrocento, was born in Florence, — his father, Tommaso, being a butcher. His mother died in his earliest infancy, and his father two years later. His aunt, a poor woman named Monna Lapaccia, then took charge of him; and in 1420, when only eight years of age, he was registered in the community of the Carmelite friars of the Carmine in Florence. Here he remained till 1432, and his early faculty for fine art was probably developed by studying from the works of Masaccio in the neighbouring chapel of the Brancacci. Between 1430 and 1432 he executed some works in the monastery, which were destroyed by a fire in 1771; they are specified by Vasari, and one of them was particularly marked by its resemblance to Masaccio's style. Eventually Fra Filippo quitted his convent, but it appears that he was not relieved from some sort of religious vow; there is a letter of his, dated in 1439, in which he speaks of himself as the poorest friar of Florence, and says he is charged with the maintenance of six marriageable nieces. In 1452 he was appointed chaplain to the convent of S. Giovanni in Florence, and in 1457 rector (*Rettore Commendatario*) of S. Quirico at Legnana, and his gains were considerable, and even uncommonly large from time to time; but his poverty seems to have been chronic none the less, the money being spent, according to one account, in frequently recurring amours.

Vasari relates some curious and romantic adventures of Fra Filippo, which modern biographers are not inclined to believe. Except through Vasari, nothing whatever is known of his visits to Ancona and Naples, and his intermediate capture by Barbary pirates and enslavement in Barbary, whence his skill in portrait-sketching availed to release him. The doubts thrown upon his semi-marital relations with a Florentine lady appear, however, to be somewhat arbitrary; Vasari's account is circumstantial, and in itself not greatly improbable, and to say that he is the sole authority for the facts goes but a small way towards invalidating them. Towards June 1456 Fra Filippo was settled in Prato (near Florence) for the purpose of fulfilling an important commission which had been given him to paint frescoes in the choir of the cathedral. Before actually undertaking this work he set about painting, in 1458, a picture for the convent chapel of St Margaret of Prato, and there saw Lucrezia Buti, the beautiful daughter of a Florentine, Francesco Buti; she was either a novice or a young lady placed under the nuns' guardianship. Lippi asked that she might be permitted to sit to him for the figure of the Madonna; he made passionate love to her, abducted her to his own house, and kept her there spite of the utmost efforts the nuns could make to reclaim her. The fruit of their loves was a boy, who became the painter, not less celebrated than his father, Filippino Lippi (noticed below). Such is substantially Vasari's narrative, published less than a century after the alleged events; it is not refuted by saying, more than three centuries later, that perhaps Lippo had nothing to do with any such Lucrezia, and perhaps Filippino was his adopted son, or only an ordinary relative, and scholar. The argument that two reputed portraits of Lucrezia in

paintings by Lippo, one as a Madonna in a very fine picture in the Pitti gallery, and the other in the same character in a Nativity in the Louvre, are not alike comes to very little; and it is reduced to nothing when the disputant adds that the Louvre painting is probably not done by Lippi at all. This painting comes, however, from St Margaret's at Prato, and is generally considered to be the very one on which Vasari's story hinges.

The frescos in the choir of Prato cathedral, being the stories of the Baptism and of St Stephen, represented on the two opposite wall spaces, are the most important and monumental works which Fra Filippo has left, more especially the last of the series, showing the ceremonial mourning over Stephen's corpse. This contains a portrait of the painter, but which is the proper figure is a question that has raised some diversity of opinion. Some of the subjects are legendary, as, for instance, the attempt of the devil to substitute a changeling for the infant protomartyr. At the end wall of the choir are S. Giovanni Gualberto and S. Albert, and on the ceiling the four evangelists.

The close of Lippi's life was spent at Spoleto, where he had been commissioned to paint, for the apse of the cathedral, some scenes from the life of the Virgin. In the semidome of the apse is Christ crowning the Madonna, with angels, sibyls, and prophets. This series, which is not wholly equal to the one at Prato, was completed by Fra Diamante after Lippi's death.

That Lippi died in Spoleto, on or about 8th October 1469, is an undoubted fact; the mode of his death is again a matter of dispute. It has been said that the pope granted Lippi a dispensation for marrying Lucrezia, but that, before the permission arrived, he had been poisoned by the indignant relatives either of Lucrezia herself, or of some lady who had replaced her in the inconstant painter's affections. This is now generally regarded as a fable; and it may very well be such, although the incident does not present any intrinsic improbability in relation to the Italy of the 15th century. Fra Filippo lies buried in Spoleto, with a monument erected to him by Lorenzo the Magnificent; he had always been zealously patronized by the Medici family, beginning with Cosmo Pater Patriæ. Francesco di Pesello (called Pesellino) and Sandro Botticelli were among his most distinguished pupils.

Some leading pictures by Lippi not already mentioned are the following. In 1461 he painted an altarpiece for the nuns of S. Ambrogio which is now a prominent attraction in the Accademia of Florence, and has been celebrated in Browning's well-known poem. It represents the Coronation of the Virgin among angels and saints, of whom many are Bernardino monks. One of these, placed to the right, is a half-length portrait of Lippi, pointed out by an inscription upon an angel's scroll "In periclit quæ." The price paid for this work in 1467 was 1200 Florentine lire, which seems surprisingly even unaccountably large. For Geminiano Ligurinus of Prato he painted the death of St Bernard, a fine specimen still extant. His principal altarpiece in this city is a Nativity in the refectory of S. Domenico, — the Infant on the ground adored by the Virgin and Joseph, between Sts George and Dominic, in a rocky landscape, with the shepherds playing and six angels in the sky. In the Uffizi is a fine Virgin adoring the infant Christ, who is held by two angels, in the London National Gallery, a Vision of St Bernard. The picture of the Virgin and Infant with an Angel, in this same gallery, also ascribed to Lippi, is disputable.

Few pictures are so thoroughly enjoyable as those of Lippo Lippi: they show the maturity of a strong rich nature, redundant in lively and unrefined whimsical observation. He approaches religious art from its human side, and is not pictorial though true to a phase of Catholic devotion. He was perhaps the greatest colourist and technical adept of his time, with good draughtsmanship, — a naturalist, with less vulgar realism than some of his contemporaries, and with much genuine epical animation, mingling semi-humorous incidents and low characters. His noble little effort after perspective and some of his foreshortenings, was fond of ornamenting pilasters and other architectural features. Vasari says that Lippi was wont to hide the extremities in drapery, to evade difficulties. His career was one of continual development, without fundamental variation in style or in colouring. In his great works the proportions are larger than life.

II. FILIPPINO or LIPPINO LIPPI (1460-1505) was the natural son of Fra Lippo Lippi and Lucrezia Buti, born in Florence and educated at Prato. Losing his father before he had completed his tenth year, the boy took up his avocation as a painter, studying under Sandro Botticelli, and probably under Fra Diamante. The style which he formed was to a great extent original, but it bears clear traces of the manner both of Lippo and of Botticelli,—more ornamental than the first, more realistic and less poetical than the second. His powers developed early; for we find him an accomplished artist by 1480, when he painted an altarpiece, the Vision of St Bernard, now in the Badia of Florence, it is in tempera, with almost the same force as oil painting. Soon afterwards, probably from 1482 to 1490, he began to work upon the frescoes which completed the decoration of the famous Brancacci chapel in the Carmine, commenced by Masolino and Masaccio many years before. He finished Masaccio's subject of the Resurrection of the King's Son, and was the sole author of Paul's Interview with Peter in Prison, the Liberation of Peter, the Two Saints before the Proconsul, and the Crucifixion of Peter. These works, were none others extant from his hand, are sufficient to prove that Lippino stood in the front rank of the artists of his time. The dignified and expressive figure of St Paul in the second-named subject has always been particularly admired, and appears to have furnished a suggestion to Raphael for his Paul at Athens. Portraits of Luigi Pulci, Antonio Pollaiuolo, Lippino himself, and various others are to be found in this series. In 1485 he executed the great altarpiece of the Virgin and Saints, with several other figures, now in the Uffizi Gallery. Another of his leading works is the altarpiece for the Nerli Chapel in S. Spirito—the Virgin Enthroned, with splendidly living portraits of Nerli and his wife, and a thronged distance. In 1489 Lippino was in Rome, painting in the church of the Minerva, having first passed through Spoleto to design the monument for his father in the cathedral of that city. Some of his principal frescoes in the Minerva are still extant, the subjects being in celebration of St Thomas Aquinas. In one picture the saint is miraculously commended by a crucifix; in another, triumphing over heretics. In 1496 Lippino painted the Adoration of the Magi now in the Uffizi, a very striking picture, with numerous figures. This was succeeded by his last important undertaking, the frescoes in the Strozzi Chapel, in the church of S. Maria Novella in Florence—*Drusiana Restored to Life by St John the Evangelist*, St John in the Cauldron of Boiling Oil, and two subjects from the legend of St Philip. These are conspicuous and attractive works, yet somewhat grotesque and exaggerated,—full of ornate architecture, showy colour, and the distinctive peculiarities of the master. Filippino, who had married in 1497, died in 1505 of an attack of throat disease and fever, aged only forty-five. His character for amiability and courtesy is described in very laudatory terms by Vasari. The best-reputed of his scholars was Raffaellino del Garbo.

Like his father, Filippino had a most marked original genius for painting, and he was hardly less a chief among the artists of his time than Fra Lippo had been in his. It may be said that in all the emuls of the art a rival instance is to be found of a father and son each of whom had such pre-eminent natural gifts and leadership. The father displayed more of sentiment, and exquisite sweetness of motive; the son more of richness, variety, and lively pictorial combination. He was admirable in all matters of decorative adjunct and presentment, such as draperies, landscape backgrounds, and accessories; and he was the first Florentine to introduce a taste for accurate details of costume, &c. He formed a large collection of objects of this kind, and left his designs of them to his son. In his later works there is a tendency to a mannered development of the extremities, and generally to faulty overdoing. The London National Gallery possesses a good and characteristic though not exactly a first-rate specimen of Lippino, the Virgin and Child between St Jerome and Dominic.

III. LORENZO LIPPI (1606-1664), a painter and poet, was born in Florence. He studied painting under Matteo Rosselli, the influence of whose style, and more especially of that of Santi di Tito, is to be traced in Lippi's works, which are marked by taste, delicacy, and a strong turn for portrait-like naturalism. His maxim was "to poetize as he spoke, and to paint as he saw." After exercising his art for some time in Florence, and having married at the age of forty the daughter of a rich sculptor named Susini, Lippi went as court painter to Innsbruck, where he has left many excellent portraits. There he wrote his humorous poem named *Malmantile Raccusato*, which was published under the anagrammatic pseudonym of "Parione Zapoli." Lippi was a friend of Salvator Rosa, and was a man of pleasant and generous temper, and very polite. He was, however, somewhat self-sufficient, and, when visiting Parma, would not look at the famous Correggios there, saying that they could teach him nothing. He died of pleurisy in 1664.

The most esteemed works of Lippi as a painter are a Crucifixion in the gallery at Florence, and a Triumph of David which he executed for the saloon of Angiolo Galli, introducing into it portraits of the seventeen children of the owner. His poem the *Malmantile Raccusato* is a burlesque romance, mostly compounded out of a variety of popular tales; its principal subject-matter is an expedition for the recovery of a fortress and territory whose queen had been expelled by a female usurper. It is full of graceful or racy Florentine idioms, and is counted by Italians as a "testo di lingua." Lippi is more generally or more advantageously remembered by this poem than by anything which he has left in the art of painting. It was not published until 1688, several years after his death. (W. M. R.)

LIPSIUS, JUSTUS (1547-1606), the Latinized form of Joest Lips, an eminent humanist of the 16th century, born 18th October 1547, at Overysche, a small village in Brabant, about half way between Brussels and Ottignies. Sent early to the Jesuit college in Cologne, he was removed at seventeen to the university of Louvain by his parents, who had some reason for fearing that he might be induced to become a professed member of the Society of Jesus. But he had received at Cologne two mental tendencies from which he never emancipated himself. One of these, which was suppressed or suspended in middle life, asserted itself later in his return to the bosom of the Catholic Church before his death. The other, derived from his Jesuit training, showed itself in his merely rhetorical or verbal view of classical literature, of which the one interest lay in its style.

Lipsius rushed into print at twenty with one of those volumes of miscellaneous remarks then in vogue (*Variorum Lectionum Libri Tres*, 1567), the dedication of which to Cardinal Granvelle procured him an appointment as Latin secretary, and a visit to Rome in the retinue of the cardinal. Here Lipsius remained two years, using his spare time in study of the Latin classics, in viewing the monuments, collecting inscriptions, and handling MSS. in the Vatican. A comparison of a second volume of miscellaneous criticism (*Antiquarum Lectionum Libri Quinque*, 1575), published after his return from Rome, with the *Varie Lectiones* of eight years earlier shows that he had advanced from the notion of purely conjectural emendation to that of emending by collation, and that he had learnt to distinguish between a "good" and a "bad" MS. In Rome he also made the acquaintance of Muretus, Paulus Manutius, and the other humanists of the catholic reaction who were then in credit there. He was also noticed by Cardinal Sirlosto and Fulvio Orsini; but he can hardly have even seen in the street Scrinio and Vettori, and the introduction of these celebrated names is perhaps only a stylistic flourish of the biographer Lo Miro, to whom we owe the only original account of Lipsius's life. In 1570 he wandered over Burgundy, Germany, Austria, Bohemia, in search of learn-

ing and learned acquaintance, and was engaged for more than a year as teacher in the university of Jena, a position which implied an outward conformity to the Lutheran Church. On his way back to Louvain, he stopped some time at Cologne, where he must again have comforted himself as a Catholic. Here he married, but the union was without issue, and in other respects did not conduce to happiness, as we gather from various allusions scattered through Lipsius's letters. He returned to Louvain, but was soon driven by the civil war to take refuge in Antwerp, where he received, in 1579, a call to the newly founded university of Leyden, as professor of history.

At Leyden, where he must have outwardly conformed to the Calvinistic creed and worship, Lipsius remained eleven years,—years about which his Catholic biographer Le Mire has nothing to tell, but speaks of the period as an enforced temporary sojourn among the infidels,—till the restoration of peace allowed him to return to his home in Brabant. In truth, this period of Lipsius's life was the period of his greatest productivity. It was now that he prepared his *Seneca*, and that he perfected, in successive editions, his *Tacitus*. To edit and comment on two authors of the first class, such as Tacitus and Seneca, in addition to the daily drudgery of teaching, might seem work enough for eleven years. But Lipsius's industry enabled him, over and above, to bring out, from the press of Plantin at Antwerp, a series of works of varied character and contents, some of pure scholarship, others collections from classical authors, and others again of more general interest. Of this latter class was a treatise on politics (*Politiorum Libri Sex*, 1589), in which he let it be seen that, though a public teacher in a country which professed toleration, he had not departed from the state maxims of Alva and Philip II. He lays it down that a Government should only suffer one religion to exist in its territory, and that dissent should be extirpated by fire and sword. This frank avowal of what were known to be his real sentiments might have easily had disagreeable consequences for the author, if he had not been sheltered from the attacks to which it exposed him by the prudence of the authorities of Leyden. Lipsius was prevailed upon to publish a declaration that his expression "*Ure, secca*," was not intended of material fire and sword, but was only a metaphor for "vigorous treatment."

The time at last arrived when Lipsius, who had always been somewhat ill at ease in his Calvinistic disguise, was to throw it off and return into the bosom of the church. In the spring of 1591 he left Leyden under pretext of taking the waters at Spa for the relief of a liver complaint. He went to Mainz, where he was reconciled to the church by the instrumentality of the Jesuit fathers. The event was one which deeply interested the Catholic world, and invitations poured in on Lipsius from the courts and universities of Italy, Austria, and Spain. But he preferred to remain in his own country, and after two years of unsettled residence at Liège, Spa, &c., settled at Louvain, as professor of Latin in the Collegium Bushidianum. He was not expected to teach, and his trifling stipend was eked out by the appointments of privy councillor and historiographer to the king of Spain.

From this time till his death Lipsius continued to publish antiquarian collections and dissertations as before. But he was, in fact, lost to learning. His name and fame, and his sententious and amusing style, were placed at the disposal of the Jesuits, and used by them to restore the credit of two local images of the Virgin, whose authentic miracles were retailed by Lipsius in two tracts, *Divia Virgo Hallensis*, and *Divia Virgo Sichemensis*. Joseph Hall, afterwards bishop of Norwich, was at Spa in the suite of Sir E. Bacon at the time of the appearance of Lipsius's brochures, and was like to have got into trouble by disput-

ing against them (Hall's *Epistles*, cent. i. ep. 5). Lipsius died at Louvain on the 23d of March 1606, at the age of fifty-eight. His Greek books and MSS. he left to the Jesuit college at Louvain, the rest of his library, choice rather than extensive, to a nephew. His furrowed doctor's robe he ordered to be offered at the shrine of the Virgin at Hall.

As, according to the fancy of some biographers, Scaliger, Casaubon, and Lipsius he erected into a literary thronum, Lipsius represents *Lapida*. His knowledge of classical antiquity was extremely limited. He had but slight acquaintance with Greek, "pour sa provision" only, said Scaliger. He is fond of adorning his letters with Greek phrases, his quotations betraying that he is a stranger to that country. In Latin literature the poets and Cæsar lay outside his range; he had no ear for metre, and no taste for poetical expression. Where he was strong was in the Latin historians and in Roman antiquities. His greatest work was his edition of Tacitus. This author he had so completely made his own that he could repeat the whole, and offered to be tested in any part of the text with a poniard held to his breast, to be used against him if he should fail. His *Tacitus* first appeared in 1575, and was five times revised and corrected by the editor—the last time in 1606, shortly before his death. His *Seneca* is dated Antwerp, 1595. His *Opera Omnia* were collected in 4 vols., Antwerp, 1637, of which the West edition, 1676, is a verbal reprint in the same number of volumes, but in a smaller form. The first volume contains also Le Mire's *Life of Lipsius*, which had appeared separately in 1607. Both editions contain ten centuries of his epistles, to which additions have been made in *Epistolæ novæ* or *ant. Decretis XII.*, &c. Hædericij, 1621; *Burmann's Collige*, tom. 1., *Lettres inédites*, ed. Dolyat, Amst., 1858. On Lipsius's relations with Scaliger see Berner's *J. J. Scaliger*, note 40. A bibliographical list of his separate publications, forty-eight in number, may be found in Nicéron, *Mémoires*, xxiv. p. 118. (M. F.)

LIQUEURS are perfumed and sweetened spirits prepared for drinking, and for use as a flavouring material in confectionery and cookery. The term liqueur is also applied to certain wines and spirits remarkable for their amount of bouquet, such as tokay and liqueur brandy, &c. Ordinary liqueurs consist of certain mixtures of pure spirit with essential oils and vegetable extracts, and with syrup of refined sugar. A certain number of such preparations have an established reputation; but the methods by which these are compounded, and the precise proportions of the various ingredients they contain, are valuable trade secrets, scrupulously kept from public knowledge.

The raw materials employed in the preparation of liqueurs are—(1) a pure flavourless spirit, which must be free from fuel oil; (2) various essential oils, on the purity and constant quality of which much of the success of the manufacture depends, or, in place of the oils, the aromatic substances from which they may be distilled; (3) bitter aromatic vegetable substances, fruits, rinds, &c., or their alcoholic extracts called tinctures; (4) fresh juicy fruits possessed of special flavour; (5) refined sugar prepared in the form of a perfectly smooth colourless syrup; (6) soft or distilled water; and (7) tinctorial substances for those liqueurs in which a particular colour is demanded by fashion. The French, who excel in the preparation of liqueurs, grade their products according to their sweetness and alcoholic strength into *crèmes*, *huiles*, or *baumes*, which have a thick oily consistency, and *cassis*, *extraits*, or *elixirs*, which, being less sweetened, are perfectly limpid. Liqueurs of British fabrication, generally of inferior quality, are frequently dealt in under the name of *cordials*. Bitters form a class of liqueurs by themselves, claiming to possess certain tonic properties and a medicinal value. Certain liqueurs, containing only a single flavouring ingredient, or having a prevailing flavour of a particular substance, are named after that body, as for example—*crème de rose*, vanilla, *thé*, *escau*, *anisette*, and *kummel*, &c. On the other hand, the liqueurs which in general are most highly prized are compounded of very numerous aromatic principles, and they are not considered fit for use till they have matured and mellowed for several years.

The simplest method of preparing liqueurs is by adding the requisite proportion of essential oil to spirit of known strength, and then mixing this with the necessary amount of clear syrup. In this way, indeed, the greater number of the commoner and cheaper kinds are manufactured. Thus for making (say) 20 gallons inferior quality of kummel, there are added to 7 gallons of spirit of wine $\frac{1}{2}$ lb of essential oil of caraway seed, $7\frac{1}{2}$ drachms of fennel-seed oil, and 15 drops of bitter almond oil. With this preparation is mixed a syrup containing 40 lb of refined sugar dissolved in about 12 gallons of water, and when fined with gelatine or with alum and soda solution the liqueur is ready for use.

To prepare, on the other hand, 20 gallons of fine kummel liqueur, there would be placed in a simple still, with 10 gallons of spirit and 8 of water, 4 lb of caraway seeds, $\frac{1}{2}$ lb of fennel, and 3 oz of Florentine iris root. This mixture after maceration is distilled, the first portion of the distillate being put aside on account of its rough aroma, after which about 8 gallons of fine kummel spirit is obtainable. There still may be procured, by forcing the heat, from 3 to 4 gallons of inferior spirit. To the 8 gallons of fine spirit is added a syrup consisting of 50 lb of refined sugar dissolved in 10 gallons of water, the two compounds being thoroughly incorporated with heat in an open vessel. On cooling, the amount of water necessary to make up 20 gallons is added; the liqueur is fined with isinglass, and stored to mature and mellow. All varieties of liqueurs may be made or imitated by both these methods; but as a rule it is only the simple-flavoured and commoner varieties which are compounded by the addition of essential oils and alcoholic tinctures. Fine liqueurs are made by macerating aromatic bodies and subsequent distillation; bitters by maceration and straining.

Of trade liqueurs the most highly esteemed in the United Kingdom are Chartreuse, Curaçao, Maraschino, and Doppel-Kummel or Almond. Of all kinds the most famous is *Chartreuse*, as could have been made at the famous Carthusian monastery near Grenoble. Three qualities are made—green, yellow, and white, the green being the richest and most delicate in flavour. Chartreuse is said to be a most complex product, resulting from the maceration and distillation of balm leaves and tops as a principal ingredient, with orange peel, dried hyssop tops, peppermint, wormwood, angelica seed and root, cinnamon, mace, cloves, Tonguin beans, *Culemus aromaticus*, and cardamoms. *Curaçao*, which is a simple liqueur, is chiefly made in Amsterdam from the dried peel of the Curaçao orange. The peel is first softened by maceration in water, then three-fourths of the quantity in preparation is distilled with mixed spirit and water, and the remaining fourth is macerated in a proportion of this distillate for two or three days, the tincture is strained off and expressed and added to the original distilled Curaçao spirit. The flavour of Curaçao is improved by the addition of about one per cent. of Jamaica rum. The centre of the *Maraschino* trade is at Dalmatia. Genuine Maraschino is prepared from a variety of cherry—the Marasca—peculiar to the Dalmatian mountain regions. The juice of the cherry fermented and distilled yields the spirit, which is flavoured with the broken cherry kernels themselves. Imitations of Maraschino are easily prepared, a paliseworthy liqueur resulting from raspberry juice, bitter almonds, and orange-flower water. In the preparation of *Almond*—which is a rich Kummel—bitter almonds, star-anise, angelica root, Florentine iris root, and orange peel are used in addition to caraway seeds. Gold-water and silver-water are liqueurs to which small quantities of powdered gold-leaf and silver-leaf have been added, on account of their lustre. They are now little used.

Gentian root is the fundamental "bitter" in most of the preparations known as *Bitters*. These compounds, prepared by maceration, are very various in their constitution, but the following is a fair typical example of the composition of a kind largely used. To prepare 20 gallons of bitters there are taken 3 lb of gentian, 6 lb each of cinnamon and caraway seeds, 1 lb of juniper berries, and $\frac{1}{2}$ lb of cloves. These are macerated in 7 gallons of spirit, 60° over proof, strained and filtered, and to the product is added 10 lb of sugar dissolved in 18 gallons of water, and the resulting liquor is coloured with cochineal.

The following list includes the names of the principal commercial liqueurs not already named:—Noyau (white and pink), trappistine (yellow and green) (from the Abbey de la Grande Chartreuse), benedictine (from Rézeaux), peppermint liqueur, French cherry brandy or Kirsbaer (from Copenhagen), maritane, peridot amon, crème de

vanille, crème de rose, thé, café, menthe, cacao, vanille, pomegranate, anis (from Dantz), anisette (from Amsterdam and Bordeaux), kirschenwasser (from Switzerland and the Black Forest), absinthe, and vermouth. (J. P.)

LIQUIDAMBAR, LIQUID AMBER, or SWEET GUM, is a product of *Liquidambar styraciflua*, L., order *Hamamelidaceae*, a deciduous tree of from 30 to 50 feet high and attaining 15 feet in circumference in Mexico, of which country it is a native, as well as of the greater portion of the United States. It bears palmately-lobed leaves, somewhat resembling those of the maple, but larger. The male and female inflorescences are on different branches of the same tree, the globular heads of fruit resembling those of the plane. This species is nearly allied to *L. orientalis*, Miller, a native of a very restricted portion of the south-west coast of Asia Minor, where it forms forests. It is from the bark of this latter tree that the storax of the ancients (Herod., ii. 107, Diosc., i. 79), the medicinal storax of to-day, is prepared (Bentley and Trimen, *Med. Plants*, No. 107). The earliest record of the tree appears to be in a Spanish work by F. Hernandez, published in 1651, in which he describes it as a large tree producing a fragrant gum resembling liquid amber, whence the name (*Nov. Plant.*, &c., p. 56). In Ray's *Historia Plantarum* (1686) it is called *Styrax liquidá*. It was introduced into Europe in 1681 by Banister, the missionary collector sent out by Bishop Compton, who planted it in the palace gardens at Fulham.

The wood is very compact and fine-grained,—the heart-wood being reddish, and, when cut into planks, marked transversely with blackish belts. It is employed for veneering in New York. Being readily dyed black, it is sometimes used instead of ebony for picture frames, balusters, &c.; but it is too liable to decay for outdoor work. The principal product of the tree, however, is the resinous gum which issues from between the bark and wood. It is sometimes called white balsam of Peru, or liquid storax, though it is said by Michaux (*Les Plantes rétrosives*, ii. p. 337) to differ materially from the latter. It is considered to be styptic and to possess healing and balsamic properties, being stimulant and aromatic. It possesses nearly the same properties as the balsam of Peru and of Tolu, for which it is often substituted, as well as for storax. Mixed with tobacco, the gum was used for smoking at the court of the Mexican emperors (Rumph., iv. 10). It has been long used in France as a perfume for gloves, &c. It is mainly produced in Mexico, little being obtained from trees growing in higher latitudes of North America, or in England. For localities where it has been observed, see Pickering's *Chron. Hist. of Plants*, p. 741.

LIQUORICE. The hard and semi-vitreous sticks of paste, black in colour and possessed of a sweet somewhat astringent taste, known as liquorice paste or black sugar, are the inspissated juice of the roots of a leguminous plant, *Glycyrrhiza glabra*, the *radix glycyrrhizae* of the pharmacopoeia. The plant is cultivated throughout the warmer parts of Europe, especially on the Mediterranean shores, and its geographical limits travel eastward throughout Central Asia to China, where its cultivation is also presented. In the United Kingdom it is grown in Surrey and in Yorkshire. The roots for use are obtained in lengths of 3 or 4 feet, and varying in diameter from $\frac{1}{4}$ to 1 inch, soft, flexible, and fibrous, and internally of a bright yellow colour with a characteristic sweet pleasant taste. To this sweet taste of the root the plant owes its generic name *Glycyrrhiza* (the sweet root), of which liquorice is a corruption. According to the analysis of Sestini (*Gaz. Chim. Ital.*, vol. viii. p. 181), the root dried at 110° C. has the following composition:—resin, 5.64, and colouring matters, 8.220; glycyrrhizin, 6.878; starch, 67.720; cellulose, 19.790; albuminoid substances,

6-373; ammonia (combined), 0-043; asparagine, 2-416, ash, 4 000 It is to the sugar-like body glycyrrhizin in combination with ammonia that the peculiar taste and properties of liquorice root are due. Glycyrrhizin in itself is a tasteless nearly insoluble substance having the composition of $C_{42}H_{64}O_{16}$, but in combination with ammonia, potash, or soda it develops its sweet taste. It is easily precipitated from its combination by the influence of mineral acids. Liquorice has been known and its virtues appreciated from the most remote periods, and the root is an article of some commercial importance on the Continent.

Stuck liquorice is made by crushing and grinding the roots to a pulp, which is boiled in water over an open fire, and the decoction separated from the solid residue of the root is evaporated in copper pans till a sufficient degree of concentration is attained, after which, on cooling, it is rolled into the form of sticks or other shapes for the market. The preparation of the juice is a widely extended industry along the Mediterranean coasts; but the quality best appreciated in the United Kingdom is made in Calabria, and sold under the names of Solena and Congiano juices. The liquorice grown in Yorkshire is made into a confection called Pottfract cakes. Liquorice in various forms is a popular remedy for coughs, and it is largely used by children as a sweetmeat. It enters into the composition of many cough lozenges and other demulcent preparations, and in the form of aromatic syrups and elixirs it has a remarkable effect in masking the taste of nauseous medicines, a property peculiar to glycyrrhizin. A considerable quantity of liquorice is used in the preparation of tobacco for chewing. Commercial liquorice paste is frequently much adulterated, and often contains distinct traces of copper, apparently derived from the vessels in which the juice is inspissated.

LIQUOR LAWS may be divided into the three great systems of free trade, restriction, and prohibition. The system of free trade may mean either that no special licence is required by law for carrying on a traffic in intoxicating liquors, or that such a licence is required, but that the licensing authority is bound to grant it in every case in which certain conditions are complied with. Wherever the determination of these conditions involves an appeal to the discretion of the licensing authority, the system of free trade tends to pass into the system of restriction. For practical purposes it does not matter much whether the law says, "every man of good character is entitled to a licence for a properly constructed house in a suitable locality," or "the magistrate must consider the character of the applicant and of the premises, but is not bound to give reasons for his decision." But wherever the applicant can submit to a court capable of dealing with evidence the question of fact whether he has fulfilled certain conditions defined by law, the system of free trade may be said in theory to exist. Wherever, on the other hand, the law distinctly affirms an absolute discretion in the magistrate, or lays down a positive principle, such as the "normal number" or the fixed proportion between public-houses and population, the system is properly described as restriction, or monopoly. This system, again, in its extreme form, tends to pass into one of prohibition. Under one of the alternative plans permitted by the Swedish licensing law of 1865, generally known as the Gothenburg plan, the municipality begins by the partial, and advances to the total, prohibition of liquor traffic, except by servants of the municipality; and this plan is sometimes advocated merely as a step towards the suppression of all trade in liquor. In nearly all countries the nature of the trade carried on in public-houses has subjected them to a much more rigorous police supervision than ordinary trades. All trades, however, must be carried on under the conditions required by the public comfort and safety; and to give unlimited licence in such matters to publicans would be to violate social rights not inferior to freedom of industry and trade.

Of recent years there has been a considerable increase in the amount of drunkenness in Europe generally. There

are no means of determining the law of the increase by reliable statistics, but it seems probable that the increase is confined to the large towns and to the lowest classes. There has also been of late, both in the United Kingdom and on the Continent, a very earnest and animated discussion on the policy and results of the various systems of liquor law. It cannot be said that so far any decisive experience has been adduced on the subject. In fact the legislation of Europe is in a very uneasy and changeable state. Thus, prior to the federal constitution of 1874, the cantons of Switzerland were in the habit of directing the municipal authorities to observe a certain proportion between the number of licences and the population. The new constitution, however, laid down the general principle of free trade, and the federal council intimated to the various cantons that it was no longer lawful to refuse a licence on the ground that there was no public need of it. In the previous year precisely the opposite change took place in Denmark. The licence system rested on the law of 29th December 1857, but this was modified by the law of 33d May 1873, which increased the conditions to be fulfilled by those applying for a licence, and conferred upon the communal authorities the power of fixing the maximum number of licences to be granted. Similarly, in France, the liquor law rests upon the decree of 1851, but public opinion is turning against the absolute discretion reposed in the administrative authority, and the law proposed by M. de Gasté and approved of by the chamber of deputies on 22d March 1878 will probably lead to a system of greater freedom. In the German empire the various states are still permitted by a law of the confederation, dated 21st June 1869, to restrict the issue of licences to what the public seem to require, but except in Württemberg this permission seems not to have been used. In Austria the rapid growth of drunkenness in Galicia made necessary the severe police law of 19th July 1877, but in other parts of the empire the exceptionally lenient law of 20th December 1859 seems to be considered sufficient. In the midst of so many fluctuations of opinion, the practical questions of legislation must be decided on general principles and not by experimental evidence. Those who speak and write on the reform of the liquor laws are divided into two great classes—(1) the nephalists, who consider alcohol, in every form, whether in distilled or in fermented liquors, to be poison, and therefore wish the sale of it to be entirely suppressed; (2) those who see no objection to moderate drinking, especially of the less alcoholic beverages, or at least regard the idea of suppression as an impracticable chimæra. In the United Kingdom the nephalists are at present agitating for Sir Wilfrid Lawson's Permissive Bill, which has latterly taken the form of a local option resolution. This means that in each burgh or parish two-thirds of the ratepayers may decide that no licences shall be given, a vote to be taken on the subject every three years. On 17th March 1879 the select committee of the House of Lords on intemperance reported emphatically against the scheme of the Permissive Bill. The committee did not examine witnesses from the United States with respect to the experiments in prohibition which have been made there on a large scale; but it is generally admitted that the Maine Liquor Law has succeeded only in villages and rural districts; in towns it has failed. So also the Michigan Law, prohibiting the sale of liquor except for medicinal or mechanical purposes, was condemned after twenty years' experience; and in 1876 a licence tax was imposed on dealers in liquor.

The result is the same under those celebrated "local option laws" which are in force in some of the United States. These laws proceed from the legislatures of the various States. They sometimes take the form of a general prohibition of the sale of intoxicants,

subject to a vote of the inhabitants in each township or county, but more frequently they merely provide in general terms for the issue of licences in the usual way, unless the local constituency shall otherwise determine. Such laws are in force in Massachusetts, New Jersey (which had the *Chatham Local Option Law of 1871*), New Hampshire, Connecticut, and Vermont. But whether they are constitutional or not is a matter of serious controversy in the courts of the United States. On the one hand, it is said that such a law amounts to a delegation by the State of its legislative power,—that it leaves the hands of the senate and general assembly in an unfinished state, commanding nothing, prohibiting nothing. On the other hand, it is said this is a police regulation, which is properly entrusted to county commissioners, or boards of select men for the protection of the health and morals of the localities over which they preside; and it is quite competent for a State to make a law delegating the power to determine some fact or state of things, upon which the law makes, or intends to make, its own action depend. In the case of the States already mentioned the constitutional character of the local option law has been upheld by decision, but in the cases of Delaware, Texas, Indiana, California (Wall's Case), Iowa, and Pennsylvania, it has been denied. The question has also been raised in the American courts whether in the case of intoxicants being imported from one State to another a local option law, which prohibits the sale of the imported goods, does not violate the freedom of commerce which is guaranteed to all the States by the American Constitution.¹

Among those who are not nephelists a variety of schemes has been suggested. A small minority are in favour of free trade subject to certain conditions. An experiment of this kind was tried by the Liverpool magistrates in 1853. "The premises were to be of high rateable value, the excise duty was to be greatly increased; the licensee was invariably to reside on the premises, and a special police for the inspection of licensing houses was to be provided." These conditions being complied with, no licence was refused. This experiment was made the subject of inquiry by Mr Villier's select committee of 1854. That committee, which included Sir George Grey and Lord Sherbrooke (Mr Lowe), reported unanimously in its favour. A similar experiment² was made in Liverpool during the years 1852-56 without evil results, and also since 1862 in the Prescott division of the county of Lancashire. On the Continent the only countries where free trade prevails are Belgium, Holland, Greece, Spain, and Roumania. In certain parts of Bavaria communes possess breweries, the produce of which they are by custom entitled to sell without any licence; and the Rhenish Palatinate has never been subject to the restrictions mentioned below which apply to the rest of the empire. In Belgium licences are unknown. The only tax which the publican pays is the "patent" which is paid by every trade. So strong is the general law in Belgium that in 1866, when the municipal authorities of Antwerp issued a regulation prohibiting the sale of alcoholic drinks in the streets, this was held to be illegal by the court of cassation. The Dutch law is the same as in Belgium. It must not be supposed, however, that the Dutch are satisfied with the present law. The Dutch "society for total abstinence from strong drink" is very active; and in 1880 the Government presented to the lower chamber a bill, introducing a licence and also the principle of the normal number, the proportion of licences to population varying according to the total population of towns. In Belgium the *Association contre l'abus des boissons alcooliques* is endeavouring to secure amendments of the law, chiefly of a fiscal and police character, but the introduction of the licence is not suggested. In Germany, with the ex-

¹ See Cooley, *On Constitutional Limitations*, and *On Taxation*, p. 408; Dillon, *On Municipal Corporations*, l. p. 393, and the recent case of *Boyd v. Bryant*, 37 Amer. Rep. 6. In some States it has been attempted to prohibit indirectly by raising enormously the licence fee. The subject is frequently before the courts, and it is decided that while the licensing power is given for revenue purposes there is no limit to the discretion of the licensing authority, but where it is given for purposes of regulation the fee should not exceed the expense of issuing the licence and inspecting and regulating the licensed trade.

ception of Wurtemberg and those places where the licence is unknown, the liquor trade is practically free. The law of 1869 declares that a licence can be refused for two reasons only—if the police condemn the structure or situation of the premises, or if the applicant is likely to encourage drunkenness, gaming, resort of theft, or improper meetings. This system may be contrasted with those of Italy and Russia. In Italy, under the law of 20th March 1865, a licence is obtained from the sub-prefect or *autorità pubblica del circondario* on the demand of the *syndico (municipio)* of the commune and after consulting with the municipal *giunta*. In Russia, under the decree of 1861 and the communal law of 28th June 1870, the licence is got from the municipal or communal council, or, in certain cases, from the owners of land, especially church land. In both countries the licensing authorities have unlimited discretion, which they have exercised so as to multiply public-houses enormously. Assuming that sufficient guarantees can be got for the respectability of the applicant and the good sanitary condition of his premises, the system of free trade, or of unrestricted licensing on defined conditions, is the only one which can be defended on principle. It is impossible for the magistrates to exercise a just discretion in deciding what public-houses are required for a locality. The fact that an applicant has invested capital in the business and is ready to begin is the best evidence that there is a demand to be supplied. There is, however, no prospect of free trade being established in the United Kingdom. The select committee of 1879 reported against it.

A larger number of licensing reformers support the scheme for introducing the "normal number" to the United Kingdom. This was embodied in the bills of Sir Robert Anstruther and Sir Harcourt Johnstone (1876). No new licences were to be granted till the number had been reduced to 1 in 500 of the population in towns, and 1 in 300 in country districts. At present the proportion is 1 to 173 of the population in towns in England and Wales. It seems impossible to determine any such proportion *ad hoc*. Even were it possible, the rough classification of towns by population, and the failure to discriminate between various rural districts, would result in great injustice. In Mr Cowen's bill of 1877 and Lord Colin Campbell's bill of 1882 it was proposed to have in each locality a separate licensing board elected annually by the ratepayers. This proposal runs against the recognized principle in the reform of local government that authorities must be consolidated, not multiplied. The select committee of 1879 suggested that the function of licensing might be entrusted to the proposed representative county boards.

Another scheme, which has the advantage of appealing to modern experience in Europe, was contained in Sir Robert Anstruther's bills of 1872 and 1874 and Mr Chamberlain's bill of 1877. These were all modifications of the Gothenburg system, which Mr Carnegie, a Scotch brewer in Gothenburg, has done much to make known in the United Kingdom. In Sweden, prior to 1855, there was absolute free trade in liquor. The General Licensing Act, passed in that year, gave power to local authorities, subject to confirmation by the provincial governor, to set annually the number of licences, and to sell them for three years on certain conditions. If a company, or "bolag," were formed for the purpose of taking all the licences, the local authority might contract with the company for three years. The Act did not apply to beer. The result of this Act has been twofold. In rural districts almost no licences have been issued. In towns, on the other hand, drinking has increased of late, and has led to the severe police laws of 18th September 1874 and 15th October 1875. In 1866 Gothenburg set the example of transferring the whole public-house traffic to a bolag, which undertakes to appropriate no profit

from the business, but to conduct its establishments in the interest of temperance and morality, and to pay over to the municipality the profits made beyond a fair interest on capital. This experiment has been a great financial success, and if developed will relieve the town from the greater part of its local taxation. The example has been followed by every town in Sweden having a population above 5000; and in 1877, after long discussion, it was adopted in Stockholm, the capital, where the number of life licences presented unusual difficulties. Mr Chamberlain proposed that the work done by the Swedish hogs should be attempted by town councils in the United Kingdom. For this purpose he asked power to acquire the freehold of all licensed premises and the interests of the licence holders. The business would then be carried on by the town council, the profits being carried to the credit of the education and poor rates. The powers of the licensing justices would cease on the adoption of the scheme by the town council. The select committee of 1879 recommended that legislative facilities should be given for the adoption of this scheme. It is doubtful, however, if the burden would be generally submitted to, except on the understanding that the local rates would be *pro tanto* diminished; and, were this realized, the tendency would be to support the municipality on the liquor trade by extending its operations.

The great mass of opinion in the United Kingdom, however, seeks some modification of the present licensing system. That system is extremely complicated. The wholesale licences are granted by the excise without a magistrate's certificate, but for nearly all retail licences such a certificate is required. Generally, the magistrate has absolute discretion as regards licences to sell on the premises, but in England a licence to sell off the premises can be refused only for one or more of the following reasons—no satisfactory evidence of good character, disorderly house, previous forfeiture of licence by misconduct, want of legal qualification. The English law is contained in the Wine and Beerhouses Act 1859, and the Licences Act 1872 and 1874. The great features of the legislation of 1872 were (1) the introduction of a confirming authority (*viz.*, the licensing committee in counties and the whole magistrates in boroughs) for the purpose of restricting the issue of new licences, (2) the qualification of annual value of public-house premises for the purpose of raising the character of those engaged in the trade; (3) the new regulations for closing; (4) the new regulations of police penalties, especially with reference to the endorsement of convictions on the licence and the forfeiture of the licence. The Act of 1874 abolished the necessity of confirmation in the case of "off" licences, gave the magistrates absolute discretion as regards the endorsement of convictions, and removed from magistrates all discretion as regards closing hours. There are not many peculiarities in the licensing law of Ireland. Public-house licences are generally held by shopkeepers, and no qualification of value is required except in the case of beerhouses. Mr Melson's Act of 1877 (37 & 38 Vict. c. 69) closed public-houses on Sunday. In Scotland prior to 1858 licences were regulated by the Home-Drummond Act (9 Geo. IV. c. 58), which authorized only one form of certificate for "common inns." In 1846 a select committee reported that the combination of the grocer trade with the sale of spirits to be consumed on the premises was conducive of evil to the working classes. This led to the Forbes Mackenzie Act of 1855, which was amended in 1862, upon the report of a royal commission in 1860 (13 & 17 Vict. c. 67; 25 & 26 Vict. c. 25). It created three licences—(1) for hotels, (2) for public-houses, (3) grocers' licences. Under the hotel licence interesting liquor may be sold to lodgers and travellers. On Sundays the public-houses are closed, and on week days the sale is practically limited to the period between 8 A.M. and 11 P.M. Cameron's Act of 1876 (39 & 40 Vict. c. 26) makes the refusal of a certificate by the magistrate final, and in the case of a new licence requires the confirmation of a county licensing committee or in boroughs of a joint committee of magistrates and justices.

Information on this subject is to be found chiefly in the *Reports* of royal commissions and select committees. It has been much discussed at the meetings of the Social Science Association, and there is a large literature of pamphlets and magazine articles, to which, among many others, Lord Sherbrooke, Mr Chamberlain, and Mr Arthur Arnold have contributed. The reports of the various international congresses "pour l'étude des questions relatives à l'alcoolisme" may be studied with advantage. See also *Alkohol und seine Folgen*, *Europäische Arbeiten zur Bekämpfung des berauschenden Alkohols*, Paris, 1879 (W. O. S.).

¹ 32 & 38 Vict. c. 27; 35 & 38 Vict. c. 94; 37 & 38 Vict. c. 49.

² So also the first English Act, 5 & 6 Edw. VI., provided one form of licence for "Alehouses."

LISBON (Portuguese, *Lisboe*), the capital of the kingdom of Portugal, is situated in 38° 42' N. lat. and 9° 8' W. long., on the northern bank of the Tagus (*Tago*), at the spot where the river broadens to a width of 9 miles, some 8 or 9 miles from the point where it enters the Atlantic. Standing on a range of low hills, backed by the lofty granite range of Cintra, and extending along the margin of the wide Tagus, Lisbon wears a very noble aspect to those who approach it from the sea. In regard to beauty of position it may rightly claim to be the third of European cities, Constantinople and Naples alone ranking before it. The river affords secure anchorage for a very large number of vessels, and the bar at the mouth is easily crossed even in rough weather. Like London, Paris, and Vienna, Lisbon stands in a geological basin of Tertiary formation. The upper portion consists of loose sand and gravel destitute of organic remains, below which is a series of beds termed by Mr Daniel Sharpe the Almada beds, composed of yellow sand, calcareous sandstone, and blue clay, rich in marine remains. The greater part of Lisbon stands on those beds which belong to the older Miocene epoch, and are nearly of the same age as those of Bordeaux. Next comes a conglomerate without fossils. These Tertiary deposits, which cover altogether an area of more than 2000 square miles, are separated, near Lisbon, from rocks of the secondary epoch by a great sheet of basalt which covered the Secondary rocks before any of the Tertiary strata were in existence. The uppermost of the Secondary deposits is the Hippurite Limestone, which corresponds to a part of the Upper Chalk of northern Europe. The narrow valley of Alcantara, in the immediate neighbourhood of Lisbon, has been excavated in this deposit, and here there are extensive quarries, where abundance of its peculiar shells may be collected.¹

Lisbon stretches along the margin of the river for 4 or 5 miles, and extends northward over the hills for nearly 3 miles, but much of it is scattered amongst gardens and fields. In the older parts the streets are very irregular, but that portion which was rebuilt after the great earthquake of 1755 consists of lofty houses arranged in long straight streets. Here are the four principal squares, the handsomest of which, the Praça do Commercio, is open on one side to the river, and on the other three is surrounded by the custom-house and Government offices, with a spacious arcade beneath. In the middle is a bronze equestrian statue of Joseph I., in whose reign the earthquake and restoration of the city took place. At the middle of the north side is a grand triumphal arch, under which is a street leading to another handsome square, the Rocio or Praça do Dom Pedro (built on the site of the Inquisition palace and prisons), where stands the theatre of D. Maria II. The houses are for the most part well built, and are divided into flats for the accommodation of several families. The streets had formerly a bad reputation in regard to cleanliness, but of late years great improvement has taken place in this respect, although no general system of drainage has yet been adopted. They are lighted with gas made from British coal. The public gardens, five in number, are small, but are much frequented in the evenings. The city contains seven theatres and a bull ring. The hotels of Lisbon offer but indifferent accommodation to

¹ After careful investigation, Mr Sharpe discovered that the greatest force of the earthquake of 1755 was expended upon the area of the above-mentioned Almada blue clay, and that not one of the buildings standing upon it escaped destruction. Those upon the slopes of the hills immediately above the clay suffered very severely, and all on the Tertiary strata were more or less injured, whilst none of the buildings on the hippurite limestone or the basalt suffered any damage whatever,—the line at which the earthquake ceased to be destructive corresponding exactly with the boundary of the Tertiary beds.

strangers; the shops present little display, and are ill furnished with wares. The markets are tolerably well supplied with meat, fish, and country produce. A large quantity of excellent fruit is brought in for sale during the season.

The king usually resides at the palace of Ajuda, situate on a hill above the suburb of Belem. It is in the Italian style, and was intended to be one of the largest palaces in Europe, but it has been left incomplete. It contains a large library, a collection of pictures, and a numismatic cabinet. There is another royal palace at Lisbon (that of the Necessidades), where former monarchs were wont to reside, and in the neighbourhood of the city are numerous others. Several of the nobility have good and spacious houses in the city, which are dignified with the name of palaces.

The houses of the British residents are mostly to be found in the elevated district called Buenos Ayres.

Two or three small forts, one on a rock at the mouth of the Tagus, afford a very inadequate defence against the attacks of a hostile fleet. In ascending the river the picturesque Tower of Belem, built about the end of the 15th century, is seen on the north bank close to the water's edge. On a rocky hill stands the citadel of St George, surrounded by the most ancient part of Lisbon, composed of narrow tortuous streets, still retaining its old Moorish name, Alfama. The chief naval and military arsenals of the kingdom are at Lisbon. Attached to the former are a naval school and a hydrographical office. Here also is a museum of colonial products. In various parts of the city are barracks for the accommodation of the



FIG. 1.—Plan of Lisbon.

troops and for the municipal guard. The churches are numerous, but are nearly all in the same tasteless Italian style; the interiors, overlaid by heavy ornament, contain pictures utterly devoid of merit. The cathedral is gloomy without being grand, but the oldest part behind the high altar may deserve inspection. The largest church in the city is St Vincent's, 222 feet by 82. The large adjacent convent is now the residence of the cardinal patriarch. In a modern chapel attached to the church the coffined corpses of the monarchs of the house of Braganza are deposited, and the public are admitted to see them on certain days in the year. Perhaps the most striking church in Lisbon itself is that of the Estrela, with a dome commanding an extensive view, and two towers, the whole design reminding the visitor of St Paul's, London. At St Roque is the famous chapel of St John

the Baptist, designed by Vanvitelli, and made at Rome for King John V, who had been enriched by the discovery of the gold and diamond mines in Brazil. Before being sent to Portugal it was set up in St Peter's, and Benedict XIV. celebrated the first mass in it. It is composed of precious marbles with mosaics and ornaments in silver and bronze, and is said to have cost upwards of £120,000. By far the most interesting architectural object at Lisbon is, however, the unfinished Hieronymite church and monastery at Belem. The church was begun in 1500 near the spot where Vasco da Gama had embarked three years before on his famous voyage to India. The style is a curious mixture of Moorish Gothic and Renaissance, with beautiful details. The English college was founded in 1628 for the education of British Roman Catholics; and the Irish Dominicans have a chapel and convent originally established for the educa-

tion of youths intended for the priesthood. Ecclesiastically Lisbon is a patriarchate, the holder of the dignity being at the head of the clergy of the kingdom, and president of the chamber of peers. He is usually made a cardinal.

The two chambers of parliament hold their sittings in a huge building, formerly the monastery of St Bento, to which a handsome facade has been added. New and ornamental buildings have been erected for the courts of justice and the municipal chamber. The mint is fitted up with steam machinery on a small scale for coining gold, silver, and copper. Postage stamps and inland revenue stamps are printed at this establishment. The national astronomical observatory is near the Ajuda palace, and the meteorological observatory is at the Polytechnic school, which also contains the national museum of natural history. Here is a good collection of the birds of Portugal, with collections in other branches of the zoology of Portugal and the Portuguese possessions in Africa—minerals, fossils, &c. The fossils collected by the Geological Commission to illustrate the geology of the kingdom are preserved in the sequestered Convento do Jesus.

Lisbon is singularly destitute of works of high art. The gallery of the Academy of Fine Arts contains only a few pictures worth notice. In the custody of the academy is an interesting assemblage of gold and silver plate taken from suppressed monasteries. There is also a collection of pictures at the Ajuda palace. At the Carmo church is an archaeological museum. The great national library consists for the most part of old theological works and ecclesiastical histories swept out of various suppressed monasteries, and has a collection of 24,000 coins with some Roman bronzes. The Portuguese take little interest in literature, art, or science, and almost everything connected with them is in a neglected state. Literary and scientific societies are few in number and badly supported, the principal one being the Royal Academy of Sciences, founded in 1775. The national printing office, a Government establishment, turns out creditable work, but the booksellers' shops are few and ill-stocked. Eight or ten daily journals are published in Lisbon, and these are a few weekly newspapers, besides periodicals appearing at longer intervals, and chiefly devoted to special interests.

Several cemeteries have been constructed of late years near Lisbon, the practice of interring in churches having been abandoned. In the English cemetery lies the English novelist Fielding, who died here in 1754; a marble sarcophagus with a long Latin inscription covers his remains. The British residents maintain a chaplain who performs service regularly in an adjacent chapel, and the Scottish Presbyterians have also a place of meeting. The great hospital of St. José contains beds for nine hundred patients, and the large lunatic asylum has accommodation for four hundred patients. The Foundling Hospital takes in more than two thousand children annually. At Belem is an excellent establishment where a large number of male orphans and foundlings are fed, clothed, educated, and taught various trades. The Lazaretto is a vast building on the south side of the Tagus, where one thousand inmates can be received at one time.

Lisbon is connected by railway with Madrid, and there is also a line northward to Coimbra and Oporto, as well as lines southward to Setúbal, Évora, and Beja. Submarine cables connect it with England and with Brazil. There is communication by regular lines of steamers with the Portuguese islands in the Atlantic and the colonies in Africa, and with a great number of ports in Britain, continental Europe, and other parts of the world. Lisbon is the largest port in the kingdom, and its custom-house is a spacious and very substantial fire-proof building worthy of any capital in Europe, in which merchants are allowed to

deposit their goods free of duty for a year, or for two years in the case of Brazilian produce. The duties annually collected here exceed £1,150,000, tobacco alone producing £400,000. Upwards of 1400 foreign vessels, and about 1100 Portuguese ships, including coasters, enter the port annually. The annual imports amount to about £5,500,000, and the exports to £4,500,000. A considerable number of foreign merchants reside in Lisbon, and there are about fifty British firms. The most active commerce is carried on with Brazil and Great Britain, tropical produce being



FIG. 2.—Port of Lisbon.

imported from the one, and manufactured goods from the other, while wine and oil are sent to both in return. The wine for exportation is all made and stored outside the city bounds, so as not to be subject to the octroi duty. There are several joint-stock banks, one of them being British (the New London and Brazilian Bank), as well as private bankers. Manufactures are carried on only to a limited extent. The largest establishment by far is the tobacco manufactory, where 1600 persons are employed, and three millions of pounds are annually manufactured.

The chief supply of water, for the use of the city is brought by an aqueduct 9 miles in length, from springs situated on the north-west. This work, one of the bores of Lisbon, was completed in 1738, and was so well executed that the great earthquake did it no injury. It crosses the Alcantara valley on thirty-five arches, the principal one being 263 feet above its base, with a span of 110 feet. On reaching the city the water is conducted into a covered massive stone reservoir, which an inscription styles "urbis ornamentum orbis miraculum," and thence it flows to the fountains, thirty-one in number, distributed throughout the city. From these fountains it is removed in barrels to the houses by "Gallegos," men from Galicia, who do the principal part of the hard work in Lisbon. Although there are two other reservoirs near the city, the supply of water is insufficient for the requirements of the place during the warm season.

For municipal purposes the city is divided into four districts (*barros*), the whole under one municipal chamber, and two suburban districts under separate chambers. The city chamber consists of twelve members elected by the burgesses every two years. Its revenue is about £75,000. The octroi duties, levied on provisions and fuel entering the city, are collected on account of the Government, and exceed £270,000 a year. The police force is paid by the Government, and consists of the municipal guard, a military force of cavalry and infantry under the orders of the home secretary, and a body of ordinary policemen at the orders of the civil governor, an official appointed by Government. According to the census of 1878 the population in the thirty-nine parishes of the city and suburbs was 253,000.

Climate.—Notwithstanding the mildness of the climate, Lisbon is not considered a healthy place of residence, owing chiefly to the defective sanitary arrangements. The annual death-rate is 36 per thousand. The deaths are said to exceed the births, and the population would therefore decrease were the city not continually recruited from the country. To chest invalids it is not by

any means to be recommended as a winter resort, on account of the frequent and rapid changes of temperature to which it is subject. These changes, and the great difference between the temperatures of sun and shade during the winter and spring, are dangerous to the delicate. In summer the heat is great, and all who have the means betake themselves during that season to Cintra or to the seaside. The following data, deduced from twenty years' observations (1846 to 1875) taken at the Meteorological Observatory, a well-managed institution which stands 835 feet above the level of the sea, will afford the means of judging the climate in its principal features. Mean annual temperature of shade, 60° 27 Fahr., mean annual range, 61° 2, mean daily range, 12° 6; highest and lowest registered during the whole period, 95° 4 and 30° 8. Mean annual quantity of rain, 38.84 inches; greatest and least annual quantity during the period, 38.8 inches (1866) and 17.22 inches (1874). The rainfall of 1876, however, amounted to 45 inches, more than one-third of which fell in the month of December. The mean annual number of days on which rain fell was one hundred and twelve, whilst snow fell only three times during the twenty years. The mean atmospheric moisture (100-saturation) was 70.59. The mean annual height of the barometer was 29.8 inches, and its mean annual range 1.3 inches. The prevailing winds of the winter and autumn are from the north, of the spring and summer from the north-north-west.

History.—The name Lisbon (Portuguese, *Lisboa*) is a modification of the ancient name Olympe, also written Olyssippo under the influence of a mythical story of a city founded by Ulysses in Iberia, which, however, according to Strabo, was placed by ancient tradition rather in the mountains of Thracia than in Iberia. The Romans Olympe became a municipium with the epithet of Felicitas Julia, but was inferior in importance to the less ancient Emerita Augusta (Merida). After the Romans the Goths and the Molesims successively became masters of the town and district. Under the latter the town bore in Arabic the name of Lashib or Chaldish. It was the first point of Molesim Spain attacked by the Normans in the invasion of 844. When Alfonso I. of Portugal took advantage of the decline and fall of the Almoravid dynasty to incorporate the provinces of Estremadura and Alemberg in his new kingdom, Lisbon was the last city of Portugal to fall into his hands, and yielded only after a siege of several months (October 1147), with the aid of English and Flemish crusaders who were on their way to Syria. In 1164 the city was again attacked by the Molesims under the powerful caliph Abu Ya'qub, but the enterprise failed. In the reign of Ferdinand I., the greater part of the town was burned by the Castilian army under Alfonso (1173). Under the reign of the Castilians again besieged Lisbon, but without success. Lisbon became the seat of an archbishop in 1180, the seat of government in 1422. It gained much in wealth and splendour from the maritime enterprises that began with the voyage of Vasco da Gama (1497). The patriarchate dates from 1716. From 1680 to 1640 Lisbon was a provincial town under Spain, and it was from this port that the Spanish Armada sailed in 1588. In 1640 the town was captured by the duke of Braganza, and the independence of the kingdom restored. For many centuries the city had suffered from earthquakes, of more or less violence, but those had been almost forgotten when, on the 1st of November 1755, it was reduced almost in an instant to a heap of ruins. A fire broke out to complete the work of destruction, and between 80,000 and 40,000 persons lost their lives. Pombal, an unscrupulous minister, but a man of great talent, applied himself with unremitting energy both to the protection of the rights of property (for the place was infested by bands of robbers) and to the reconstruction of the buildings. The handsomest part of the present city was erected under his direction, but even to this day there are edifices which speak forcibly of the great earthquake. In 1807 Napoleon proclaimed that the house of Braganza had ceased to reign in Europe, whereupon the regent Don John (the mother the reigning queen Maria I. having become insane) thought it prudent to quit the country for Brazil, and next day a French army under Junot entered the city, possession of which he retained for ten months. He then quietly embarked his army under the protection of the inextinguishable conflagration of Cintra so close at hand as the English general Sir Arthur Wellesley was stricken by yellow fever, and many thousands were carried off before the plague was stayed. Lisbon boasts of having been the birthplace of St Anthony, surnamed of Padua, of Camoens, the national epic poet (to whose honour a bronze statue has been placed in one of the squares), and of Pombal (see XXI.).

LISBURN, a market-town, cathedral city, and municipal and parliamentary borough of Ulster, Ireland, partly in Antrim and partly in Down, is situated in a beautiful and fertile district on the Lagan, and on the Ulster Railway, 8 miles south-south-west of Belfast. It is substantially built, and consists principally of one long and irregular street, in the centre of which there is a large open space for the market. The parish church, which possesses a fine

octagonal tower, is the cathedral church of the united dioceses of Down, Connor, and Dromore, and contains a monument to Jeremy Taylor, who was bishop of the see. Among other buildings are the court-house, the market-house, the linen-hall, and the county infirmary. There are a number of charitable foundations. The staple manufacture of the town is linen, specially damasks and muslins. There are also bleaching and dyeing works. The population in 1871 was 9326, and in 1881 it was 10,834.

In the reign of James I. Lismur, which was then known as Lismagarry, was only an inconspicuous village, but in 1527 it was granted by Charles I. to Viscount Conway, who erected the castle for his residence, and laid the foundation of the prosperity of the town by the introduction of English and Welsh settlers. In November 1641 the town was taken by the insurgents, who on the approach of superior numbers set fire to it. The troops of Cromwell gained a victory near the town in 1649, and the castle surrendered to them in 1650. The church was constituted a cathedral by Charles II., from whom the town received the privilege of returning two members to parliament, but since the Union it has returned only one.

LISIEUX, capital of an arrondissement in the department of Calvados, France, 113 miles by rail west-north-west from Paris, and 24 miles as the crow flies east from Caen, is prettily situated on the Touques, at the point where it is joined by the Orbiquet, 24 miles above Trouville. The Paris and Caen Railway has a branch from Lisieux to Honfleur and Trouville, and another to Orbec. The cathedral church, dedicated to St Peter, founded about 1045, and finished in 1233, which has recently been restored, is the most interesting specimen to be found in Normandy of the transition from the Roman to the Ogival style. It is 360 feet in length, 90 in breadth, and 55 in height; the south tower rises to 230 feet. The nave is remarkable for harmony of proportion, purity of design, and unity of style. The church of St Jacques, built at the end of the 15th century, contains some beautiful glass of the Renaissance, some remarkable woodwork and old frescoes, and a curious picture on wood, restored in 1681. The old episcopal palace (Lisieux ceased to be a bishopric in 1801) near the cathedral is now used as a court-house and prison. In the court-house is a beautiful hall called the Salle Dorée. The town still retains quaint examples of the wooden houses of the 14th, 15th, and 16th centuries; and there are some elegant modern villas. It also possesses a charming public garden and a small museum. The confluence of the two rivers renders it subject to disastrous inundations; but its commerce and industry cause it, notwithstanding, to rank among the richest towns of Normandy. There is a large cattle trade, and the arrondissement has nearly three hundred factories, employing about ten thousand workmen in the manufacture of cloth and crotches. Connected with this industry are numerous spinning-mills, bleaching-fields, and dye-works; and there are besides wool-mills, chemical works, tanneries, saw-mills, and the like, which bring up the trade of Lisieux to an annual aggregate of upwards of 50 million francs. The population in 1876 was 18,400.

In the time of Caesar, Lisieux, by the name of *Noviomagus*, was the capital of the Lexovii. Though destroyed by the barbarians, by the 6th century it had become one of the most important towns of Neustria. In 680 it was sold to date from the 8th or 9th century. In 877 it was pillaged by the Normans, and in 911 we find it included in the duchy by the treaty of St. Clair-sur-Epte. Civil authority was exercised by the bishop as count of the town. In 1136 Geoffrey Plantagenet laid siege to Lisieux, which had taken the side of Stephen of Blois. The war lasted five years, and reduced Lisieux and its neighbourhood to the direst extremities of famine. In 1155 the marriage of Henry II. of England to Eleanor of Guienne, which added so largely to his dominions, was celebrated in the cathedral. Thomas à Becket took refuge here, and some vestments used by him are still shown in the hospital chapel. Taken by Philip Augustus and reunited to France in 1200, the town was a frequent subject of dispute between the contending parties during the Hundred Years' War, the religious wars, and those of the League.

Among the bishops of Lisieux may be mentioned Nicholas Oresme, who died in 1382, and Pierre Cauchon, the judge of Jean of Arc, who occupied this see after he had been driven from that of Beauvais.

LISKEARD, anciently LISCARRETT, a market-town and municipal and parliamentary borough in the county of Cornwall, England, is picturesquely situated, partly in a hollow and partly on a rocky eminence, 12 miles east of Bodmin, and 265 west-south-west of London by rail. The church of St Martin, in the Perpendicular style, with a tower of earlier date which possesses a Norman arch, is the largest ecclesiastical building in the county, except the church of Bodmin. A town-hall in the Italian style was erected in 1859. A grammar school was founded at a very early period, and there are several other schools and charities. There are manufactures of leather, but the prosperity of the town is dependent chiefly on agriculture, and the neighbouring tin, lead, and copper mines. Liskeard returns one member to parliament. It received its first charter in 1240, from Richard, earl of Cornwall, brother of Henry III., but its principal charter in 1586, from Queen Elizabeth. The population of the municipal borough (area 810 acres) in 1871 was 4700, and in 1881 it was 4478, that of the parliamentary borough (area 8387 acres) in the same years being 6576 and 5591.

LISLE, JOSEPH NICOLAS DU (1698-1768), astronomer, was born at Paris on April 4, 1698, and was educated at the Collège Mazarin. His devotion to astronomy dates from 1706, in which year he carefully observed an eclipse of the sun. In 1714 he was admitted to the Academy of Sciences, and in 1720 he made the proposals for determining the figure of the earth, which were carried out under the auspices of that body some years afterwards. In 1724 De Lisle visited England, where, through Newton and Halley, he was received into the Royal Society, and in 1726 he accepted an invitation from Catherine I. to the chair of astronomy in the Imperial Academy of Sciences at St Petersburg. In 1747 he returned to Paris, and was allowed a very imperfect observatory in the Hôtel Clugny, where Messier and Lalande were among his pupils. In 1753, previous to the transit of Mercury, he published a map of the world representing the effect of that planet's parallaxes in different countries, and in 1754 he was made geographical astronomer to the naval department. In 1762 he resigned in favour of Lalande, and withdrew to the abbey of Sainte Geneviève, where he died of apoplexy on September 11, 1768.

Besides numerous papers contributed to the *Transactions* of the Académie de Paris, Berlin, and St Petersburg, he wrote *Mémoires pour servir à l'histoire et aux progrès de l'astronomie, de la géographie, et de la physique* (St Petersburg, 1738), *Séances et communications, ad années 1784, 1788, et années précédentes 1789* (Berlin, 1784), and *Mémoires sur les nouvelles découvertes au nord de la mer du Sud* (Paris, 1762-58). See *Astronomy*, vol. ii p. 757.

LISMORE, an island of 9600 acres, about 10 miles long and averaging 1½ miles broad, with a population in 1881 of 630, lying south-west and north-east at the entrance of the Linnhe Loch in Argyllshire, Scotland. The name means the great enclosure (whether "garden," as the Scotch, or "fort," as the Irish authorities suppose, is uncertain), and occurs in Ireland in the Waterford Lismore and ten other places. "Lis" is one of the most frequent words in compound Irish names, there being one thousand four hundred townlands or villages which begin with it. A Columban monastery was founded there by St Moluag about 593 (Reeves, *Adamnan*, p. 34), whose bell is perhaps that found in 1814 at Kilnichol Glassary,¹ and whose crozier or staff is in the possession of the duke of

Argyll.² About 1200 the see of Argyll was separated from Dunkeld by Bishop John "the Englishman," and Lismore soon after became the seat of the bishop of Argyll, sometimes called "Episcopus Lismoriensis" (Skene, *Celtic Scotland*, n. p. 408 *sq.*), quite distinct from the bishop of the Isles (Sudreys and Isle of Man), called "Episcopus Sodorienus" or "Insularum," whose see was divided into the English bishopric of Sodor and Man and the Scottish bishopric of the Isles in the 14th century (Keith's *Catalogue*, p. 173). The monastic establishment of Lismore, at one time consisting of Culdees (Reeves, *Culdees*, p. 49), was converted into a chapter of canons regular and a dean, whose right to elect the bishop was recognized as early as 1249 (Baluze, *Miscel.*, vii p. 442; *Orig. Paroch. Scot.*, ii. pt. 1, p. 181).

Lismore has an accidental celebrity from the *Book of the Dean of Lismore*, a MS. collection of poems, Gaelic and English, made by James M'Gregor, vicar of Fortingall and dean of Lismore (1614-61). A selection of the Gaelic poems, with translations by Rev. T. M'Lauchlan, and introduction by Mr W. F. Skene, published 1862, is of value both for the language and the contents. The language is the Gaelic of the West Highlands, spelt phonetically, as spoken in the beginning of the 16th century, and its variations from ancient Irish on the one hand and modern Gaelic on the other are of much interest to Celtic scholars. Its contents are Ossianic fragments, some of Irish, others of Scotch origin, and a few more recent Gaelic verses. The publication of this work, and J. F. Campbell of Inverary's collection from oral sources of the existing traditional Gaelic poetry, have for the first time given a genuine historical solution of the Ossianic problem (see *Ossian*). There are remains of three castles on Lismore—at Turefort a fort of two concentric circles of dry stones, supposed to be Norse or Danish; at Achdundun a square keep with walls 40 feet high, believed to be the palace of the bishop; and on the west end of the island Castle Corrin, mentioned in a grant to Campbell of Glenmuiray in 1470 (*Orig. Feud. Sc.*, n. p. 109).

LISMORE, a market-town and seat of a diocese, partly in Cork but chiefly in Waterford, Ireland, is beautifully situated on a steep eminence rising abruptly from the Blackwater, 40 miles west-south-west of Waterford. At the verge of the rock on the western side is the old baronial castle, erected by King John in 1185, which was the residence of the bishops till the 16th century. It was besieged in 1641 and 1643, and in 1645 it was partly destroyed by fire. To the east, on the summit of the height, is the cathedral of St Carthage, erected in 1663 by the earl of Cork, in the Later English style, with a square tower surmounted by a tapering spire. There are a grammar school, a free school, and a number of charities. Some trade is carried on by means of the river, and there is a salmon fishery. The population of the town in 1871 was 1945.

The original name of Lismore was Magheasteth. Its present name was derived from a monastery, founded by St Carthage in 683, which became so celebrated as a seat of learning that it is said no less than twenty churches were erected in its vicinity. In the 9th and beginning of the 10th centuries the town was repeatedly plundered by the Danes, and in 978 the town and abbey were burned by the Ossianians. Henry II., after landing at Waterford, recaptured in Lismore castle the allegiance of the archbishops and bishops of Ireland. In 1518 the manor was granted to Sir Walter Raleigh, from whom it passed to Sir Richard Boyle, afterwards earl of Cork. From the earl of Cork it descended by marriage to the duke of Devonshire. It was incorporated as a municipal borough in the time of Charles I., when it also received the privilege of returning members to parliament, but at the Union it was disfranchised, and also ceased to exercise its municipal functions. Lismore is the birthplace of Robert Boyle, but its claim to be the birthplace of Congress does not rest on a sufficient foundation.

LISSA (in Polish, *Lesna*), a manufacturing town in the circle of Fraustadt, district of Posen, Prussia, is situated on the Breslau and Posen Railway, near the frontier of Silesia. The most prominent buildings are the handsome château, the mediæval town-house, the three churches, and the synagogue. Its manufactures consist chiefly of cloth, liqueurs, tobacco, and wax; it also

¹ Anderson, *Scotland in Early Christian Times*, 1st ser., p. 206, where it is figured.

² See *Orig. Paroch. Scot.*, where it is figured.

possesses several tanneries and a large steam flour-mill, and carries on a brisk trade in grain, cattle, spirits, wine, and furs. The population in 1880 was 11,758, including 3810 Roman Catholics and 1839 Jews.

Lissa owes its origin to a number of Moravian Brothers from Bohemia, who were banished by the emperor Ferdinand I in the 16th century, and found a refuge on the estate of the Polish family of Łęczyński. Their settlement received municipal rights in 1546. During the Thirty Years' War the population was reinforced by other refugees, and Lissa became an important commercial town, and the chief seat of the Moravian Brothers in Poland. COZZIUS (q.v.) was first rector of the celebrated Moravian school there. Lissa was twice burned down (in 1666 and 1707) during the Swedish and Polish wars.

LISSA (Lat., *Lissa*, Slav, *Vše*), an Austrian island in the Adriatic, 9 miles long, with a greatest breadth of 4 miles, is situated 41 miles from the coast of southern Dalmatia, almost due west of the mouth of the Neretva, in 43° 1' N. lat. and 16° 6' E. long. "The shape is one of the finest harbours of refuge in the Adriatic" on the eastern short side, and the Vallone di Comisa contained between two long prongs stretching due west and south-west. The outer walls are stony ridges rising from 470 to 610 feet above sea-level, and declining quaquaversally to the fertile plateau which, averaging 400 feet high, forms the body of the island. The apex is Monte Hum, a bald and flattened cone (1868 feet) on the south-west" (Burton). Wine-growing (for which Lissa was famous of old) still forms the principal means of subsistence, an average season yielding from 70,000 to 80,000 barrels; but the sardine fishery (15,000 to 25,000 barrels per annum) is of growing importance, and the peasants distil about 24,000 lb of rosemary oil annually. The island is divided into two communes, Lissa and Comisa. In the former is the chief town, Lissa, with the palace of the old Venetian counts Gariboldi, the former residence of the English governor, the monastery of the Minorites, and at a little distance to the west the ruins of the ancient city of Issa. The population, 6485 in 1869, was 7871 in 1880.

Lissa is said to have been settled by people from Lesbos, the Issa of the *Ægean*. The Patene, assisted by Dionysius the Elder of Syracuse, introduced a colony in the 4th century B.C. During the First Punic War the Issians with their beaked ships helped the Roman Daulias, and the great republic, having defeated their island against the attacks of Agron of Illyria and his queen Teuta, again found them faithful and serviceable allies in the war with Philip of Macedon. As early as 996 we find the Venetians in possession of the island, and, though they retired for a time before the Ragusians, their power was effectually established in 1278. Velo Solo, which by that time had become the chief settlement, was destroyed by Ferdinand of Naples in 1488, and by the Turks in 1671. The present city arose shortly afterwards. During the Napoleonic wars Lissa was occupied by the French, but the English defeated their squadron in 1810, and kept possession of the island till July 1815, evicting the French (disarmed in 1870) and making it a centre of operations. In 1866 the Italians under Persano made an attack on Lissa, but were defeated by the Austrians under Tegethoff—the battle being fought about 10 miles north of the harbour.

See WILKINSON (1848), NISSE (1861); BRECKENRIDGE, in the *Times*, August 14, 1866; *Revue marit.*, & col., 1867, and Burton in *Journ. Roy. Geog. Soc.*, 1879.

LISTON, JOHN (1776–1846), comedian, was the son of a watchmaker in Soho, London, where he was born in 1776. While the teacher of a day school near Leicester Square, he began to take part in private theatricals, and soon conceived a passion for the stage. He made his debut at a small theatre in the Strand, and shortly afterwards obtained an engagement at Dublin theatre, where, although he adopted tragedy as his role, his natural talent for acting attracted the attention of Stephen Kemble, who engaged him for his theatre at Newcastle-on-Tyne. Discovering accidentally that his forte was not tragedy but comedy, Liston displayed in his personation of old men and country boys a fund of drollery and humour which proved irresistible. An introduction to Charles Kemble led to his

appearance at the Haymarket in 1805 as Zerkel Homespun, and from this time he occupied an unrivalled position in his own line of performance, his broad humour being tempered by true artistic finish, while he possessed an original power of creation which, with his boundless facility in the elaboration of absurdities, filled up meagre and commonplace outlines with the characteristics of vivid individuality. Paul Pry, first represented in 1825, and always his most popular part, soon became to many a real personage. Liston played successively at Covent Garden, Drury Lane, and the Olympic, and remained on the stage till almost the close of his life. He died March 22, 1846.

LISTON, ROBERT (1794–1847), an eminent Scottish surgeon, was born on the 28th of October 1794, at Ecclefechan, where his father was parish minister. He commenced the study of anatomy under Dr Barclay in Edinburgh University in 1810, and soon became a skilful anatomist. After eight years' study, he began his career as a lecturer on anatomy and surgery in the Edinburgh School of Medicine; and in 1827 he was elected one of the surgeons to the Royal Infirmary. In 1835 he was invited to fill the chair of clinical surgery in University College, London. He held the appointment until his death, on the 7th of December 1847. Liston was a teacher more by what he did than by what he said. He taught simplicity in all operative procedures, fertile in expedients, of great nerve, and of powerful frame, his name is remembered at the present day as a bold and rapid operator. He inspired all around with confidence, and every one present at his operations felt that the knife in his hands, however rapidly he worked, was guided with skill founded upon knowledge. He was the author of *The Elements of Surgery and Practical Surgery*, and made several improvements in methods of amputation, and in the dressing of wounds.

LITANY. This word (*litaneia*), like *λητή* (both from *litaein*), is used by Eusebius and Chrysostom, most commonly in the plural, in a quite general sense, to denote a prayer, or prayers, of any sort whatever, whether public or private; it is similarly employed in the law of Arcadius (*Cod. Theod.*, xvi. tit. 5, leg. 30), which forbids heretics to hold assemblies in the city "ad litaneia faciendam." But some trace of a more technical meaning is found in the epistle (*Ep.* 63) of Basil to the church of Neocaesarea, in which he argues, against those who were objecting to certain innovations, that neither were "Litaneia" used in the time of Gregory Thaumaturgus. The nature of the recently introduced litaneia, which must be assumed to have been practised at Neocaesarea in Basil's day, can only be vaguely conjectured; probably they had many points in common with the "rogations," which, according to Sidonius Apollinaris, had been gradually coming into occasional use in France about the beginning of the 5th century, especially when rain or fine weather was desired, and which, so far as the three fast days before Ascension were concerned, were first definitely fixed, for one particular district at least, by Mamertus or Mamerus of Vienne (c. 460 A.D.). We gather that they were penitential and intercessory prayers offered by the community while going about in procession, fasting, and clothed in sackcloth. Sidonius alludes to the incongruity of men going "castorinati ad litaneia." In the following century the manner of making litaneia (litaneia facere) was to some extent regulated for the entire Eastern empire by one of the *Novels* of Justinian, which forbade their celebration without the presence of the bishops and clergy, and ordered that the crosses (which were carried about in procession) should not be deposited elsewhere than in churches, nor be carried by any but such persons as were duly appointed to do so. The first synod of Orleans (511 A.D.) in its twenty-seventh canon enjoins

for all Gaul that the "litanies" before Ascension be celebrated for three days; on these days all menials are to be exempt from work, so that every one may be free to attend divine service. The diet is to be the same as in Quadragesima; clerks not observing these rogations are to be punished by the bishop. In 617 A.D. the synod of Gerunda provided for two sets of "litanies"; the first was to be observed for three days (from Thursday to Saturday) in the week after Pentecost with fasting, the second for three days from November 1. A synod of Paris (573) in its tenth canon ordered litanies to be held for three days at the beginning of Lent, and the fifth synod of Toledo (636) appointed litanies to be observed throughout the kingdom for three whole days from December 14. The first mention of the word *litany* in connexion with the Roman Church goes back to the pontificate of Pelagius I. (555), but implies that the thing was at that time already old. In 590 Gregory I., moved by the pestilence which had followed an inundation, ordered a "litania septiformis," that is to say, a sevenfold procession of clergy, laity, monks, virgins, matrons, widows, poor, and children. He is said also to have appointed the processions or litanies of April 25 (St. Mark's day), which seem to have come in the place of the ceremonies of the old Robigalia. In 747 the synod of Cloveshoe (can. 16 and 17) ordered the litanies or rogations to be gone about by all the clergy and people with great reverence,—on April 25 "after the manner of the Roman Church," and on the three days before Ascension "after the manner of our ancestors." The latter are still known in the English Church as Rogation Days. Games, horse racing, junketings were forbidden, and in the litanies the name of Augustine was to be inserted after that of Gregory. The reforming synod of Mainz in 813 ordered the major litany to be observed by all for three days, not with horses or in magnificent attire, but in sackcloth and ashes, and barefoot. The sick only were exempted from this command.

As regards the form of words prescribed for use in these "litanies" or "supplications," documentary evidence is somewhat defective. Sometimes it would appear that the "procession" or "litany" did nothing else but chant "Kyrie eleison" without variation. There is no reason to doubt that from an early period the special written litanies of the various churches all showed the common features which are now regarded as essential to a litany, in as far as they consisted of (1) invocations, (2) deprecations, (3) intercessions, (4) supplications. But in details they must have varied immensely. The offices of the Roman Catholic Church at present recognize two litanies, the "Litanie majores" and the "Litanie breves," which differ from one another chiefly in respect of the fulness with which details are entered upon under each of the four heads mentioned above. It is said that in the time of Charlemagne the angels Orithel, Raguel, Tobiel were invoked, but the names were removed by Pope Zacharias as really belonging to demons. In some medieval litanies there were special invocations of S. Sapientia, S. Fides, S. Spes, S. Charitas. The major litanies, as given in the Breviary, are at present appointed to be recited on bended knees, along with the penitential psalms, in all the six week days of Lent when ordinary service is held. Without the psalms they are said on the feast of Saint Mark and on the three rogation days. They are also chanted in procession before mass on Holy Saturday. The "litany" or "general supplication" of the Church of England, which is appointed "to be sung or said after morning prayer upon Sundays, Wednesdays, and Fridays, and at other times when it shall be commanded by the ordinary," closely follows the "Litanie majores" of the Breviary, the invocations of saints being of course omitted. A very similar German litany will be found in

the works of Luther. In the Roman Church there are a number of special litanies peculiar to particular localities or orders, such as the "Litanies of Mary" or the "Litanies of the Sacred Name of Jesus."

LITHGOW, WILLIAM (c. 1583–c. 1660), a noted Scottish traveller, was born in Lanark, where his father was a bargess, possessed of considerable horthable property. The date generally assigned to his birth is 1583, and he was educated at the grammar school of his native town, then celebrated as a seminary of learning. His natural disposition was probably active and restless, as even in his boyhood he tells us that he made voyages to both the Orkneys and the Shetlands, and somewhat later travelled through the Low Countries, Germany, Bohemia, and Switzerland. The final impelling cause of his leaving Scotland, however, appears to have been some savage outrage committed either upon himself or on one nearly connected with him, arising, it is thought, from some love affair, which gave him an intolerable disgust to home. He left his native country about 1608 or 1609, and proceeded to Paris, where he remained ten months, and then crossed the Alps to Rome and Naples; after which he wandered through Istria, Dalmatia, Albania, Greece, Asia Minor, Syria, Mesopotamia, Palestine, and Egypt, most of his journey having been performed on foot. In the course of his travels he escaped innumerable dangers from robbers, and hardships from exposure to inclement weather. He returned to England by Sicily and Paris. Another tour which he made lay through Morocco, Algiers, Tunis, Tripoli, Hungary, Germany, and Poland. On his arrival in London he became an object of interest to King James, who, on the spirit of travel again returning upon him, furnished him with commendatory letters to all kings, princes, dukes, &c., whose territories he might desire to visit. In 1619, accordingly, he went over to France, and thence passed through Portugal and Spain as far as Malaga. There he was apprehended as a spy, and after suffering the most excruciating torture, first in prison and afterwards in the Inquisition, he was at length released on the interference of the English consul, and allowed to return to England in 1621. The minute description which he gives of the terrible torture to which he was subjected is almost unequalled for horror, and, when he arrived in London, he had the appearance of a man more dead than alive. He was carried on a feather bed to Theobald's in order that King James might be an eyewitness of what he called his "martyred anatomy." The whole court crowded to see him. The king commanded that the greatest care should be taken of him, and he was twice sent to Bath at his Majesty's expense. On recovering his health, he was desired by James to apply to Gondomar, the Spanish ambassador, for recovery of the money and other valuables of which he had been plundered by the governor of Malaga, and for a thousand pounds in reparation of his injuries. Gondomar gave fair promises that all his demands should be granted, but nothing was done. Whereupon, having met the ambassador at the royal levee, and reproached him with his perfidy, after high words on both sides, Lithgow furiously assailed him with his fists, in the presence of the king, the imperial ambassador, and the knights and gentlemen of the court. This, of course, was an offence which could not be passed over, and, though his boldness was generally commended, he had to suffer an imprisonment of nine weeks in the Marshalsea. His latter years are understood to have been spent in his native town, and he is said to have died somewhere about 1660.

A portion of his travels appeared in a small volume in London in 1614, but the complete work was not published till 1682. It has been repeatedly reprinted. It was also translated into Dutch and published at Amsterdam in his lifetime. His other works are—*An Account of the Siege of Breida* (1687) at which he had been

present; *A Survey of London and England's State, 1645*. *Relation of the Steps of Newcastle, 1645*. His posthumous remains, collected by James Maidment, were published at Edinburgh in 1863.

LITHIUM, one of the rarer metallic elements, intermediate in its character between sodium and barium. It was discovered in 1817 by Arfvedson in the course of an analysis of petalite in Berzelius's laboratory. He recognized the presence in this mineral of a new kind of alkali, which his master subsequently named "lithium," to denote its mineral origin. Lithium, though widely disseminated throughout the mineral world—traces of it being found in almost all alkaliferous minerals, in the soils derived from these, and in many mineral waters—nowhere occurs in any abundance, except in the immense masses of lithia-mica (lepidolite) known to exist in Bohemia. Of other lithia-minerals (all rare) we may name petalite and spodumene (both silicates of alumina and alkalies) and triphylite, a mixed phosphate of ferrous, manganous, and lithium oxides. Only lepidolite comes into consideration as a raw material for the preparation of lithia and its salts. But the extraction from it of pure lithia in any form is difficult. The first step is the disintegration of the finely powdered mineral, which may be effected by means of nitric and hydrofluoric acid (or vitriol and fluor-spar); the silicon goes off as gaseous fluoride, the bases remain as sulphates. Or else we may mix the mineral intimately with quicklime, and by very intense heating of the mixture produce a more highly basic silicate, which is readily disintegratable by acids. In either case it is added to unite all the bases (Al_2O_3 , Fe_2O_3 , CaO , MgO , Li_2O , K_2O , Na_2O) into a solution of chlorides or sulphates. From it we precipitate successively and remove by filtration (1) the bases not alkalies or Li_2O by means of excess of milk of lime, and (2) the lime introduced by operation (1) by means of carbonate of ammonia. There results a mixed solution of potash, soda, lithia, and ammoniac salt, from which the last-named component is easily removed by evaporation to dryness and ignition. For these very tedious operations Troost has substituted an elegant process which, though admittedly imperfect in the analytic sense, lends itself admirably to manufacturing purposes. He mixes ten parts of the finely powdered mineral with ten parts of carbonate of baryta, five parts of sulphate of baryta, and three parts of sulphate of potash, and melts down the mixture in a powerful wind-furnace. There results a mass which separates spontaneously into a lower layer forming a transparent glass, and an upper one consisting of the sulphates of barium, potassium (sodium), and lithium, the latter representing about three-fourths of the lithia contained in the mineral. By treatment with water the sulphate of baryta is easily removed as an insoluble residue; the mixed alkaline sulphates are converted into chlorides by decomposition with chloride of barium, and from the dry mixed chlorides approximately pure chloride of lithium is obtained by lixiviation with ether-alcohol, which solvent dissolves only very small proportions of the other chlorides. To purify the crude chloride it is dissolved in water and, by double decomposition with carbonate of soda, converted into a precipitate of carbonate of lithia, Li_2CO_3 , which must be washed with small instalments of water, as it is very appreciably soluble in water. This carbonate of lithia is still contaminated with soda. To purify it fully dissolve it in water with the help of carbonic acid, filter, and evaporate slowly on a water-bath; the added carbonic acid goes off, and pure carbonate of lithia separates out in crystalline crusts (Troost). One liure of pure water dissolves 12 grammes; 1 litre of water kept saturated with carbonate lithia dissolves 52.5 grammes of the carbonate. The dry salt fuses at a red heat, but before cooling it shows no of its carbonic acid, which, after cooling, it shows no

tendency to take up again from the atmosphere. Perfectly acid-free lithia, Li_2O , can be obtained by heating a mixture of the carbonate and pure charcoal in a platinum crucible, or by heating the nitrate for a long time in a silver one. If the preparation, ultimately, of the hydrate $Li_2O.H_2O = 2LiOH$ is contemplated, the latter operation may be very materially shortened by addition of metallic copper, which reduces the nitric acid. The anhydrous oxide, when treated with water, dissolves without much evolution of heat as hydrate, $LiOH$, which, by evaporation (in silver) is easily obtained in the solid form. It melts at a dull red heat, but at even higher temperatures loses no water. It dissolves in water (far less abundantly than soda), with formation of a strongly alkaline solution, which neutralizes all acids, with formation of salts. Like baryta, it refuses to form acid sulphates or carbonates (the bodies $HLiSO_4$ and $HLiCO_3$ exist only in solution), and forms insoluble or almost insoluble salts with carbonic and phosphoric acids (formulas Li_2CO_3 and Li_2PO_4); and, last not least, it is not reducible to metal by charcoal at any temperature. Add to this that the highly deliquescent chloride $LiCl$, when dehydrated by heating, always loses part of its chlorine as HCl , and we feel tempted to conclude that in the case of lithium, as in that of barium or magnesium, two equivalents are united into one atom $Li = Li_2 = 14$. But the specific heat of the metal demands the lesser number.¹

Metalline Lithium, although long before known to exist, was successfully prepared for the first time in 1855, by Bunsen. He obtained it by fusing the pure chloride in a porcelain crucible, and decomposing the fused salt by a battery of four or six "Bunsens," using a rod of retort charcoal as a positive and a knitting wire as a negative pole. The metal separates out in about pea-sized globules, which stick to the wire, and, thanks to the protecting action of the fused chloride, can be lifted out and collected without reoxidation, under rock-oil. Lithium is a silver-white metal, of only .68 specific gravity (it floats on rock-oil), somewhat softer than lead, and like it susceptible of being pressed into wire. It tarnishes in air, though far less readily than sodium. When thrown upon water it gradually dissolves as hydrate, with evolution of hydrogen, but without fusing. The metal melts at $180^\circ C$, and at a somewhat higher temperature takes fire and burns into oxide with a brilliant white flame. Hence the characteristic intensely red colour which a colourless gas flame assumes when a lithium salt is volatilized in it must be a property of something else than the metal itself; perhaps it is the hydroxide $LiOH$ that emits it. The red lithium flame forms a spectrum consisting chiefly of one brilliant red and a somewhat faint orange line.

Lithia-salt solutions behave to general reagents pretty much like those of potash or soda, from which, however, they differ in the following points—(1) concentrated solutions are precipitated by carbonate of potash or soda; (2) even dilute solutions when mixed with phosphate of soda and caustic soda, in the heat more readily, give precipitates of the phosphate PO_4Li_3 , soluble in 2040 parts of plain, and in 8900 parts of ammoniac water, more largely in solutions of ammoniac salts; (3) unlike potassium salts, they give no precipitate with chloride of platinum. (W. D.)

LITHOGRAPHY. The principle upon which the art of lithography is based is very simple—the antagonistic qualities of grease and water. An unctuous composition is made to adhere to a peculiar kind of limestone; the parts thus covered acquire the power of receiving printing ink; the other parts are prevented from receiving it by the interposition of a film of water; and then by pressing paper strongly upon the stone impressions are obtained. There are two distinct branches in lithography—drawing and printing. Those practising the first are known as lithographic draughtsmen or writers, the second as lithographic printers.

The art of lithography was discovered by Alois Senefelder, a native of Prague, born 6th November 1771. His father, Peter Senefelder, was one of the performers of

¹ Lithia oxide and carbonate were long supposed to exert a characteristically powerful corrosive action on platinum vessels used for their fusion. This, according to Troost, holds only for such preparations as are contaminated with rubidia or caesia. The pure lithia compounds, even the oxide (and hydrate), do not attack platinum.

the Theatre Royal at Munich. The son Alois wished to follow the same profession, but, his father being opposed to this, he went to the university of Ingolstadt, and devoted himself to the study of jurisprudence. Owing to the death of his father shortly afterwards, he was unable to continue his studies at the university, and, yielding to his old inclination, he tried to support himself as a performer and author, but without success. In order to accelerate the publication of one of his works, he frequently spent whole days in the printing office, and thus became acquainted with all the particulars of the process of printing. It appeared so simple that he conceived the idea of purchasing a small printing press, thus enabling himself to print and publish his own compositions; but his means were inadequate, and to this circumstance we probably owe the invention of lithography. Unable to pay for the engraving of his compositions, he attempted to engrave them himself. He tried numerous experiments with little success; tools and skill were alike wanting. Copper-plates were expensive, and the want of a sufficient number entailed the tedious process of grinding and polishing afresh those he had used. About this period his attention was accidentally directed to a fine piece of Kollheim stone which he had purchased for the purpose of grinding his ink. His first idea was to use it merely for practice in his exercises in writing backwards, the ease with which the stone could be ground and polished afresh being the chief inducement. The idea of being able to take impressions from the stone had not yet occurred to him. While he was engaged one day in polishing a stone slab on which to continue his exercises, his mother entered the room and desired him to write her a bill for the washer-woman, who was waiting for the linen. Neither paper nor ink being at hand, the bill was written on the stone he had just polished. The ink used was composed of wax, soap, and lamp-black. Some time afterwards, when about to wipe the writing from the stone, the idea all at once struck him to try the effect of biting the stone with aqua fortis. If the parts written on resisted its action, impressions might then be taken in the same way as from wood engravings. Surrounding the stone with a border of wax, he covered its surface with a mixture of one part of aqua fortis and ten parts of water. The result of the experiment was that at the end of five minutes he found the writing elevated about the tenth part of a line ($\frac{1}{10}$ inch). He then proceeded to apply the printing ink to the stone, using at first a common printer's ball, but soon found that a thin piece of board covered with fine cloth answered better, communicating the ink more equally. He was able to take satisfactory impressions, and, the method of printing being new, he hoped to obtain a patent for it, or even some assistance from the Government. For years Sensfelder continued his experiments, until the art not only became simplified, but reached a high degree of excellence in his hands. In later years the king of Bavaria settled a handsome pension on Sensfelder. He died at Munich in 1834, having lived to see his invention brought to comparative perfection.

Materials Employed by the Lithographic Artist.—Lithographic stones are very compact homogeneous limestones, imported chiefly from Germany. The traffic has its centre in the village of Solenhofen, in the district of Monheim. The Solenhofen stone, in its chemical decomposition, consists of lime and carbonic acid. It is generally cut in slabs from 2 to 3 inches in thickness, and is sold by weight. Stones yielding impressions in the lithographic press have been found in England, France, Italy, Canada, and the West Indies; but all are much inferior to the best German stones. Lithographic stones vary in colour from a dull grey or yellow to a light creamy shade, the dark

grey stones being the hardest. They are sometimes uneven in colour, having light and dark patches. These are suitable for ordinary transfer work; but, in cases where the artist requires to see the effect he is producing during progress (as in chalk drawing), stones of an even grey or drab colour should be selected.

Lithographic ink is composed of tallow (4 oz.), wax (5 oz.), soap (4 oz.), shellac (3 oz.), and *quant. suff.* of fine Paris black. The inks of Lemercier and Vanhymbeek are generally considered as among the best. Lithographic chalk is made in the same manner as the ink, but requires to be burnt sufficiently hard for use in drawing. Excellent lithographic crayons are manufactured by Lemercier of Paris. They are made of several degrees of hardness, copal chalk, used for outlining, being the hardest.

Transfer paper for writing and drawing is prepared by coating the surface of the paper with a composition of size, made from parchment cuttings and flake white. Sometimes the coating is composed of starch and glue. Colouring matter, generally gamboge, is added, the object being to show more readily which is the coated side of the paper. The coating is applied with a flat brush. For writing, the paper used is thin, for drawing it is thicker; for large subjects ordinary drawing paper is used. It is afterwards glazed by being pulled through the lithographic press, face down, on a smooth stone, or hot pressed. There are several other varieties of transfer papers—a transparent or tracing paper, and a transfer paper for chalk drawing, having a finely granulated surface. Mr Nelson of Edinburgh patented a method of graining transfer paper by means of stippled plates. The older method was to press the coated surface of the paper on an ordinary sand-grained stone or plate.

Instruments and Appliances used in Lithographic Drawing and Writing.—For the finer purposes of lithography ordinary steel pens are useless; "Perry's lithographic pen" may be found serviceable when the work is not very delicate. Transfer writers prefer pens of their own making. These are either made from quills scraped down, before cutting, with a piece of broken glass, until the barrel yields to pressure of the nail, or cut with a pair of sharp scissors from thin sheets of steel prepared for the purpose. This operation is difficult, and requires much skill and practice. Pens are also made of watch springs, reduced to the necessary tenuity by nitric acid and water.

Lithographic brushes are made from red sable crowquill pencils; a portion of the hair is cut away all round, and only the central part of the brush is used.

Scrapers are employed in correcting the work upon stone, but a penknife or ordinary erasing knife answers the purpose equally well.

Crayon holders of the ordinary kind may be used for lithographic chalk. When cut in two and fitted with a wooden handle, they will be found lighter and pleasanter to work with.

The hand-board is a piece of wood about 6 inches wide, three-eighths of an inch thick, and somewhat longer than the stone on which the draughtsman works. It rests upon thick strips of millboard fixed round the edges of the stone, to keep it from touching the part to be drawn on.

Ruling and circle pens, parallel rulers, tracing paper, a tracing point, and red tracing paper, for transferring tracings to paper or stone, are also requisites.

Drawing on Stone—The Chalk Method.—For artistic purposes this is perhaps the most important and interesting department of lithography. In preparing the stone for chalk drawing, the surface, instead of being polished, is broken up into minute points or "grained." The coarseness or fineness of the grain is varied according to the work to be done. A hard stone, free from veins, marks, and chalk

spots, and of a clear grey colour, is selected. It is first ground and pumiced to free it from scratches. A small quantity of the finest gravel sand, or "graining sand," is sprinkled over the surface, and a few drops of water added; a smaller stone of the same size and hardness is placed above, face downwards, and moved about with a circular motion, water is added from time to time, and fresh sand when needed. Care must be taken that no scratches are caused by grains of coarser sand finding their way to the stone; the stone is afterwards washed in clean water and dried, and the grain tested with a crayon. If it prove too coarse or too fine, or if scratches are discovered, the graining is done over again.

The drawing is then traced upon the stone. As it has to be reversed, the tracing is fastened face downwards, red tracing paper is introduced between, and the outline carefully gone over with a steel tracing point or a hard pencil. The tracing papers are then removed, and the surface of the stone protected with a sheet of plain paper. The hand-board is placed across to keep the warmth of the hand from causing the condensation of moisture resulting from its coming in contact with the paper covering the stone. The paper covering the part of the drawing to be first commenced is then removed. The crayons are pointed with the knife, cutting from the point upwards.

Great care and cleanliness are necessary to prevent injury to the work. If the artist wishes to talk he ought first to cover up the surface of the stone, as a drop of saliva falling upon it prevents the penetration of the chemical chalk, and a white spot will be the result when the drawing is "brought up" by the printer. If the stone is touched by greasy hands, the form of the fingers and of the skin will appear in black.

The drawing is commenced by outlining. For this purpose the hardest chalk (copal) may be used, but No. 1, when it will answer the purpose, is better. The "tinting" or shading follows; lights may be picked out with the scraper or penknife, and ink used when sharp, dark touches are desirable. It is difficult to rectify mistakes;—prevention is better than cure. In reversing the drawing a small hand looking-glass will be found useful.

When completed the drawing is "etched." There are two different ways of applying the acid—one by flooding the stone with nitric acid diluted with water, the other with acid diluted with gum-water, applied with a flat, soft brush about 4 or 5 inches in width. Although this operation appears simple, it is not without risks; much of the success of the impressions depends upon it. If the stone is too strongly etched, the delicate tints and lines disappear; if not etched strong enough, the drawing is apt to lose clearness, and run smutty in printing. When the etching is completed, the water is drained off and the stone gummed and allowed to dry. It may then be put into the hands of the printer for proving.

Pen and Brush Method.—The surface of the stone is ground and afterwards polished with Water-of-Ayr stone or snake-stone. The drawing or writing is traced upon the surface in the manner already described. The principal drawback in this method is the necessity of reversing writing and lettering, which cannot be done without considerable practice. Its advantages over the transfer method scarcely compensate for the additional difficulties. The stone is etched as in chalk drawing before passing into the printer's hands.

Engraving on stone is chiefly useful in the reproduction of drawings by architects, civil engineers, &c. Its advantages are accuracy and sharpness in drawing and printing. A thin film of gum is spread on the surface of the stone, and when dry washed off; a dark ground is then laid on by rubbing in Paris black. Red grounds also are sometimes

used. The tracing, if on a black ground, is made with paper prepared with chrome yellow, if on a red ground with Paris black. The method of engraving is simple. The tools are strong needles, firmly fixed in cane handles, and good spring dividers; the incised lines show white upon the black or red ground. When the work is finished they are filled up with fatty ink, and the stone cleared with water and a piece of coarse flannel.

In printing, the stone is damped in the usual way, but the ink is applied with a dabber instead of a roller.

Lithography on Paper, or Transfer Lithography.—By this method the work is done on paper, and afterwards transferred to the stone. The paper has been already described, as also the instruments used in writing and drawing. The ink is prepared by rubbing a small quantity into a saucer of white delft or china, the saucer being first heated to make the ink adhere; water is then added, and the ink rubbed with the finger till it dissolves. Care has to be taken to make it of the proper consistency. If pale and thin, it will not transfer properly; if too thick, it will not flow freely from the pen or brush, and will spread in transferring.

The paper should not be handled or touched, except at the edges. Finger marks from a moist or greasy hand will roll-up black. A piece of clean white paper is kept under the hand when working. The same line must not be gone over twice while wet, as the composition on the surface of the paper is apt to get mixed with the ink and destroy its qualities. In drawing on chalk transfer paper the crayon is used instead of the brush or pen. Dark touches may be put in with ink, and the lights picked out with the knife.

The stone for the reception of transfers is polished free from perceptible scratches, and is generally warmed to make it more susceptible of receiving the ink. The transfer is placed face downwards on the stone, pulled repeatedly through the press, and afterwards removed to the trough, where hot water is poured over it. It is then peeled off, leaving the ink and the composition on the stone; the latter is washed off, and the stone gummed and allowed to dry. The work is afterwards "proved" by rolling-up, cleaning, etching, and taking the first impressions.

The transfer method is also applied successfully to the reproduction by lithography of engraved plates, wood engravings, and type.

Photo-Lithography.—By this method copies of prints or drawings executed in clear lines or dots can be produced. They may be either of the same or of altered dimensions. The copying is done by photography upon glass; but, as it is necessary that the negatives should have straight marginal lines, ordinary photographic lenses are not adapted for the purpose—"rectilinear," "aplanatic," "symmetrical," and other varieties being used instead. The negative is put into a photographic printing frame, and a piece of sensitive transfer paper placed face downwards upon it, the glass side being exposed to the light. The time of exposure varies according to the intensity of the light and the quality of the negative. When sufficiently exposed it is carried into a dark room, the photographic print taken out of the frame, laid face downwards on a stone coated over with transfer ink, and pulled through the press. It is then soaked for a few minutes in water warmed to the temperature of 100°, and the inked side of the paper carefully sponged with gum-water to remove the transferring ink from the parts upon which the light could not act. After being washed in warm water it is allowed to dry, and is then transferred to the stone and printed from in the usual manner.

Zincography so nearly resembles lithography in its principles that a very few words of explanation will be sufficient. Zinc plates possess the advantage of costing less

and being much more portable than lithographic stones, and are easily cut into convenient sizes. They are grained in the same manner as lithographic stones, a muller of zinc being used instead of one of stone. Drawings on zinc, whether in chalk or ink, are executed on a grained surface. Zinc plates are subject to oxidation, and care must be taken to dry them off quickly after graining. The drawing is done precisely in the same way as on stone; the etching solution is applied with a fat camel-hair brush. It consists of a decoction of nut-galls; a solution of gum and phosphoric acid is sometimes added. During printing the plate is screwed for support to a block of beech or other hard wood. As neither crayon nor ink penetrates the zinc as they do the stone, the adhesion of the ink forming the drawing is less thorough than in lithography, and greater precautions have to be taken to prevent accidents in printing.

Chromo-Lithography—Great advances have been made in recent years in this branch of the art, notably in the reproduction of works of an artistic character. Its simplest form is the tint, in several gradations of one colour, printed over drawings in chalk or line; in its more elaborate forms it includes imitations of water-colour drawings, decorative and ornamental designs, &c. The term "chromo-lithography" is usually applied only to the more elaborate kinds of colour printing.

All lithographs in two or more colours are printed from two or more stones. It is therefore necessary to employ some method to get a correct repetition of the subject on the first stone made upon the others, and to be able in printing to place the sheet so correctly in position that the second and each succeeding printing shall fall exactly into its place upon the first. Much of the success of the work depends upon this, and various modes of "registering," by "lay," by needles, by fixed points, &c., are employed. The first drawing is generally in outline. It is called the *keystone*, and provision is made in it for "registering," according to the particular method adopted by the artist. It is used only to take as many impressions on other stones as are required for the several colours, and as a means of getting each colour in its exact place. In work of an artistic character it is omitted in printing.

For ordinary colour printing the stone is polished; when gradation of colour is required the stone is grained, but in a somewhat coarser way than for chalk drawing. It will be sufficient here to describe the production of drawings with two tints. The principal drawing is done upon a grained stone in chalk, and should be very bold, more like a sketch on tinted paper, the middle and finer tints being left out. The stone is then etched, and two impressions are taken, so that when each of these is put upon a roughly-grained stone, and passed through the press, counter impressions will be found upon the stones, revealing the drawing quite distinctly. After having cut in the outlines with a sharp-pointed graver, or steel needle, the artist covers those parts on the two stones which are not to appear in the one or the other colour, as well as the margin of the two stones, with a brush containing acid and gum. The stones are then warmed, and a composition containing the same ingredients, as soft chalk, with double the quantity of soap, and three times the quantity of tallow, is rubbed over it with a bit of coarse flannel, until it is of a dark greyish-brown colour. From having been previously cut in, the outline comes out very distinctly. The artist can now produce an effect similar to crayon sketches which have been washed in with two separate colours. Those portions which have been rubbed in, and which appear dark greyish-brown, form the middle tint, and the scraper may be used to reduce the colour of the tint where the gradation of colour is desired,—the darkest portions being laid in with lithographic ink,

and the blending together done with chalk, brush, pen, and scraper, so as to produce in many places the effect of shadings of one colour over another. When the work is of a very elaborate or complicated nature, the order in which the colours should succeed each other in printing is of much importance, and requires to be very carefully considered. In highly finished chromo-lithographs, fifteen or more printings are frequently necessary. Difficulties sometimes arise from the paper stretching, either from the moisture on the surface of the stone or from the action of the press.

Lithography differs from chromo-lithography only in name, and is a mere vulgar attempt to imitate oil painting. The finished print is mounted on canvas, sized, and varnished. The loaded colours and rough textures, if there happen to be such in the original, are suggested by embossing, with what result it is hardly needful to say.

Instrument, Tools, and Apparatus used in Printing—Lithographic presses are of a great variety of construction, and we can only glance at the chief points in their mechanism. The scraper is a wedge-shaped plate of boxwood, fixed to the bottom of the platen; its edge is covered with a piece of leather, and properly adjusted. The table on which the stone with the paper for receiving the impression is placed, and on which the tympan is brought down, is by means of a handle or wheel, brought upon the metallic moving roller and under the scraper; the pressure is applied with a lever, and continued from one end of the stone to the other; when it has passed through the press, the lever is lifted, the moving table brought to its original place, and the printed sheet removed. The lithographic steam-press began to be generally used about 1837, and has quite revolutionized the lithographic trade.

The rollers for printing may be made of different lengths, from 6 to 24 inches long, and 5 to 5 inches in diameter. They are made of wood of the alder and lime tree, with wooden handles to project and hold by, the roller is then covered with several complete turns of flannel, well stretched and fastened by sewing at the extremities near the handles; the whole is then covered with oil-skin, sewed with great care, so as to fit tightly, and laced near the handles. For printing chalk, tints, and colours, skins of different preparations are required. Hollow metal rollers covered with oil-skin and oil-skin, are in use on some parts of the Continent, where they are preferred to rollers made of wood.

The best varnishes for making the printing-ink are boiled from old linseed oil, of different degrees of strength—thin, middle, strong, and very strong varnish, for printing with gold-leaf, bronze, and dusting colours, the very strongest varnish is required. For writings, maps, and music, common calcined lamp-black is ground with the varnish; some hard body is added to improve the colour, and to make the ink dry in a short time; for chalk ink, Paris black is used instead of the common lamp-black. For tinting and colour-printing, colourless or bleached varnish must be used, as otherwise the purity of the colours will suffer.

Printing—After the stones containing the writings or drawings in chalk and those used for tinting or colour-printing are etched, and the preparation has become dry, the stones may be put into the press and properly fixed. To prevent a stone containing drawings of any value from breaking, it should, if thin, be backed to another stone, or, what is better, to a slab of Aberdeen granite. This is done by a mixture of plaster of Paris and cold water, of the consistency of syrup, a pretty thick coating of which should be spread evenly and quickly on the slab; the stone containing the drawing is placed into this layer, and moved in all directions until the plaster of Paris becomes quite hard, which will take place in a very short time. After the printing is accomplished, the stone can be quite easily removed from the slab, by using a chisel, and by giving some side strokes with a wooden hammer. The old dry plaster of Paris is now removed, and the slab is again fit for use.

Everything being ready, the gum is quickly washed away with a soft Turkey sponge and water; the writing or drawing is then obliterated by taking a clean sponge and oil of turpentine, to which may be added, at pleasure, a few drops of sweet oil, after which the stone must be cleaned with water. An entirely clean sponge (or for stones made of soft canvas manufactured for the purpose) is now required for the printing. The stone is slightly wetted with this sponge; the printing roller, charged already with the proper ink, is passed repeatedly over the whole stone, and the writing or drawing will begin to reappear; the roller is again worked on the ink-slab, the stone wetted away with the sponge, and again rolled over, until the writing or drawing appears in full strength. A sheet of damped paper (dry paper may be used for writings and drawings in line) is put on the stone, the tympan is let down, the scraper brought to its proper place, the pressure effected, and, by means of the handle, cross, or wheel, according to the style of press, the table with the stone is slowly and equally drawn through to nearly

the end of the stone, for which purpose the press requires to be set properly beforehand. The printer now releases the pressure, the table with the stone runs to its original place, the tympan is put back, and the impression is carefully taken up from the stone. The stone is then again wetted as before, inked in anew, the paper placed upon the stone, and further impressions are effected. When the stone is to be kept after the required number of impressions has been struck off, it should always be inked up with preserving ink, which is made by melting lard, tallow, and wax, in equal proportions, with a quantity of printing-ink. When about to be used, this preserving-ink may be thinned with some oil of turpentine, thinly spread on a roller kept for this purpose; it must then be properly run on the slab, the writing or drawing is washed out with oil of turpentine, the whole removed with a clean sponge, and the stone wetted and inked in with this preserving-ink. A few minutes afterwards, when the turpentine has evaporated, a thin solution of gum-arabic is spread over the stone, containing a little sugar-candy to prevent the cracking of the gum by change of atmosphere. The stone will keep any length of time; but the preserving-ink should be renewed at least every twelve months.

The printing of tint and colour stones is treated in the same way, only the rollers, varnishes, and colours are different from those used for ordinary black and chalk printing. The printing of the class of work requires great skill and taste. Many of the lithographic printers of London, Paris, Brussels, Munich, Berlin, Vienna, and Dresden are justly famed for their beautiful productions.

An engraved stone is printed by using a small wooden tapper or tampon, either round at the sides, flat below, with handle at top, or square, with the corners rounded off. This tampon is cornered several times with a very coarse blanket, or coarse thick firm cloth, fastened at the sides, the ink is then spread very thinly on the slab, the tapper is properly tapped into it, the gum is removed from the stone, and the drawing is removed with oil of turpentine, the stone is wetted, the tampon is tapped over the whole drawing, the stone cleaned with a lot of wet canvas, and finally a printing roller is passed once or twice over the stone, which removes all impurities, a damp sheet of paper is then placed on the stone, and the impression made as formerly explained.

Some printers print drawings, pictures, or drawings done with thin lines entirely with the roller, which is a great saving of time, other printers begin an engraving with a large shoe brush with long stiff bristles—which is rubbed on the ink-slab to give it the ink required—by brushing over the drawing in all directions.

Paper.—The proper selection of paper for lithographic printing when beauty of impression is a chief consideration, is of great importance. Hand-made and hand-sized papers are objectionable, the materials used in making being frequently inimical to perfect lithographic printing. Absorbent papers, such as India paper, plate-paper, half-sized plate-paper, and fine printing paper yield the best impressions, common writing papers, hand-made writing, loan, or other hand-made English-sized papers should be used only when the work is for business or similar purpose.

Since the invention of photography, and its wide application to processes connected with art, artistic lithography, except in the way of colour printing, has been perhaps rather less in demand than formerly. Many of the finest British examples of lithographic art date from more than twenty to thirty years back, when artists such as J. D. Harding, Samuel Prout, Louis Haghe, Ghamer, William Simpson, and others were largely—some of them almost exclusively—engaged in its practice. Harding, although practising as a water-colour painter, devoted much of his time to lithography. The dexterity and brilliancy of his execution give to his works in this style a peculiar charm, altogether wanting in the more laboured productions of the professional lithographic artist. Of this quality in Harding's drawings on stone, Mr Ruskin writes—"His execution, in the way, no one can at all equal. The best chalk drawing of Calame and other foreign masters is quite childish and feeble in comparison." Samuel Prout, also a water-colour painter, produced many admirable works in lithography. Mr Ruskin's testimony may again be quoted—"All his published lithographic sketches are of the greatest value, wholly unrivalled in power of composition, and in love and feeling of architectural subject." "His lithographic work (*Sketches in Flanders and Germany*), which was, I believe, the first of the kind, still remains the most valuable of all, numerous and elaborate as its various successors have been. Their value is much increased by the circumstance of their being drawn by the

artist's own hand upon the stone." Louis Haghe's work on the *Architecture of the Middle Ages in Germany and the Netherlands*, Roberts's *Holy Land and Egypt* (drawn on stone by Haghe), and Simpson's drawings of the Crimean war may also be cited as excellent examples of artistic lithography. Lithographic studies of heads and figures by Julien of Paris, and other foreign artists, were at one time largely employed as copies by drawing masters, the new system of teaching introduced of late years has almost put an end to their use for this purpose, and they are now less frequently met with. Although lithography is increasingly employed for commercial and other purposes, artists of first-rate ability now seem, on the whole, to prefer other processes for the reproduction of their works. (G 22)

LITHUANIANS, a people (about 3,000,000 in number) of Indo-European origin, which inhabits several western provinces of Russia and the north-eastern parts of Poland and Prussia, on the shores of the Baltic Sea, and in the basins of the Niemen and of the Duna. Very little is known about their origin, and nothing about the time of their appearance in the country they now inhabit. Ptolemy mentions (lib. iii. chap. 5) two clans, the Galindæ and Sudeti, most probably Lithuanians of the western branch of this nationality, the Borussia. In the 10th century they were already known under the name of Litvæ, and together with two other branches of the same stem,—the Borussia and the Lettæ,—they occupied the south-eastern coast of the Baltic Sea from the Vistula to the Duna, extending north-east towards the Lakes Wierzy-järvi and Peipus, south-east to the watershed between the affluents of the Baltic and those of the Black Sea, and south to the middle course of the Vistula (Brest Litovsk),—a tract bounded by Finnish tribes in the north, and by Slavonians elsewhere.

The country which since that time they have continued to inhabit is flat, undulating, and covered by numberless small lakes, ponds, and wide marshes, which, though to a great extent drained during the last ten centuries, nevertheless still cover immense tracts of land. The costly work of artificial draining has been actively carried on during late years, but in the south the marshes are disappearing slowly. The soil, being sandy in the north, and a hard boulder-clay elsewhere, is unproductive. Thick forests cover it, and—though considerable tracts have been destroyed by fire and by the hatchets of the *budniks* who during many centuries have cleared the most remote thickets, founding there their villages, while, later, wide forest regions, given by Catherine II. as gifts to her officials, have quite disappeared—there still remain immense tracts of land covered with nearly virgin forests, thus, the Byelovezh Pushcha covers no less than 650,000 acres of land on the level plateau 660 feet high, where tributaries of the Nareff and Bug have a common origin in marshes. These forests have played an important part in the history of the Lithuanians, giving many original features to their history, as well as to their mythology, poetry, and music. They protected them from foreign invasions, and have contributed to the maintenance of their national character, notwithstanding the vicissitudes of their history, and of their primitive religion until the 14th century. Their chief priest, the Krive-Krivyto (the judge of the judges), under whom were no less than seventeen different classes of priests and elders, worshipped in the forests; the Waidelots brought their offerings to the divinities at the foot of mighty oaks, and even during the 14th century an unextinguishable fire, the "zinc," was maintained in the midst of the "pushcha," or "pushcha"; even now, the worship of great oaks is a widely spread custom in the villages of the Lithuanians, and even of the Lettæ. In the absence of great forests they worship isolated trees.

Even at that time the Lithuanian stem was divided into three main branches—"the *Borussians* or *Prussians*"; the *Lets* (who call themselves *Latvis*, whilst the name under which they are known in Russian chronicles, *Letygola*, is an abbreviation of *Latvin-galas*, "the confines of Lithuania"), and the *Lithuanians*, or rather *Lituanians*, *Litoi*, or *Letuvivinkai*,—these last being subdivided into Lithuanians proper, and *Jmud* (*Zmuds*, *Samogitians*, or *Zemales*), the "Lowlanders." To these three main branches, which have maintained their national distinctions uninterrupted until the present time, must be added also the *Yatvays*, or *Yatvings*, a warlike, black-haired people who inhabited the thick forests at the upper tributaries of the Niemen and Bug, and the survivors of whom are easily distinguishable now as a mixture with White-Russians and Mazurs in some parts of the governments Grodno and Polesk, and in several north-eastern parts of those of Lomza and Warsaw. Nestor's chronicle distinguishes also the *Jemgala*, who later became known under the name of *Semigalia*, and inhabited in the 10th century the left bank of the Duna. Several authors consider also as Lithuanians the *Kors* of Russian chronicles, or *Courons* of Western authors, who inhabited the peninsula of Courland, and the *Galad*, a clan settled on the banks of the Porvta, tributary of the Moskva river, which seems to have been thrown far from the main stem during its migration to the north.¹ The *Krivitschi*, who inhabited what is now the government of Smolensk, whose name recalls the Krive-Krivoyto, and whose ethnological features recall the Lithuanians, seem to belong to the same stem; but now these are rather a mixture of Lithuanians and Slavonians.

All these peoples are only ethnographical subdivisions, and each of them was subdivided in its turn into numerous independent clans and villages, separated from one another by forests and marshes; they had no towns or fortified places, a feature which has struck many earlier Occidental writers. The Lithuanian territory thus lay open to foreign invasions, and the warlike Russian *Kniazes*, as well as the German crusaders, availed themselves of the opportunity. The Borussians soon fell under the dominion of Germans, and ceased to constitute a separate nationality, leaving only their name to the state which later became Prussia. The Lets were driven farther to the north, mixing there with Livs and Ehsts, and fell under the dominion of the Livonian order. Only the Lithuanians proper, together with Samogitians, succeeded in forming an independent state. The early history of this state is but imperfectly known, all the more that the old Lithuanian chronicles have suffered from subsequent alterations (*Antonovich, loc. cit.*). During the continuous petty war carried on against Slavonic invasions, the military chief of one of the clans, Ryngold, acquired, in the first half of the 13th century, a certain preponderance over other clans of Lithuania and Black Russia (*Yatvays*), as well as over the republics of Red Russia. At this time, the invasions of the Livonian order becoming more frequent, and always extending southward, there was a general feeling of the necessity of some organization to resist them, and Ryngold's son, Mendowg, availed himself of this opportunity to pursue the policy of his father. He made different concessions to the order, ceded to it several parts of Lithuania, and even agreed to be baptized, in 1250, at Novogrod Litovskiy, receiving in exchange a crown from Innocent IV., with which he was crowned king of Lithuanians. He ceded also the whole of Lithuania to the order in case he should die without leaving offspring. But he had accepted Christianity only to increase his influence among other clans; and,

as soon as he had consolidated a union between Lithuanians, Samogitians, and Cours, he relapsed, proclaiming, in 1260, a general uprising of the Lithuanian people against the Livonian order. The yoke was shaken off, but internal war followed, and three years later Mendowg was killed. About the end of the 13th century a new dynasty of rulers of Lithuania was founded by Lutouwer, whose second son, Gedymin (1316-1341), with the aid of fresh forces he organized from his relations with Red Russia, established something like regular government; he extended at the same time his dominions over Russian countries—over Black Russia (Novogrodok, Ziditoff, Grodno, Slonim, and Volkovysk) and the principalities of Polotsk, Tournovsk, Pinsk, Vitebsk, and Volhynia. He named himself *Rex Lithovinarum et multorum Ruthenorum*. In 1326 he concluded a treaty with Poland against the Livonian order, which treaty was the first step towards the union of both countries realized two centuries later. The seven sons of Gedymin considered themselves as quite independent; but two of them, Olgerd and Keistut, soon became the more powerful. They represented two different tendencies which existed at that time in Lithuania. Olgerd, whose family relations attracted him towards the south, was the advocate of union with Russia; rather politician than warrior, he increased his influence by diplomacy and by organization. His wife and sons being Christians, he also soon agreed to be baptized in the Greek Church. Keistut represented the revival of the Lithuanian nationality. Continually engaged in wars with Livonia, and remaining true to the national religion, he became the national legendary hero. In 1340 both brothers agreed to re-establish the great principality of Lithuania, and, after having taken Vilna, the old sanctuary of the country, all the brothers recognized the supremacy of Olgerd. His son Yagello, who married the queen of Poland, Yadviga, after having been baptized in the Latin Church, was crowned, on February 14, 1386, king of Poland. At the beginning of the 15th century Lithuania was a mighty state, extending her dominions as far east as Vyazma on the banks of the Moskva river, the present government of Kaluga, and Poutivl, and south-east as far as Poltava, the shores of the Sea of Azoff, and Hadji-bey (Odessa), thus including Kiass and Lontak. The union with Poland remained, however, but nominal until 1569, when Sigismund Augustus was king of Poland. In the 16th century Lithuania did not extend its power so far east and south-east as two centuries before, but it constituted a compact state, including Polotsk, Moghileff, Minsk, Grodno, Kovno, Vilna, Brest, and reaching as far south-east as Tchernigoff. From the union with Poland, the history of Lithuania becomes a part of Poland's history, Lithuanians and White-Russians partaking of the fate of the Polish kingdom. After its three partitions, they fell under the dominion of the Russian empire. In 1793 Russia took the provinces of Moghileff and Polotsk, and in 1795 those of Vilna, Troki, Novogrod-Syeverek, Brest, and Vitebsk. In 1797 all these provinces were united together, constituting the "Lithuanian government" (*Litovskaya Gubernia*). But the name of Lithuanian provinces was usually given only to the governments of Vilna and Kovno, and, though Nicholas I. prohibited the use of this name, it is still used, even in official documents. In Russia, all the White-Russian population of the former Polish Lithuania are mostly considered as Lithuanians, the name of Jmud being restricted to Lithuanians proper.

The ethnographical limits of the Lithuanians are quite undefined, and their number is estimated very differently by different authors. The Lets occupy a part of the Courland peninsula (according to M. Rittich, they numbered there 305,800 in 1870, to which several authors add 188,800 Cours), of Livonia (416,400 at same date), and of Vitebsk (165,900), a few other settlements being spread also in the governments of Kovno (16,500), St. Petersburg (2700), and

¹ W. B. Antonovich, *A Sketch of History of the Great Principality of Lithuania*, and Professor Barczak, *Russian Historical Geography*, both in Russian.

Moghileff (1000). The Lithuanians proper inhabit the governments of Kovno (485,610), Vilna (850,700), Suwalki (54,800), and Grodno (2500), whilst the Samogitians, or Jmud, inhabit the governments of Kovno (498,900) and Suwalki (165,200). To these must be added about 200,000 Bessarabians, the whole number of Lithuanians being 2,687,000 in 1870 (3,878,000 with the Gours), or, taking into account the rate of increase of population for different governments, about 3,014,700 in 1882 (3,281,000 with Gours). Other authors estimate the number of Lithuanians in the Polish provinces at 277,050 in 1860, probably including Yatvyags, mixed to some extent with Mazurs. In this case the number of Lithuanians would be in 1882 about 3,082,000 (3,341,000 with Gours). They are now slowly extending towards the south, especially the Letts, who leave their country in consequence of want of land and of the difficulty they experienced in getting means of subsistence, numerous emigrants have already penetrated into Slavonic lands as far as the government of Voronezh.

The Lithuanians are well built, the face is mostly elongated, the features fine, the very fair hair, blue eyes, and delicate skin distinguish them from Poles and Russians. Their dress is usually plain in comparison with that of Poles, and the predominance in it of greyish colours has been frequently noticed. Their language has great similarities to the Sanskrit. It is affirmed that while Sanskrit phrases are well understood by the peasants of the banks of the Niemen. But it contains also a considerable amount of Slavonic words. The vocabulary is very copious, especially in words referring to natural phenomena, and which express certain pathological states of the mind. Primitives are exceedingly numerous, and various diminutive forms are applied even to adjectives and verbs. But, as a whole, the Lithuanian language is at a very low stage of development, and the written literature is very poor; only religious books, a few translations, and a single newspaper are published in it. On the other hand, the unwritten popular literature is very rich, and contains true treasure of poetry. It was long doubted if Lithuanians have any epic poetry; it now appears, however, that there are, scattered in songs, fragments of a great Lithuanian epic poem. But the popular poetry is especially rich in idyllic and lyric songs, imbued with tender love and melancholy. The songs of nature, and especially the elegies, are remarkable for their absolute chastity, the irony which sometimes appears in them is usually refined and gentle. The elegies (*trauzos*) are very melancholy, and of a rare beauty. The national character is fully expressed in these songs,—not warlike at all, melancholy, very lovely, and very sad.

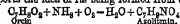
The language of the Letts is, according to Schleicher, as similar to the Lithuanian as the Italian to the Latin, but contains a greater mixture of German and Slavonic words. The literary language is more developed. A scientific Lettish grammar was published by Stender at the end of the last century, and the Letts possess translations of Shakespeare, Schiller, and other great poets. Five political papers were published in Lettish in 1878. A revival of national feeling having begun in this century, rich collections of Lettish songs were published by Germans, Russians, and Letts. M. Eversmann's collection, published by the Moscow Anthropological Society, being the most recent. The Lettish songs have the same characters as those of the Lithuanians, to which a special feature, the hatred of the people to the German landholders, must be added.

The Letts of Courland, with the exception of about 50,000 who belong to the Greek Church, are Lithuanians. Nearly all are now. Those of the government of Vitebsk, who were under Polish dominion, are Catholics, as well as the Lithuanians proper, a part of whom, however, have returned to the Greek Church, in which they were before the union with Poland. The Samogitians are Catholics; they more than other Lithuanians have preserved their national features. But all Lithuanians have retained much of their heathen practices and creed; the names of pagan divinities, very numerous in the former mythology, are continually mentioned in songs, and also in common speech.

The chief occupation of Lithuanians is agriculture. The trades in towns are generally carried on by men of other races, chiefly by Germans, Jews, or Poles. The only exception is afforded to some extent by the Letts. The Samogitians are good hunters, and all Lithuanians are given to apiculture and cattle breeding. But the Lithuanians, as well in the Baltic provinces as in the central ones, were until the last recent years proprietors of almost all they held. They have given a few families to the Russian nobility, but the great mass of the people become serfs of foreign landowners, German and Polish, who reduced them to the greatest misery. Since the Polish insurrection of 1863, the Russian Government has given to the Lithuanians the land of the Polish proprietors on much less terms than in former times, and the allotments of soil and the redemption taxes are very unequally distributed; and a not insignificant number of peasants (the *kolonizatsii*) were even deprived of the land they had for centuries considered their own. The Letts remain in the same state as before, and are restrained from emigrating en masse only by coercive measures. (T. A. K.)

LITMUS (German, *Lackmus*; French, *Tournefort*), a colouring matter which occurs in commerce in the form of small blue tablets, which, however, consist mostly, not of the pigment proper, but of carbonate and sulphate of lime and other matter devoid of tinctorial value. Litmus is never used as a dye, but is extensively employed by chemists as a reagent for the detection of free acids and free alkalis. An aqueous infusion of litmus, when exactly neutralized by an acid, exhibits a violet colour, which by the least trace of free acid is changed to red, while free alkali turns it to blue. The reagent is generally used in the form of test paper,—bibulous paper dyed red, purple, or blue by the respective kind of infusion. Litmus is manufactured in Holland from the same kinds of lichens (species of *Rocella* and *Lecanora*) as are used for the preparation of ARCHIL (q.v.).

What orelin is to erchil, a substance "azolitum," which Kane extracted from it, seems to be to litmus. At any rate, Kane's analysis supports the idea of its being formed from orelin, thus,—



A solution of this substance when treated with nascent hydrogen loses its colour. So does litmus solution when left to itself in closely stoppered bottles. When preserved in contact with air it retains its colour.

LITTLE FALLS, a village and township in Herkimer county, New York, on the Erie canal, 73½ miles west-north-west of Albany by the New York Central and Hudson River Railroad, at a point where the Mohawk river passes by a series of rapids through a picturesque defile. The water-power is turned to account in the manufacture of paper, woollen and cotton goods, starch, &c. The village, which lies partly in the township of Manheim, had a population of 6910 in 1880. Little Falls has the largest cheese market in the United States.

LITTLE ROCK, capital of the State of Arkansas, United States, as well as of Pulaski county, is situated on the south bank of the Arkansas river, about 280 miles from its mouth, and near the centre of the State. It derives its name from occupying the top of a rocky cliff about 50 feet in height, which is much less conspicuous than the precipitous cliffs that line the river just above the city. The river, which is navigable by large steamers to this point during two-thirds of the year, is crossed here by an iron drawbridge on the St Louis, Iron Mountain, and Southern Railway. Little Rock, founded in 1820, contains the State house, the State asylums for the blind and for deaf mutes, the State prison, the State library, St John's Military College, and other schools. It is also the seat of the United States court of the eastern district of Arkansas, and a United States arsenal and land office. Flour-mills, carriage-works, and foundries are among the chief industrial establishments. Population in 1880, 13,138.

LITTLETON, THOMAS DE, of Frankley in Worcestershire, judge of the court of common pleas in the reign of Edward IV., and author of the well-known work on *Twines*. Littleton's surname was that of his mother, who was the sole daughter and heiress of Thomas de Littleton, lord of Frankley. She married on Thomas Westcott. Thomas was the eldest of four sons of the marriage, and took the name of Littleton, or, as it seems to have been more commonly spelt, Lutulton. The date of his birth appears to be uncertain. He is said by Sir E. Coke to have been a member of the Inner Temple, and to have lectured there on the Statute of Westminster II., *De Donis Conditionalibus*. His name occurs in the Paston letters about 1445 as that of a well-known counsel. He appears to have been recorder of Coventry in 1450, to have been made king's sergeant in 1455, and afterwards to have been a justice of assize on the northern circuit. In 1466 he was made a

judge of the common pleas, and in 1475 a knight of the Bath. He died, according to the inscription on his tomb in Worcester cathedral, on August 23, 1481. He married Joan, widow of Sir Philip Chestwind of Ingestre in Staffordshire, and by her had three sons, through whom he became ancestor of the families in which are the existing peerages of Lyttelton and Hatherton.

The work on tenures was probably written late in his life. It is addressed to his second son Richard, who went to the bar, and whose name occurs in the year books of the reign of Henry VII. The book, both historically and from its intrinsic merit, may be characterized as the first textbook upon the English law of property. The law of property in Littleton's time was mainly concerned with rights over land, and it was the law relating to this class of rights which Littleton set himself to digest and classify. The time was ripe for the task. Ever since the Conquest regular courts of justice had been at work administering a law which had grown out of an admixture of Teutonic custom and of Norman feudalism. Under Henry II the courts had been organized, and the practice of keeping regular records of the proceedings had been carefully observed. The centralizing influence of the royal courts and of the justices of assize, working steadily through three centuries, had made the rules governing the law of property uniform throughout the land; local customs were confined within certain prescribed limits, and were only recognized as giving rise to certain well-defined classes of rights, such, for instance, as the security of tenure acquired by villeins by virtue of the custom of the manor, and the rights of freeholders, in some towns, to dispose of their land by will. Thus, by the time of Littleton (Henry VI and Edward IV.), an immense mass of material had been acquired and preserved in the rolls of the various courts. Reports of important cases were published in the "year books." A glance at Statham's *Abreviement*, the earliest digest of decided cases, published nearly at the same time as Littleton's *Tenures*, is sufficient to show the enormous bulk which reported cases had already attained as materials for the knowledge of English law.

Littleton's treatise was written in French, or rather in that peculiar dialect compounded of Norman-French and English phrases called law French. Although it had been provided by a statute of 36 Edward III. that *visu voce* proceedings in court should no longer be conducted in the French tongue, "which was much unknown in the realm," the practice of reporting proceedings in that language, and of using it in legal treatises, lingered till a much later period, and was at length prohibited by a statute passed in the time of the Commonwealth in 1660. Unlike the preceding writers on English law, Glanville, Bracton, and the authors of the treatises known by the names of Britton and Fleta, Littleton borrows nothing from the sources of Roman law or the commentators. He deals purely and exclusively with English law.

The book is written on a definite system, and is the first attempt at something like a scientific classification of rights over land. Littleton's method is to begin with a definition, usually clearly and briefly expressed, of the class of rights with which he is dealing. He then proceeds to illustrate the various characteristics and incidents of the class by stating particular instances, some of which refer to decisions which had actually occurred, but more commonly they are hypothetical cases put by way of illustration of his principles. He occasionally but rarely refers to reported cases. His book is thus much more than a mere digest of judicial decisions, to some extent he pursues the method which gave to Roman law its breadth and consistency of principle. In Roman law this result was attained through the practice of putting to juriconsults hypothetical cases to be solved

by them. Littleton, in like manner, is constantly stating and solving by reference to principles of law cases which may or may not have occurred in actual practice.

In dealing with freehold estates Littleton adopts a classification which has been followed by all writers who have attempted to systematize the English law of land, especially Sir M. Hale and Sir William Blackstone. It is indeed the only possible approach to a scientific arrangement of the intricate "estates in land" known to English law. He classifies estates in land by reference to their duration, or in other words by reference to the differences between the persons who are entitled to succeed upon the death of the person in possession or "tenant." First of all, he describes the characteristics of tenancy in fee simple,—an interest in lands which devolves on the death of the tenant to his heir, whether such heir be of the same line or collateral. Thus it still is as it was in Littleton's time the largest interest in land known to the law. Next in order comes tenancy in fee tail, the outcome, as Littleton informs us, of the Statute of Westminster II, 13 Edw. I. c. 1, "De Donis Conditionalibus," which enacted in the interest of the great lords that a gift to a man and "the heirs of his body" should no longer bear the construction which the courts had put upon the words, holding the donee to be thereby invested with full power over the land so soon as he had issue born, but should descend according to the form of the gift to lineal descendants so long as lineal descendants should exist. The various classes of estates tail are sketched by Littleton with brevity and accuracy, but he is silent as to the important practice, which first received judicial recognition shortly before his death, of "suffering a recovery," whereby through a series of judicial fictions a tenant in tail was enabled to convert his estate tail into a fee simple, thus acquiring full power of alienation. After discussing in their logical order other freehold interests in land, he passes to interests in land called by later writers interests less than freehold, namely, tenancies for terms of years and tenancies at will. With the exception of tenancy from year to year, now so familiar to us, but which was a judicial creation of a date later than the time of Littleton, the first book is a complete statement of the principles of the common law, as they then stood, as to the acquisition, governing and regulating interests in land. The first book concludes with a very interesting chapter on copyhold tenures, which marks the exact point at which the tenant by copy of court roll, the ancestor of the villen, who in his turn represented the freeman reduced to villenage by the growth of the manorial system, acquired security of tenure by the judicial view of the fact that the "will of the lord" was controlled by and could only be exercised in accordance with the "custom of the manor."

The second book relates to the reciprocal rights and duties of lord and tenant, and is mainly of historical interest to the modern lawyer. It contains a complete statement of the law as it stood in Littleton's time relating to homage, fealty, and service, the money compensation to be paid to the lord in lieu of military service to be rendered to the king, a peculiar characteristic of English as distinguished from Continental feudalism.

Littleton then proceeds to notice the important features of tenure by knight's service with its distinguishing incidents of the right of wardship of the lands and person of the infant heir or heiress, and the right of disposing of the ward in marriage. The non-military freehold tenures are next dealt with, we have an account of "service tenure," into which all military tenures were subsequently commuted by a now unrecalled Act of the Long Parliament in 1650, afterwards re-enacted by the well-known statute of 12 Charles II. c. 24, and of "frankalmoin," or the spiritual tenure by which churchmen held, their duty being "to make orisons, prayers, masses, and other divine services for the souls of their grantor or feoffee, and being bound to no fealty to the lord because that his divine service is better for them before God than any other kind of fealty." In the description of burgage tenure and tenure in villenage, the life of which consists in the validity of ancient customs recognized by law, we recognize survivals of a time before the iron rule of feudalism had moulded the law of land in the interests of the king and the great lords. Finally he deals with the law of rents, discussing the various kinds of rents which may be reserved to the grantor upon a grant of lands and the remedies for recovery of rent, especially the remedy by distress.¹

The third and concluding book of Littleton's treatise deals mainly with the various ways in which rights over land can be acquired and terminated in the case of a single possessor or several possessors. This leads him to discuss the various modes in which several persons may simultaneously have rights over the same land, as parsonages,—daughters who are co-heiresses, or sons in gavelkind;

¹ These two books are stated, in a note to the table at the conclusion of the work, to have been made for the better understanding of certain chapters of the *Antient Book of Tenures*. This refers to a tract called *The Old Tenures*, said to have been written in the reign of Edward III. By way of distinguishing it from this work, Littleton's book is called in all the early editions "*Tenures Novellæ*."

joint tenants, where the interest does not pass to the heir of the deceased joint tenant, but devolves upon the surviving joint tenant; and tenants in common, where the interest is separate and descends to the heir of each of the co-tenants, though the land over which the right exists is undivided and held in common with one or more other persons. Next follow elaborate discussions upon what are called estates upon condition,—a class of interests which occupied a large space in the early common law, giving rise on one side to estates tail, on another to mortgages. In Littleton's time a mortgage, which he carefully describes, was merely a conveyance of land by the tenant to the mortgagee, with a condition that, if he repaid to the mortgagee a certain sum on a certain day, he might re-enter and have the land again. If the condition was not fulfilled, the interest of the mortgagee became absolute, and Littleton gives no indication of any modification of this strict rule, such as was introduced by courts of equity, permitting the debtor to redeem his land by payment of all that was due to the mortgagee although the day of payment had passed, and his interest had become at law indefeasible. The remainder of the work is occupied with an exposition of a miscellaneous class of modes of acquiring rights of property, the analysis of which would occupy too large a space.

The work is thus a complete summary of the common law as it stood at the time. It is nearly silent as to the remarkable class of rights which had already assumed vast practical importance—equitable interests in lands. These are only noticed incidentally in the chapter on "Release." But it was already clear in Littleton's time that this class of rights would become the most important of all. Littleton's own will, which has been preserved, may be adduced in proof of this assertion. Although nothing was more opposed to the spirit of Norman feudalism than that a tenant of lands should dispose of them by will, we find Littleton directing by his will the feeble of certain manors to make estates by the persons named in his will. In other words, matter to acquire over lands powers unknown to the common law, the lands had been conveyed to "feoffees" who had full right over them according to the common law, but who were under a conscientious obligation to execute those rights in the direction of the executor of the will of the person whose "use" the lands were held. This conscientious obligation was recognized and enforced by the chancellor, and thus arose the class of equitable interests in lands. Littleton is the first writer on English law after these rights had risen into a prominent position, and it is curious to find in what he says they are ignored by law. Unlike their treatment in the old instruments, the common lawyers wholly refused to recognize the right of the real or beneficial owner, when the legal interest was vested in another, though the latter had then but the semblance without the reality of ownership. Hence it was that the most important class of rights developed outside the common law. After his every attempt to reunite the classes of legal and equitable interests by the Statute of Uses (27 Henry VIII. c. 10), the effect of which was to introduce still greater technicality and complication into the law of real property, the two classes have continued to exist side by side, until in our own times the Judicature Act of 1873, by uniting in one court the tribunals the difference between which originally gave rise to the distinction between legal and equitable interests, has perhaps paved the way for a simpler and more rational classification of rights over land.

The work of Littleton occupies a place in the history of typography as well as of law. The earliest printed edition seems to be that by John Letou and William de Machinle, two printers who probably came from the Continent and carried out their business in partnership, as their note to the edition of Littleton states, "In civitate Londinensi, fecit et perperit per nos Joh. Letou et Will. de Machinle, anno domini 1483." The date is uncertain. The date of the first edition is most probably conjecture, based on typographical grounds, places it about the latter part of 1483. The next edition is one by Machinle alone, and is dated 1484. It is the first time the form *machinle* was then in use; hence also "*Justa possem quo vulgo dicitur Fleta bridge*." Next came the Robert or Broom edition, erroneously said for Sir S. Coke to be the earliest, and to have been printed about 1580. It was, however, of a much earlier date. Tomlins, the latest editor of Littleton, gives reasons for thinking that it cannot have been printed later than 1550, and in a note has been printed at Broom by William W. Taylor at Institution Richard Fyson. Copies of all these editions are in the British Museum. In all these editions the work is styled *Tractatus de personis*, probably a corruption from the "Old Tenures."

There are three early MSS. of Littleton in the University Library at Cambridge. One of these formerly contained a note on the first page, in which it was stated that it was bought in St. Paul's Churchyard on July 20, 1480. It was therefore in circulation in Littleton's lifetime. The other two MSS. are of somewhat later date, but of them certain that some of them may be the earliest English translation of the *Tractatus*, and is probably not later than 1500.

In the 16th century followed in rapid succession from the press of Pynson, Kessellene, Berthelet, Trevel, and others. The practice of annotating the text caused several editions to be introduced, which, however, are easily detected by comparison of the earlier copies. In 1681 West divided the text into seven hundred and forty-six sections, which have ever since been preserved. Many of these editions were printed at the expense of the purpose of the university, and some of them may be seen in Lincoln's Inn Library.

The practice of annotating Littleton was very general, and was adopted by many eminent lawyers, besides the university. The most famous of these was the commentary of this kind, by an unknown hand of earlier date than Sir S. Coke's, was edited by Cary in 1684. Following the general practice of dealing with Littleton as the great authority in the law of England, the most perfect and valuable work that ever was written in any human language, Sir S. Coke makes it the text of that portion of his work which he calls the first part of the Institutes of the law of England, the other parts, the law of property.

The first printed English translation of Littleton was by Rastell, who seems to

have combined the professions of author, printer, and sergeant-at-law, between 1514 and 1539. Many English editions by various editors followed, the best of which is Tolly in 1656. Sir S. Coke adopted some translation earlier than this, which he drew from by the name of Sir S. Coke's translation, &c. However, thorough comments not on the translation but on the French text, and the reputation of the commentary has to some extent overtaken and obscured the intrinsic merit of the original. (See *Ch. D.*)

LITTRE, PAUL MAXIMILIEN ÉMILE (1801-1881), the compiler of the best dictionary of any living language, and the Frenchman of most encyclopedic knowledge and Didot, was born at Paris on February 1, 1801. His father had been a gunner, and afterwards sergeant-major of marine artillery, in the French navy, and was deeply imbued with the revolutionary ideas of the day. Settling down as a collector of taxes, he married Sophie Johannet, a free-thinker like himself, and devoted himself to the education of his son Émile. The boy was sent to the Lycée Louis-le-Grand, where he had for friends Haechette and Eugène Burnouf, and he distinguished himself alike in his work and in his athletic exercises. He had completed his course at school, he hesitated for a time as to what profession he should adopt, and meanwhile made himself master, not only of the English and German languages, but of the classical and Sanskrit literature and philology. At last he determined to study medicine, and in 1822 entered his name as a student of medicine. He passed all his examinations in due course, and had only his thesis to prepare in order to obtain his degree as doctor when in 1827 his father died, leaving his mother absolutely without resources. He at once renounced his degree, and, while attending the lectures of Bayle and taking a keen interest in medicine, began teaching Latin and Greek for a livelihood. He carried a basket on the popular side of the revolution of February 1830, and was one of the national guards who followed Charles X. to Rambouillet. At last, in 1831, when quite thirty years of age, he obtained an appointment as Assistant Curator, the editor of the *National*, who gave him the task of reading the English and German papers for excerpts. Carrel by the merest chance in 1835 discovered the ability of his reader, who from that time became a constant contributor, and eventually director of the paper. In 1836 he began to contribute articles on all sorts of subjects to the *Revue des Deux Mondes*; in 1837 he married, and in 1839 appeared the first volume of his edition of the works of Hippocrates. This volume at once placed Littré in the forefront of the literary and scientific world; its ability was recognized by his election the same year into the Académie des Inscriptions at Belles-Lettres. At the age of thirty-eight then he had won for himself a high reputation as a learned man of letters and of science, but was still tormented by the unsettled ideas and thoughts which generally beset younger men, and were only increased by the study of his favorite authors Byron and Obermann.

At this epoch he came across the works of Auguste Comte, the reading of which formed, as he himself said, "the cardinal point of his life," and from this time onward appears the influence of positivism on his own life, and, what is of even more importance, his influence on positivism; for he gave at least as much to positivism as he received from it. He brought to it a wide knowledge of science and literature, a great and growing reputation, and a clear head. He soon became an intimate friend of Comte's, and set to work to popularize his ideas in numerous works on the positivist philosophy, while at the same time continuing his edition of Hippocrates, which was not completed till 1869, publishing a similar edition of Pliny's *Natural History*, containing sixteen volumes in the place of Faurlat at the commission engaged on the *Histoire littéraire de la France*, where his knowledge of the early French language and literature was invaluable, and contributing largely to the *National* and *Revue des Deux Mondes*. In the revolution

of July 1848 he took a keen interest, and himself took part in the repression of the extreme republican party in June 1849, under the banner of order. His essays, contributed during this period to the *National*, were collected together and published under the title of *Conservation, Révolution, et Positivisme* in 1852, and show, not only a lively faith in a good time coming, but a thorough acceptance of all the doctrines propounded by Comte. However, during the later years of his master's life, he began to perceive that he could not wholly accept all the dogmas or the more mystic ideas of his friend and master, but he studiously concealed his differences of opinion almost from himself, and Comte failed to perceive that his pupil had outgrown him, as he himself had outgrown his master Saint-Simon. Comte's death in 1858 freed Littré from any fear of embittering his master's later years, and he published his own ideas in his *Paroles de la Philosophie Positive* in 1859, and at still greater length in his work in *Auguste Comte et la Philosophie positive* in 1863. In this book he traces the origin of Comte's ideas through Turgot, Kant, and Saint-Simon, then eulogizes Comte's own life, his method of philosophy, his great services to the cause, and the effect of his works, and finally proceeds to show where he himself differs from him. He approved wholly of Comte's philosophy, his great laws of society, and his philosophical method, which indeed he defended warmly against J. S. Mill, but declared that, while he believed in a positivist philosophy, he did not believe in a religion of humanity. In the year 1863, after completing his *Hippocrates* and his *Pliny*, he set to work on his great French dictionary, bringing to the task an unexampled knowledge of old French, of modern and classical languages, and of modern philology, which were to make his dictionary unique in its interest and accuracy. In the same year he was proposed for the Académie Française, but rejected, owing to the opposition of the fiery bishop of Orleans, who denounced him as the chief of the French materialists. He also at this time started with M. Wyzouff the *Philosophie Positive*, a review which was to embody the views of modern positivists, and to which he largely contributed. His life was thus absorbed in literary work, and flowed quietly on, till the overthrow of the empire called on him to take a part in politics. He felt himself too old to undergo the privations of the siege of Paris, and retired with his family to Brittany, whence he was summoned by M. Gambetta to Bordeaux, to lecture on history, and thence to Versailles to take his seat in the senate to which he had been chosen by the department of the Seine. In December 1871 he was elected a member of the Académie Française in spite of the renewed opposition of the Mgr. Dupanloup, bishop of Orleans, who resigned his seat rather than receive him. His dictionary was completed in 1873, and he lived on full of years and honours, for in 1874 he was elected a life senator. The most notable of his productions in these latter years were his political papers attacking and unravelling the confederacy of the Orleanists and legitimists, and in favour of the republic, his republication of many of his old articles and books, among others the *Conservation, Révolution, et Positivisme* of 1852 (which he reprinted word for word, appending a formal, categorical renunciation of many of the Comtist doctrines therein contained), and a little tract *Pour la dernière fois*, in which he maintained his unalterable belief in materialism. When it became obvious that the old man could not live much longer, his wife and daughter, who had always been fervent Catholics, strove to convert him to their religion. He had long interviews with Père Millériot, a celebrated controversialist, and was much grieved at his death; but it is hardly probable he would have ever been really converted. Nevertheless, when on the point of death, his wife had him

baptized, and his funeral was conducted with the rites of the Catholic Church. He died June 3, 1881.

It is almost impossible to characterize the varied learning and immense intellectual activity of Littré. As a philosopher he had popularized and sifted the ideas of Comte, and had succeeded Comte as Comte succeeded Turgot, Kant, and Saint-Simon; as a lexicographer he has been compared to Johnson, though his work is as far ahead of Johnson's as the philological knowledge of the 19th century is in advance of that of the 18th, and as a man of almost universal knowledge, and a writer on every sort of subject, from barbarian learning and modern science to epic poetry and the military genius of Napoleon, he remains unrivalled, even in a country which can boast of Diderot and Comte.

It would take too much space to give a complete list of all Littré's voluminous works, but the following are those of greatest importance:—his editions of Hippocrates, 1839-61, and of *Pliny's Natural History*, 1848-50, his translation of Strabo's *Vie de Jésus*, 1839-40, and Muller's *Manuel de Physiologie*, 1861, his edition of the works of Armand Carrel, with notes, 1864-68; his *Histoire de la langue française*, a collection of magazine articles, 1863; and his *Dictionnaire de la langue française*, 1869-73. In the domain of science must be noted his edition, with Charles Robin, of Nyssen's *Dictionnaire de médecine, de chirurgie, &c.*, 1855, in that of philosophy, his *Analyses et éléments du cours de philosophie positive de M. A. Comte*, 1848, *Applications de la Philosophie positive au Gouvernement*, 1849, *Conservation, Révolution, et Positivisme*, 1852 (2d edition with supplement, 1879), *Paroles de la Philosophie positive*, 1859; *Auguste Comte et la Philosophie positive*, 1863; *La Science au point de vue philosophique*, 1873; *Fragment de philosophie et de sociologie contemporaines*, 1876; and his most interesting miscellaneous works, his *Éléments d'Histoire*, 1850, *La Vieillesse sur la mort d'Alexandre le Grand*, 1865; *Études sur les barbares et le moyen âge*, 1867, *Mémoires d'Éléments*, 1871; *Littérature et Histoire*, 1876; and *Discours de réception à l'Académie Française*, 1878.

For his life consult Sainte-Beuve's notice, 1862, and the numerous articles published after his death in the newspapers and reviews, of which the best are the notices of M. Duval-Gérville in the *Nouvelles Revues* of August 1881, of M. Caro in the *Revue des Deux Mondes*, and of M. Frédéric Godfrey in the *Revue chrétienne* (H. M. S.)

LITURGY. The word "Liturgy" technically denotes the "Order for the Celebration and Administration of the Eucharist." It has come to be used in a more popular sense to denote any or all of the various services of the Christian church, whether contained in separate volumes or bound up together in the form of a Book of Common Prayer. We propose to treat of "the Liturgy" chiefly, but not exclusively, in the former and stricter sense, and, without further discussion of the use of the word in Biblical or patristic literature, and without entering into various questions with reference to their origin, growth, first commit to writing, &c., to give our readers some account of the principal liturgies which exist, or have existed, in the Christian church.

There are five main families or groups of liturgies, three of them Eastern in origin and use, one Eastern in origin but Western in use, one Western both in origin and use. They are known either by the names of the apostles with whom they are traditionally connected, or by the names of the countries or cities in which they are known or believed to have been once or always in use.

GROUP I. St James, West Syrian, Jerusalem.—The principal liturgies to be enumerated under this group are the Clementine, so called from being found in the eighth book of the *Apostolic Constitutions*, which have been erroneously referred to St Clement, first bishop of Rome (lib. viii. 10-16); the Greek and Syrian liturgies of St James; the Greek liturgies of St Basil and St Chrysostom; the Armenian liturgy of St Gregory the Illuminator, first patriarch of Armenia; a large number of later Syrian liturgies springing from the Syrian liturgy of St James. Of these liturgies, that of St Chrysostom is used now by the Orthodox Eastern Church, except on the first five Sundays in Lent, Thursday and Saturday in Holy Week,

the vigils of Christmas and Epiphany, and St Basil's Day, when the liturgy of St Basil is used; and in Lent (except Sundays and Saturdays and Lady Day), when the liturgy of the pre-sanctified is used.

This group, like all the purely Eastern liturgies, is marked by an absence of flexibility as to number and shape of prefaces, collects, &c. Its special feature, if we may adopt a recently employed canon of differentiation, is the position of the great intercession for quick and dead, for rulers in church and state, for the sick, for travellers, for the fruits of the earth, &c., after the consecration of the elements has been completed by the invocation of the Holy Spirit (C. E. Hammond, *Lit. Eastern and Western*, pp. 26-29).

GROUP II. *St Mark, Egyptian, Alexandria*.—This group includes the Greek liturgies of St Mark, St Basil, and St Gregory; the Coptic liturgies of St Cyril, St Basil, and St Gregory; the Ethiopic liturgy known as the "Canon Universalis" or "Liturgy of all the Apostles," together with sixteen other subordinate Ethiopic liturgies. They are distinguished by the position of the great intercession in the middle of the preface, as well as by the prominent part assigned throughout to the deacon.

GROUP III. *St Adeus, East Syrian, Edessa*.—There are three extant liturgies belonging to this group, now exclusively used by Nestorian Christians,—those of SS. Adeus and Maria, Theodore of Mopsuestia, and Nestorius; its titles of three lost liturgies have been preserved,—those of Narses, Barsumas, and Diodorus of Tarsus. The liturgy of the Christians of St Thomas, on the Malabar coast of India, formerly belonged to this group, but it was almost completely assimilated to the Roman liturgy by Portuguese Jesuits at the synod of Diamper in 1599. The characteristic of this group is the position of the great intercession in the middle of the consecration, between the words of institution (or, to speak more accurately, the place where the words of institution must have occurred) and the invocation.

GROUP IV. *St John, Hispano-Gallican, Ephesus*.—This group of Latin liturgies, which once prevailed very widely in western Europe, has been almost universally superseded by the liturgy of the Church of Rome. Where it survives it has been either partially or almost completely assimilated to the Roman pattern. It prevailed once throughout Spain, France, part of northern Italy, and Great Britain and Ireland, in forms of which a detailed account is appended. The term "Ephesine" has been applied to this family of liturgies, chiefly by modern English liturgiologists, to denote a theory as to their origin which, although upheld by other than English writers, must be regarded rather as a possible hypothesis than a proved fact (Leslie, *Pref. to Messar. Missal*, sect. 25, Bickell, *Messe und Pascha*, p. 10). The many traces of Eastern influence in their composition, and the close connexion which is known to have existed at a very early period between the churches of Lyons and of western Asia Minor, have suggested the theory that the latter country must have been the birthplace of this class of liturgies. The names of the apostle St John and of Ephesus his place of residence have been pressed into service as further particularizations of the same theory. The special feature of these liturgies is the position of the great intercession after the offertory, before the commencement of the preface and canon.

The chief traces of Oriental affinity lie in the following points:—(1) the various proclamations made by the deacon, including that of "Silentium facite" before the epistle (Migne, tom. lxxv. p. 534); (2) the presence of a third lesson, preceding the epistle, taken from the Old Testament; (3) the occasional presence of "processes," a series of short intercessions resembling the Greek "Ektenoi," or

deacon's litany; (4) the position of the kiss of peace at an early point in the service, before the canon, instead of the Roman position after consecration; (5) the exclamation "sancta sanctis" occurring in the Mozarabic rite, the counterpart of the Eastern *ta dyia rois dyiois*; (6) traces of the presence of the "Epiclesis," that is to say, the invocation of the Holy Spirit, in its Eastern position, after the words of institution, as in the collect styled the Post-pride in the Mozarabic service for the second Sunday after Epiphany:—"We beseech thee that thou wouldest sanctify this oblation with the permixture of Thy Spirit, and conform it with full transformation into the Body and Blood of our Lord Jesus Christ." On the other hand, the great variability of its parts, and its immense number of proper prefaces, ally it to the Western family of liturgies.

We now proceed to give a more detailed account of the chief liturgies of the Hispano-Gallican group.

1. *The Mozarabic Liturgy*.—This was the national liturgy of the Spanish Church till the close of the 11th century, when the Roman liturgy was forced upon it. Its use, however, lingered on, till in the 16th century Cardinal Ximenes, anxious to prevent its becoming quite obsolete, had its books restored and printed, and founded a college of priests at Toledo to perpetuate its use. It survives now only in that and one other church in Spain, and even there not without certain Roman modifications of its original text and ritual.

Its date and origin, like the date and origin of all existing liturgies, are uncertain, and enveloped in the mists of antiquity. It is evidently not derived from the Roman liturgy. Its whole structure, and every separate detail, disprove such a parentage, and therefore it is strange to find St Isidore of Seville (*Lit. de Eccles. Offic.*, i. 15) attributing it to St Peter. No proof is adduced, and the only value which can be placed upon such an unsupported assertion is that it shows that a very high and even apostolic antiquity was claimed for it. A theory, originating with Pinus, that it may have been brought by the Goths from Constantinople when they invaded Spain, is as improbable as it is unproven. It may have been derived from Gaul. The Gallican liturgy stood to it in the relation of twin-sister, if it could not claim that of mother. The resemblance was so great that, when Charles the Bald (843-877) wished to gain some idea of the character of the already obsolete Gallican rite, he sent to Toledo for some Spanish priests to perform mass according to the Mozarabic rite in his presence. But there is no record of the conversion of Spain by Gallican missionaries. Christianity existed in Spain from the earliest times. Probably St Paul travelled there (Rom. xv. 24-28). It may be at least conjectured that its liturgy was Pauline rather than Petrine or Johannine.

2. *Gallican Liturgy*.—This was the ancient and national liturgy of France till the commencement of the 9th century, when it was suppressed by order of Charlemagne, who directed the Roman missal to be everywhere substituted in its place. All traces of it seemed for some time to have been lost, until three Gallican sacramentaries were discovered and published by Thomasius in 1680, under the titles of *Missale Gallicanum*, *Missale Gallicanum*, and *Missale Francorum*, and a fourth was discovered and published by Mabillon in 1687, under the title of *Sacramentarium Bobbiense*. Fragmentary discoveries have been made since then. More discovered fragments of eleven Gallican masses, and published them at Carlsruhe in 1850. Other fragments from the library of St Gall have been published by Bunsen (*Arch. Aeth. No.*, iii. 263-66), and from the Ambrosian library at Milan by Cardinal Mai (*Script. Vet. Vat. Coll.*, iii. 2, 247). More of this MS. is being prepared for publication by Dr Ceriani. A single page was

discovered in the library of Gonville and Caius College, Cambridge, in 1867, which has not yet been published. These documents, illustrated by early Gallican canons, and by allusions in the writings of Sulpicius Severus, Caesarius of Arles, Gregory of Tours, Germanus of Paris, and other authors, enable scholars to reconstruct the greater part of this liturgy. The previously enumerated signs of Eastern origin and influence are found here as well as in the Mozarabic liturgy, together with certain other more or less minute peculiarities, which would be of interest to professed liturgiologists, but which we must not pause to specify here. They point to the possibility of the theory that the Gallican liturgy was introduced into use by Irenaeus, bishop of Lyons (c. 130-200), who had learned it in the East from St Polycarp, the disciple of the apostle St John.

3. *Ambrosian Liturgy*.—Considerable variety of opinion has existed among liturgical writers as to the proper classification of the "Ambrosian" or "Milanese" liturgy. If we are to accept it in its present form, and to make the present position of the great intercession the test of its *genus*, then we must place it under Group V, the "Petrine," and consider it as a branch of the Roman family. If, on the other hand, we consider the important variations from the Roman liturgy which yet exist, and the still more marked and numerous traces of variation which confront us in the older printed and MS. copies of the Ambrosian rite, we shall detect in it an original member of the Ephesine group of liturgies, which for centuries past has been undergoing a gradual but ever increasing assimilation to Rome. We know this as a matter of history, as well as a matter of inference from changes in the text itself. Charlemagne adopted the same policy towards the Milanese as towards the Gallican Church. He carried off all the Milanese Church books which he could obtain, with the view of substituting Roman books in their place, but the completeness of his intentions failed, partly through the attachment of the Lombards to their own rites, partly through the intercession of a Gallican bishop named Eugenius (Mabillon, *Mss. Lat.*, i., ii. p. 106). It has been asserted by Joseph Vicoeques that this is an originally independent liturgy drawn up by St Barnabas, who first preached the gospel at Milan (*De Misse Ric.*, i. chap. xi., xii.), and this tradition is preserved in the title and proper preface for St Barnabas Day in the Ambrosian missal (Pamelius, i. 385, 386).

We can trace the following points in which the Milanese differs from the Roman liturgy, many of them exhibiting distinct lines of Ephesine or Eastern influence. Some of them are no longer found in recent Ambrosian missals, and only survive in the earlier MSS. published by Pamelius (*Liturgion*, tom. i. p. 298). Muratori (*Lit. Rom. Vet.*, i. 132), and Ceriani (in his edition, 1881, of an ancient MS. at Milan).

(a) The collect entitled "oratio super populum" corresponding to the *εὐχὴ μετὰ τὸ ἀνασθῆναι τὸ εὐχαρίσταν*; (b) the proclamation of silence by the deacon before the epistle; (c) the litanies and after the ingress (introid) on Sunday in Lent, closely resembling the Greek *Εκτενε*; (d) varying forms of introduction to the Lord's Prayer, in *Omnia Domini* (Ceriani, p. 116), in Pascha (ib., p. 124), (e) the presence of passages in the Prayer of Consecration which are not part of the Roman canon, and one of which at least corresponds in import and position though not in words to the Greek *Ἐπίκλησις*: *Ἰησὺν vero est, omnipotens Pater, mittens*, &c. (ib., p. 116); (f) the survival of a distinctly Gallican form of consecration in the Post-Sanctus: "in Sabbato Sancto": *Vere Sanctus, vere benedictus Dominus noster*, &c. (ib., p. 126); (g) the varying nomenclature of the Sundays after Pentecost; (h) the position of the fraction before the Lord's Prayer; (i) the omission of the second oblation after the words of institution (Muratori, *Lit. Rom. Vet.*, i. 138); (k) a third lesson or *Propheta* from the Old Testament preceding the epistle and gospel; (l) the lay offering of the oblations and the formula accompanying their reception (Pam., i. 297); (m) the position of the ablation of the hands in the middle of the canon just before the words of institution; (n) the position of the "oratio super populum" which corresponds in matter but not in name to the collect for the day before the Gloria in Excelsis.

4. *Galic Liturgy*.—We postpone the consideration of

this subject to a position under the heading of the liturgies of Great Britain and Ireland.

GROUP V. *St Peter, Italian, Rome*.—There is only one liturgy to be enumerated under this group, viz., the present liturgy of the Church of Rome, which, though originally local in character and circumscribed in use, has come to be nearly coextensive with the Roman Church, sometimes cuckoo-like ejecting earlier national liturgies, as in France and Spain, sometimes incorporating more or less of the ancient ritual of a country into itself, and producing from such incorporation a subclass of distinct uses, as in England, France, and North Italy. Even these subordinate uses have for the most part become, or are rapidly becoming, obsolete. The genius and policy of Rome are in favour of uniformity; and it requires no keen powers of vision to foretell that, liturgically speaking, she will be, before long, within all her dominions supreme.

The date, origin, and early history of the Roman liturgy are obscure. The first Christians at Rome were a Greek-speaking community, and their liturgy must have been Greek, and is possibly represented in the so-called Clementine liturgy. But the date when such a state of things ceased, when and by whom the present Latin liturgy was composed, whether it is an original composition, or, as its structure seems to imply, a survival of some intermediate form of liturgy,—all these are questions which are waiting for their solution, and to which no certain answer can be given, unless and until some further discovery shall be given of earlier liturgical remains.

One MS. exists which claims to represent the Roman liturgy as it existed in the time of Leo I., 440-61. It was discovered at Verona by Bianchini in 1735, assigned by him to the 8th century, and published under the title of *Sacramentarium Leonianum*; but this title was from the first purely conjectural, and is in the teeth of the internal evidence which the MS. itself affords, and is now being gradually abandoned. It is impossible here to enter into the minutiae of the evidence for this and other conclusions. The question is discussed at some length by Muratori, *Lit. Rom. Vet.*, i. chap. 3.

A MS. of the 9th or 10th century was found at Rome by Thomasius, and published by him in 1680 under the title of *Sacramentarium Gelasianum*. But it was written in France, and is certainly not a pure Gelasian codex; and, although there is historical evidence of that pope (492-96) having made some changes in the Roman liturgy, and although other MSS. have been published by Gerbertus and others, claiming the title of Gelasian, we neither have nor are likely to have genuine and contemporary MS. evidence of the real state of the liturgy in that pope's time.

The larger number of MSS. of this group are copies of the Gregorian sacramentary, that is to say, MSS. representing, or purporting to represent, the state of the Roman liturgy in the days of Gregory the Great (590-604). But they cannot be accepted as certain evidence, for the following reasons:—not one of them was written earlier than the 9th century; not one of them was written in Italy, but every one north of the Alps; every one contains internal evidence of a post-Gregorian date in the shape of masses for the repose or for the intercession of St Gregory, and in various other ways.

The Roman liturgy was introduced into England in the 7th, into France in the 9th, and into Spain in the 11th century. In France certain features of the service and certain points in the ritual of the ancient national liturgy became interwoven with its text, and formed those many varying medieval Gallican uses, which are associated with the names of the different French sees.

The distinguishing characteristics of the Petrine liturgy are these:—(a) the position of the great intercession within the canon,

the commemoration of the living being placed just before, and the commemoration of the departed just after, the words of institution, (b) the absence of the Epiclesis or Invocation of the Holy Spirit; (c) the position of the Pax or "Kiss of Peace" after the consecration and just before the communion, whereas in other liturgies it occurs at a much earlier point in the service.

Liturgies of the British Islands.

PERIOD I. The Celtic Church.—Until recently almost nothing was known of the character of the liturgical service of the vast Celtic Church which existed in these islands before the Anglo-Saxon conquest, and which continued to exist in Ireland, Scotland, Wales, and Cornwall for very considerable though varying periods of time after that event. But recently a good deal of light has been thrown on the subject, partly by the publication of the few genuine works of St. Patrick, Columba, Columbanus, and other Celtic saints; partly by the discovery of liturgical remains in the Scottish *Book of Deer*, and in the Irish *Books of Dimma and Mulling* and the *Stowe Missal*; partly by the publication of medieval Irish compendiums such as the *Leabhar Breac*, *Liber Hymnorum*, &c., which contain ecclesiastical calendars, legends, treatises, &c., of considerable but very varying antiquity. The evidence collected from these sources is sufficient to prove that the liturgy of the Celtic Church was of the Ephesine type. In central England the churches, together with their books and everything else belonging to them, were destroyed by heathen invaders from Jutland, Schleswig, and Holstein at the close of the 5th century; but the Celtic Church in the remoter parts of England, as well as in the neighbouring kingdoms of Scotland and Ireland, retained its liturgical independence for many centuries afterward.

An examination of its few extant service books and fragments of service books yields the following evidence of the Ephesine origin and character of the Celtic liturgy:—(a) The presence of whole collects and anthems which occur in the Gallican and Mozarabic but not in the Roman liturgy; (b) various formulae of thanksgiving after communion; (c) frequent addresses to the people in the form of Gallican *Præfationes*; (d) the Gallican form of consecration prayer, being a variable Post-Sanctus leading up to the words of institution; (e) the complicated rite of fraction as described in an Irish tract at the end of the *Stowe missal* finds its only counterpart in the elaborate ceremonial of the Mozarabic Church; (f) the presence of the Gallican ceremonial of *Pediluvium* or "Washing of Feet" in the earliest Irish baptismal office. For a further description of these and of other features which seem to be peculiar to the Celtic liturgy the reader is referred to Warren's *Liturgy and Ritual of the Celtic Church*, 1881.

PERIOD II. The Anglo-Saxon Church.—We find ourselves here on firmer ground, and can speak with certainty as to the nature of the liturgy of the English Church after the beginning of the 7th century. Information is drawn from the liturgical allusions in the extant canons of numerous councils, from the voluminous writings of Bede, Alcuin, and many other ecclesiastical authors of the Anglo-Saxon period, and above all from a very considerable number of service books written in England before the Norman Conquest. Three of these books are manuscript missals of more or less completeness, and, as none of them have yet been published, their names are appended:—(1) the Leofric missal, a composite 10th to 11th century MS., presented to the cathedral of Exeter by Leofric, the first bishop of that see (1046–1072), now in the Bodleian Library at Oxford; (2) the missal of Robert of Jumieges, archbishop of Canterbury (1061–52), executed probably at Winchester, and presented by Archbishop Robert to his old monastery of Jumieges in the neighbourhood of Rouen, in the public library of which town it now lies; (3) the Red Book of Derby, an incomplete missal of the second half of the 11th century, now in the library of Corpus Christi College, Cambridge.

A perusal of these volumes proves, what we should have expected *a priori*, that the Roman liturgy was in use in

the Anglo-Saxon Church. This was, no doubt, the case from the very first. That church owed its foundation to the forethought of a Roman pontiff, and the energy of a band of missionaries, headed by St. Augustine, who came directly from Rome, and who brought, as we are expressly assured by Bede, their liturgical codices with them from their native country (*Hist. Eccl.*, ii. 28). Accordingly, when we speak of an Anglo-Saxon missal, we mean a Roman missal only exhibiting one or more of the following features which differentiate it from an Italian missal of the same century.

(a) Rubrics, and other emblems of a miscellaneous character, written in the vernacular language of the country; (b) the commemoration of national or local saints in the calendar, in the canon of the mass, and in the litanies which occur on Easter eve, and in the baptismal offices; (c) the presence of a few special masses in honour of these national saints, together with a certain number of collects of a necessarily local character, for the rulers of the country, for its natural produce, &c.; (d) the addition of certain peculiarities of liturgical structure and arrangement interpolated into the purely Roman service from an extraneous source. There are two noteworthy examples of this in Anglo-Saxon service books. Every Sunday and festival, and almost every votive mass, has its proper *præface*, although the number of these *præfaces* in the Gregorian sacramentary of the same period had been reduced to eight. There were a large but not quite an equal number of triple episcopal benedictions to be pronounced by the bishop after the Lord's Prayer and before the communion. This custom must either have been perpetuated from the old Celtic liturgy, or directly derived from a Gallican source.

PERIOD III. Anglo-Norman Church.—The influx of numerous foreigners, especially from Normandy and Lorraine, which preceded, accompanied, and followed the Conquest, and the occupation by them of the highest posts in church as well as state, had a distinct effect on the liturgy of the English Church. These foreign ecclesiastics brought over with them a preference for and a habit of using certain features of the Gallican liturgy and ritual, which they succeeded in incorporating into the service books of the Church of England. One of these prelates named Osmund, a Norman count, earl of Dorset, chancellor of England, and bishop of Salisbury, 1078–99, undertook the revision of the English service books, and the missal which he produced in 1085, which we know as the *Sarum Missal*, or the *Missal according to the Use of Sarum*, practically became the liturgy of the English Church. It was not only received in the province of Canterbury, but was largely adopted beyond those limits—in Ireland in the 12th, and in various Scottish dioceses in the 12th and 13th centuries.

It would be outside the scope of a general article like the present to tabulate the numerous and frequently minute differences between medieval *Sarum* and the earlier Anglo-Saxon or contemporary Roman liturgy. They lie mainly in differences of collects and litanies, variations of ritual on Candlemas, Ash Wednesday, and throughout Holy Week, the introduction into the canon of the mass of certain clauses and usages of Ephesine character or origin, the words of rubrics in the eucharistic or imperpetrator's tone, the peculiar "Process in Prostrata," the procession of Corpus Christi on Palm Sunday, the forms of exorcism and reconciliation of penitents, &c. The varying episcopal benedictions as used in the Anglo-Saxon Church were retained, but the numerous proper *præfaces* were discarded, the number being reduced to ten.

Besides the famous and far-spreading use of *Sarum*, other uses, more local and less known, grew up in various English dioceses. In virtue of a recognized diocesan independence, bishops were able to regulate or alter their ritual, and to add special masses or commemorations for use within the limits of their jurisdiction. The better known, and the more distinctive of these uses were those of York and Hereford, but we also find traces of, or allusions to, the uses of Bangor, Lichfield, Lincoln, Ripon, St. Asaph, St. Paul's, Wells, and Winchester.

Other Service Books.—The Eucharistic service was contained in the volume called the *MISSAL* (q. v.), as the ordinary choir offices were contained in the volume known as the *BREVETARY* (q. v.). But besides these two volumes there were a large number of other service books. Mr. Maskell has enumerated and described ninety-one such volumes in the use of the Western Church only. It must be understood, however, that many of these ninety-one names are synonyms (*Mon. Lit. Eccl. Anglo*, 1846, vol. i. p. ccxv.). The

list might be increased, but it will be possible here only to name and describe a few of the most important of them. (1) *Agnus-Rituale*. (2) The *Antiphonary* contained the antiphons sung at the canonical hours, and contain other minor portions of the service. (3) The *Benedictional* contained those triple episcopal benedictions previously described as used on Sundays and the chief festivals throughout the year. (4) The *Collectary* contained the collects for the seasons, together with a few other parts of the day offices. It was an inchoate Breviary. (5) The *Epistolarium* contained the epistles, and (6) the *Evangelistarium* the gospels for the year. (7) The *Gradual* contained the introt, gradual, sequences, and the other portions of the canonical service which at high mass were sung by the choir. (8) The *Litania* contained the lessons read at mass and at other times, and may be taken as a generic term to include the *Homiliarium*, *Martyrology*, *Psalms*, and other volumes. (9) The *Manual* was the term usually employed in England to denote the *Rituale*. (10) The *Penitential* contained the order of ordination, consecration, and such other rites as could, ordinarily, only be performed by the bishop. (11) The *Rituale* or *Ritual* comprised the occasional offices for baptism, marriage, burial, and those other offices which it ordinarily fell to the lot of the parish priest to execute. To these we must add a book which was not strictly a church office book, but a handy book for the use of the laity, and which was in very popular use, and often very highly embellished in the 14th to 16th century, the *Book of the Hours*, or *Horæ Beate Marci Virginitatis*. It contained portions of the canonical hours, litanies, the penitential psalms, and other devotions of a miscellaneous and private character.

The Eastern Church, too, possessed and still possesses numerous and voluminous office books, of which the chief are the following:—The *Euchologion*, containing the liturgy itself with the remaining sacramental offices bound up in the same volume, the *Horologion*, containing the surviving portion of the Breviary, the *Menologion* being equivalent to a complete Breviary, the *Menologion*, or martyrology, the *Octoechos* and *Parastaseis*, containing Tropars, and answering to the Western Antiphonary, the *Pentecostarion*, containing the services from Easter Day to All Saints' Sunday, as the *Troparion* contained those from Septuagesima to Sunday after Pentecost. The *Typicon* was a general book of rubrics corresponding to the Ordinale or the Pie of Western Christendom.

PERIOD IV. The Reformed Church.—The liturgy of the English Church passed through a more marked phase of change in the 16th century than during any of those periods which we have briefly described. The desire for some reform, and the sense of its necessity, which had been manifesting itself in various ways for more than a century and a half, culminated in the reign of Edward VI., and caused the appearance, with the full sanction of church and state, of the First Prayer Book of Edward VI. which was published on March 7, 1549, and came into general use on the feast of Whitsunday, June 9, 1549. Without attempting to enumerate particular points, we will summarize the general features which marked this change, and will exhibit the gains of such a reform, which, from an Anglican point of view, constitutes its complete justification.

(a) Simplification in the number and character of books required for divine service. The Prayer Book is a compendium of most of the volumes which have been recently named and described. Its matins and evensong are a compilation from the Breviary, the office of Holy Communion, with the collects, epistles, and gospels, is a translation and adaptation of the missal; the occasional offices represent the ritual or manual, and the offices of consecration and of ordination are taken, with modifications, from the position.

(b) The removal from the service of a vast quantity of legendary matter which was read in the form of lessons, and which was objectionable partly because it was unauthoritative, partly because it was indorous and almost profane. As an instance of unauthoritative matter, we quote a passage in the fourth lesson for the festival of St. Silvester, December 31, bishop of Rome, 314–335—

"In which office of the priesthood he (Silvester) dissembled himself above the rest of the clergy, and afterwards received Melchisedec on the papal throne in the reign of Constantine. That day he was ordered from heaven, and in order to care himself, by the advice of his physicians he ordered a bath to be prepared of infant's blood. But the holy apostles Peter and Paul appeared to him in private, and told him that, if he wished to be free from his journey, he should obtain the man's plan of an impious bath, and send for Silvester dwelling in seclusion at Monte Sineone, that by him the emperor should be refreshed in the bath of salvation, and should order temples to be built in every province of the Roman empire after the fashion of the Christians, and that he should do away with the images of idols, statues, and ornaments, the worship of the true God. Constantine, therefore, in obedience to the divine command, made diligent search for and summoned Silvester, by vision, recognizing the description of the apostles, he was baptized, and inclined to defend and defend his religion."

This lesson retains its position in the present Roman Breviary, although its unauthoritative character can be abundantly proved and

is generally acknowledged. The Breviary in fact is still, and was even more so then, full of legends which once passed for but have long since been abandoned as history.

As examples of the ludicrous we quote the first lesson for the festival of St. Felix from the Aberdeen Breviary of 1609, fol. xxvii., and the eighth lesson for the festival of St. Serf from the same Breviary (July 5, fol. xvi.)—

"His (Felix) was born, as it was foretold of him, with a stone in his mouth, on account of which he was so deplored by his father that he was ordered immediately after his birth to be thrown into a neighboring pond and drowned. In this pond he was miraculously nourished by angels for a whole year. But after the lapse of a year he was found by Bishop Iudica, to whom a divine revelation of the fact had been given, playing among the angels. He was taken out of the pond safe and sound, was baptized, and afterwards became distinguished in sacred literature."

"A certain robber called out one day a sheep which used to live and feed in the house of St. Serf, and killed it and ate it. Diligent inquiry was made for the thief but without success. At length suspicion fell on the robber, and he hastened into St. Serf's presence, prepared to deny the accusation with an oath. He swore a big oath that he was innocent of the charge laid against him, when, wonderful to relate (a fact which would not be believed on merely human testimony), the sheep which had lately been eaten began to baw in the stomach of the robber. Whereupon in confusion the man fell prostrate to the ground, and humbly asked for pardon, and the saint prayed for him."

There was also a quantity of objectionable matter introduced by a process of adaptation, or sometimes, as it was technically termed, by a process of farrago, into the older prayers. The *Canon* in English in the Sarum Missal is preserved almost unchanged in edit. i, 1641, p. 686—the faced words are represented by italics—

"Qui tollis peccata mundi, auscipe deprecationem nostram, ad Mariam gloriam. Qui sedes ad dexteram Patris, miserere nobis. Quoniam tu solus sanctus, Mariam sanctificans. Tu selus Dominus, Mariam gubernans. Tu solus altissimus, Mariam coronans. Jesu Christe, cum Sancto Spiritu in gloria Dei atri. Amen."

(c) For the first time, so far as can be ascertained, in the history of the English Church, the vernacular tongue was employed

(d) The numerous litanies to and invocations of the saints, especially of the Virgin Mary, were expunged.

(e) There was a very great extension of the portion of Holy Scripture read in divine service, partly by the extension of non-Scriptural matter, partly by the lengthening of lessons which sometimes consisted only of one or two verses, so "that many times there was more business to find out what should be read than to read it when it was found out."

(f) There was a general simplification of the services, by the reduction of the number of saints' days, by the cutting away of antiphons, invitatories, and responses, by the compression of the seven canonical hours into the two daily services of matins and evensong, &c.

(g) The various offices for the dead were abolished, and numerous prayers which involved a belief in the medieval idea of the penal flames of purgatory made way for the present burial office and the commemoration of the departed in the Eucharistic service.

The first reformed Prayer Book of 1549 remained in use till 1552, when by Act of Uniformity passed on April 6 it was ordered that a further reformed Prayer Book should come into general use on the feast of All Saints (November 1) following. This second Prayer Book, commonly spoken of as the Second Prayer Book of King Edward the VI., marks the furthest point in the Puritan direction which was ever reached by the liturgy of the Church of England. An idea of its character may be gained by mentioning some of the features retained in the first and discarded in the Second Prayer Book, and some of the features added in the Second, but absent from the First Prayer Book.

In the former class are—(a) the sign of the cross used in consecration, confirmation, marriage, and visitation of the sick, (b) the use of exorcism, chrism, and chrism in baptism; (c) unction of the sick, (d) certain prayers for the dead, and a special Eucharist for funerals; (e) the mention of vestments with alms and tuns for Eucharistic use, and of the pastoral staff and cope for the morning and evening prayer, (f) the addition of the Jubilate, Cantata, and Deus Meus at alternative canticles; (g) the words "commonly called the mass" omitted from the title of Holy Communion; (h) the words "mutant here on earth" added to the title of the prayer for the whole state of Christ's Church; (i) the deacon's introduction at the commencement of the communion service; (j) the second clause in the formula of sacramental distribution was substituted for the first, the two being subsequently combined in 1569. These are merely samples out of many more points which might be named.

It has not been ascertained that this Prayer Book ever received the sanction of Convocation, and it probably never came into complete use. Such use was in any case short-lived, for Edward VI. died on July 6, 1553, and the English Prayer Book was abolished and the Latin missal restored to use by one of the first Acts of Queen Mary, in October 1553. Queen Mary died on November 17, 1558, and another complete change of policy took place. The reformed Prayer Book was brought into use again on June 24, 1559, not in the exact shape which it bore in 1553, but with various modifications, which we forbear to enumerate in detail. It may be said of them, as of the various alterations introduced subsequently into the Prayer Book, that their general tendency was conservative rather than destructive, and in a Catholic rather than in a Protestant direction. The next important revisions of the Prayer Book took place in 1604, under James I., after the Hampton Court Conference, and in 1661-62, after the restoration of Charles II. The Book of Common Prayer had been abolished under the Commonwealth, and it could only be used under the risk of heavy penalties from 1645 to 1661. It was now restored with a considerable number of additions and alterations, after having been discussed without any satisfactory result between churchmen and Puritans at the Savoy conference in 1661. When these had received the sanction of the Convocations of Canterbury and York, it was attached to an Act of Uniformity which received the royal assent on May 19, 1662, by the provisions of which Act it came into general use on St. Bartholomew's Day, August 24, 1662. Since that date, although various slight changes have been made in recent years, nothing has been done amounting to a revision or new edition of the Prayer Book, or demanding notice in these columns.

A few words are added about other national versions of the reformed liturgy.

The Liturgy of the Scottish Episcopal Church.—This liturgy in nearly its present form was compiled by Scottish bishops in 1636, and imposed, or, to speak more accurately, attempted to be imposed upon the Scottish people by the royal authority of Charles I. in 1637. The prelates chiefly concerned in it were Spottiswood, bishop of Glasgow; Maxwell, bishop of Ross; Wedderburn, bishop of Dunblane; and Forbes, bishop of Edinburgh. Their work was approved and revised by certain members of the English episcopate, especially Laud, archbishop of Canterbury; Juxon, bishop of London; and Wren, bishop of Norwich. This liturgy has met with varied fortunes, and passed through several editions. It is now used as an alternative form with the English communion office in the Scottish Episcopal Church.

Among its more noteworthy features are—(a) the retention in its integrity and in its primitive position after the words of institution, of the invocation of the Holy Spirit;¹ (b) the reservation of the sacrament is permitted for the purpose of communicating the absent or the sick; (c) the mixed chalice is explicitly ordered; (d) the minimum number of communicants is fixed at one or two, instead of three or four. The general arrangement of the parts approximates more closely to the First Prayer Book of Edward VI. than to the present Anglican Book of Common Prayer.

The American Liturgy.—The Prayer Book of the "Protestant Episcopal Church" in America was adopted by the General Convention of the American Church held in 1789. It is substantially the same as the English Book of Common Prayer, but among the more important variations we may

name the following:—(a) the arrangement and wording of the communion office rather resembles that of the Scottish than of the Anglican liturgy, especially in the position of the oblation and invocation immediately after the words of institution; (b) the Magnificat, Nunc Dimittis, and Athanasian creed are disused; (c) ten selections of psalms are appointed to be used as alternatives for the psalms of the day. In addition to these there are various verbal and other unimportant alterations.

The Irish Prayer Book.—The Prayer Book in use in the Irish portion of the United Church of England and Ireland was the Anglican Book of Common Prayer, but after the disestablishment of the Irish Church several changes were introduced into it by a synod held in Dublin in 1870. These changes included (a) the exclusion of all lessons from the Apocrypha, (b) of the rubric ordering the recitation of the Athanasian creed, (c) of the rubric ordering the vestments of the second year of Edward VI., (d) of the form of absolution in the office for the visitation of the sick, (e) the addition of one question and answer in the Church Catechism, bringing out more clearly the spiritual character of the real presence.

The Presbyterian Church.—The Presbyterian churches of Scotland at present possess no liturgy properly so called. Certain general rules for the conduct of divine service are contained in the "Directory for the Public Worship of God," agreed upon by the Assembly of Divines at Westminster, with the assistance of commissioners from the Church of Scotland, approved and established by an Act of the General Assembly, and by an Act of Parliament, both in 1645. In 1654 John Knox had drawn up an order of liturgy, closely modelled on the Genevan pattern, for the use of the English congregation to which he was then ministering at Frankfurt. On his return to Scotland this form of liturgy was adopted by an Act of the General Assembly in 1660, and became the established form of worship in the Presbyterian Church, until the year 1846, when the Directory of Public Worship took its place. Herein regulations are laid down for the conduct of public worship, for the reading of Scripture, and for extempore prayer before and after the sermon and in the administration of the sacraments of baptism and the Lord's supper, for the solemnization of marriage, visitation of the sick, and burial of the dead, for the observance of days of public fasting and public thanksgiving, together with a form of ordination, and a directory for family worship. In all these cases, although the general tenor of the prayer is frequently indicated, the wording of it is left to the discretion of the minister, with these exceptions:—at the act of baptism this formula must be used—"I baptize thee in the name of the Father, and of the Son, and of the Holy Ghost;" and for the Lord's Supper these forms are suggested, but with liberty to the minister to use "other like, used by Christ or his apostle upon this occasion:—"

"According to the holy institution, command, and example of our blessed Saviour Jesus Christ, I take this bread, and, having given thanks, break it, and give it unto you. Take ye, eat ye; this is the body of Christ which is broken for you; do this in remembrance of him." And again, "According to the institution, command, and example of our Lord Jesus Christ, I take this cup and give it unto you; this cup is the New Testament in the blood of Christ, which is shed for the remission of the sins of many; drink ye all of it."

There is also an unvarying form of words directed to be used before the minister by the man to the woman and by the woman to the man in the case of the solemnization of matrimony. The form of words on all other occasions, including ordination, is left to the discretion of the officiating minister, or of the presbytery.

Continental Protestant Churches. The Calvinistic Churches.—Rather more of the liturgical element, in the shape of a set form of

¹ The present clause runs thus:—"And we most humbly beseech thee O merciful Father to hear us, and of Thy almighty goodness vouchsafe to bless and sanctify with Thy word and Holy Spirit these and Thy gifts and creatures of Bread and Wine, that they may become the Body and Blood of Thy most dearly-beloved Son." This petition is found in the Brevier but not in the Roman or Anglican Breviers.

words, enters into the service of the French and German Calvinistic Protestants. The Sunday morning service, as drawn up by Calvin, was to open with a portion of Holy Scripture and the recitation of the Ten Commandments. Afterwards the minister, inviting the people to accompany him, proceeded to a confession of sins and supplication in grace. Then one of the Psalms of David was sung. Then came the sermon, prefaced by an extempore prayer and concluding with the Lord's Prayer, creed, and benediction. The communion service began with an exhortation leading up to the apostle's creed, then followed a long exhortation, after which the bread and cup were distributed to the people, who sat down in rows and on either side, while a Psalter was sung as on a suitable passage of Scripture was being read. After all had communicated a set form of thanksgiving was said by the minister. Then the hymn of Simon was sung by the congregation, who were then dismissed with the blessing. The form of service has been modified in various ways from time to time, but it remains substantially the type of service in use among the Reformed Churches of Germany, Switzerland, and France.

The Lutheran Church.—Luther was far more conservative than the rest of the Protestant Reformers, and his conservatism appeared nowhere more than in the service books which he drew up for the use of the church which bears his name. In 1523 he published a treatise *Of the Order of the Service in the Congregation*, and in 1526 he published the *German Mass*. Except that the vernacular was substituted for the Latin language, the old Massbook and order of the Roman Mass were closely followed, beginning with the Confiteor, Introit, Kyrie Eleison, Gloria in excelsis, &c. The text of this and other Lutheran services is given in *Agende für christliche Gemeinden des lutherischen Bekenntnisses*, Nordhagen, 1858. At the same time Luther was tolerant, and expressed a hope that different portions of the Lutheran Church would from time to time make such changes or adaptations in the order of service as might be found convenient. The Lutheran Churches of northern Europe have not been slow to avail themselves of this advice and permission. Most of them have drawn up liturgies for themselves, sometimes following very closely, sometimes differing considerably from the original service composed by Luther himself. In 1828, on the union of the Lutheran and Reformed (Calvinistic) Churches of Prussia, a new liturgy was published at Berlin. It is used in its entirety in the chapel royal, but great liberty as to its use was allowed to the parochial clergy, and considerable variations of text appear in the more recent editions of the service book.

The Swedes, Danes, Livonians, and other Protestant bodies have drawn up liturgies for themselves, but they are hardly of sufficient historical importance to be described at length here.

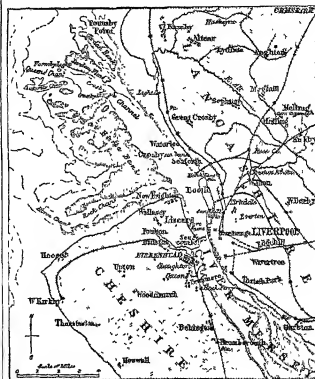
The Old Catholics, finally, published a *Rituale* in 1870 containing the occasional offices for baptism, matrimony, burial, &c., and a text for reception of holy communion, in the German language. The latter is for temporary use in anticipation of a revised and not yet published massal, corresponding to the order of communion in English published March 8, 1848, in anticipation of the complete office in the Prayer Book of 1849. (F. E. W.)

LUTPRAND (c. 922–972), Italian chronicler, was born towards the beginning of the 10th century, of a good Lombard family. The name is sometimes spelled Lutprand and even Luitprand. In 931 he entered the service of King Hugo of Italy as page, he afterwards rose to a high position at the court of Hugo's successor Berengar, having become chancellor, and having been sent (949) on an embassy to the Byzantine court. Falling into disgrace with Berengar, he attached himself to the emperor Otto I., whom in 961 he accompanied into Italy, and by whom in 962 he was made bishop of Ciemousa. He was frequently employed in missions to the pope, and on two occasions (968, 971) to Byzantium, to negotiate on behalf of the younger Otto (afterwards Otto II.) for the hand of Theophano. Lutprand died in 972.

He wrote (1) *Antipodesta, seu romanorum per Europam gestarum, Libri 87*, an historical narrative, relating to the events from 887 to 949, compiled, as its name almost implies, with the object of avenging himself upon Berengar and Wala his queen; (2) *Historia Ottonis*, unfortunately covering only the years from 960 to 961, and (3) *Relatio de Legatione Constantinopolitana* (968–969). All are to be found in the *Monum. Germ. Hist. of Pertz*, and in the *Rer. Ital. Script.* of Muratori; there is a recent edition by Dümmler (1877), and a partial translation into German, with introduction by Wattenbach, is given in the second volume of the *Geschichte schreiben der Deutschen Prosa* (1893). Compere Wattenbach, *Deutsche Geschichtsschreiber im Mittelalter* (3d ed., 1878). Three other works, entitled *Adversus Arrianos*, *Chronicon* (904–960), and *Opusculum de vita Romanorum pontificum*, are usually, but wrongly, assigned to Lutprand.

LIVERPOOL, a city and seaport of England, in the hundred of West Derby, in the county palatine of Lancashire, situated on the right bank of the estuary of the Mersey, about three miles from the open sea. The form of the city is that of an irregular semicircle, having the base line formed by the docks and quays extending about six miles along the east bank of the estuary, which here runs nearly north and south, and is about a mile in breadth. On the north the city is bounded by the borough of Bootle, along which the line of docks is continued. The area of the city is 5210 acres.

General Aspect and Features.—The suburb of Liverpool is the Hunter stratification of the New Red Sandstone, overlying the Coal-measures, which rise up some distance to the eastward. In the lower districts there is a deposit of boulder clay, which has been extensively used for the manufacture of bricks. The sandstone rises in long ridges to the eastward, in the highest points about 250 feet above the sea level. The city therefore lies on a continuous



Port of Liverpool

slope varying in gradient, but in some districts very steep. Exposed to the western sea breezes, with a dry subsoil and excellent natural drainage, the site is naturally salubrious, but neglect and perverseness have in past times done much to neutralize these advantages. The old borough, lying between the pool and the river, was a conglomeration of narrow alleys and mean houses packed together without any regard to sanitary provisions; and during the 16th and 17th centuries it was several times visited by the plague, which carried off many of the inhabitants. When the town burst its original limits, and expanded up the slopes beyond, a better state of things began to exist. The older parts of the town have at successive periods been entirely taken down and renovated. The streets of shops—Church Street, Bold Street, &c.—are equal in display to similar establishments in London. The commercial part of the city is remarkable for the number of palatial-looking piles of offices, built of hewn stone, principally in the Italian Renaissance style, amongst which the banks and insurance offices stand pre-eminent. The

demand for cottages about the beginning of the present century led to the construction of what are called "cous," being narrow *clos de ses*, close packed, with no thorough ventilation. This, combined with the degraded habits of a population brought together indiscriminately, resulted in a very high rate of mortality, to contend with which enormous sums have been expended in sanitary reforms of various kinds. The more modern cottages, erected on the higher grounds, are all that can be desired for that class of habitation.

Parks—The public parks of Liverpool now form a

prominent feature in the aspect of the town. The earliest, the Prince's Park, was laid out in 1843 by private enterprise. Seton Park, the most extensive, containing about 400 acres, was commenced in 1865, and completed at a cost of £410,000. A large portion of the land round the margin has been leased for the erection of villas. Waver-tree, Newsam, Sheil, and Stanley Parks have also been constructed at the public expense. Connected with Waver-tree Park are the botanic gardens, with the usual plant houses, and a large and lofty palm house. The suburbs are rapidly extending, and those on the south contain many



Plan of Liverpool.

good private residences. A boulevard, about a mile in length, planted with trees in the centre, leads to the entrance to Prince's Park.

Public Buildings—The old town has been so completely renovated during the present century that scarcely any of the public buildings date from an earlier period.

The earliest, and in many respects the most interesting, is the town-hall in Castle Street. This was erected from the designs of John Wood, the architect of the squares and crescents of Bath, and was opened in 1754. The building has since undergone considerable alterations and extensions, but the main features remain unchanged. It is a classical rectangular stone building in the Corinthian style, with an advanced portico in front, and crowned with a lofty dome

surmounted by a seated statue of Minerva. The interior was destroyed by fire in 1795, and was entirely remodelled in the restoration. It now contains a splendid suite of apartments, including a ball-room about 100 feet by 60, approached by a noble staircase. The building is occupied by the mayor as the municipal mansion house. A range of municipal offices was erected in Dale Street in 1860. The building is in the Palladian style, of considerable extent and imposing design, with a dominating tower and square pyramidal spire.

The crowning architectural feature of Liverpool is St George's Hall, completed in 1854. The original intention was to erect a music hall suited for the triennial festivals which had been periodically held in the town. About the

same time the corporation proposed to erect law courts for the assizes, which had been transferred to Liverpool and Manchester. In the competitive designs, the first prize was gained in both cases by Harvey Lonsdale Elmes. He was employed to combine the two objects in a new design, of which the present building is the outcome.

The structure is one of which the city may well feel proud, and notwithstanding some defects it will always hold a high and honourable place amongst the erections of modern times. It is fortunate in its situation, occupying the most central position in the town, and surrounded by an area sufficiently extensive to exhibit its proportions to the best advantage. Another advantage it possesses is that of size; there are few buildings in the country, forming a solid mass under one roof, which surpasses it in dimension. The plan is simple in arrangement, and easily described. The centre is occupied by the great hall, 169 feet in length, and, with the galleries, 27 feet wide and 74 feet high, covered with a solid vault in masonry. Attached to each end, and opening therefrom, are the law courts. A corridor runs round the hall and the courts, communicating with the various accessory rooms. Externally the east front is faced with a fine portico of sixteen Corinthian columns about 60 feet in height. An advanced portico of similar columns fronts the south end crowned with a pediment filled with sculpture, with the inscription—

"Arthas, Legibus, Censitibus
Locum Municipia Constituitur
Anno Domini MCCCCLXXII."

The style is Roman, but the refinement of the details is suggestive of the noblest period of Grecian art.

The great hall is finished with considerable richness in polished granite columns, marble balustrades and pavements, polished brass doors with rich foliated tracery, &c. The organ, built by Messrs Willis of London, from the specification of Mr Samuel Wesley, is equal to any in the country for extent, power, and beauty of tone. Mr Elmes, a young architect of great promise, having died during the progress of the work, the building was completed by the late Mr O. R. Cockrell, R.A.

Next to the public buildings belonging to the city, the most important is the exchange, forming three sides of a quadrangle, adjoining the town-hall on the north side. The town-hall was originally built to combine a mercantile exchange with municipal offices, but the merchants perversely preferred to meet in the open street adjoining. Thus, with other circumstances, led to the erection of the new exchange, a building of considerable merit, which was commenced in 1803 and opened in 1808. It had scarcely been in use for more than fifty years when it was found that the wants of commerce had outstripped the accommodation, and the structure was taken down to make room for the present building, in which greater convenience has been attained, with considerable sacrifice of æsthetic effect.

The revenue buildings, commenced in 1838, on the site of the original Liverpool Dock, combine the customs, inland revenue, post-office, and dock board departments. It is a huge heavy structure, with three advanced porticoes in the *Ilyssus* Ionic style. Near by stands the sailors' home, a large building in the Semi-Gothic or Elizabethan style.

The Philharmonic Hall in Hope Street, with not much pretension externally, is one of the finest music rooms in the kingdom, it accommodates an audience of about 2500.

The group of buildings forming the free public library, museum, and gallery of art are finely situated on the brow of the slope opposite St George's Hall. The library and gallery of art are separate buildings connected by the circular reading-room in the middle. The latter possesses some novelties in construction, having a circular floor 100 feet in diameter without columns or any intermediate support, and a lecture-room underneath, amphitheatrical in form, with grades or benches hewn out of the solid rock.

Railways.—There are three passenger stations in Liverpool, the London and North-Western, the Lancashire and Yorkshire, and the combined station of the Midland, Great Northern, and Manchester and Sheffield. The rapid increase of traffic has led to large extensions of the North-Western, and a very large addition to the Lancashire and Yorkshire is in progress (1892). The tunnel under the

Mersey now in course of construction will give access for the Great Western and Cumbrian systems into Liverpool.

Water and Gas Supply.—The original supply of water was from wells in the sandstone rock, but in 1846 an Act was passed, under which extensive works were constructed at Hvington, about 25 miles distant, by which a much larger supply was obtained. The vast increase of population led to further requirements, and in 1880 another Act gave power to impound the waters of the Vyrnwy, one of the affluents of the Severn. This scheme which, it is expected, will give a copious supply for many years to come, is now being carried out. The gas-works are the property of a company. Efforts have been made to effect a purchase by the city, but hitherto without success.

Administration of Justice.—The city has quarter sessions for criminal cases, presided over by the recorder, but the sessions are really held eight times in the year. The court of passage for civil cases is a very ancient institution, dating from the foundation of the borough by King John, originally intended for cases arising out of the imposts and exports passing through. Its jurisdiction has been confirmed and settled by parliament, and it is now competent, by consent, to try causes to any amount. The mayor is nominally the president, but the actual judge is an assessor appointed by the crown. There are two police courts which sit daily, one presided over by the lay magistracy, the other by the stipendiary magistrate.

Eccelesiastical.—The parish, which was separated from Walton-on-the-Hill in 1699, contained two churches, St Nicholas, the ancient chapel, and St Peter's, then built. There were two rectors, the living being held in mediæties. Over recent years changes have been sanctioned by parliament. The living is now held by a single incumbent, and a large number of the churches which have since been built have been formed into parishes by the ecclesiastical commissioners. St Peter's has been constituted the pro-cathedral, pending the erection of a more suitable building. Besides the two original parish churches, there are sixty-seven others belonging to the establishment.

The Roman Catholics form a very numerous and powerful body in the city, and it is estimated that from a third to a fourth of the entire population are Catholics. A large part of these are Irish settlers or their descendants, but this district of Lancashire has always been a stronghold of Catholicism, many of the landed gentry belonging to old Catholic families.

Charities.—These are numerous, and are maintained with no niggardly hand. The earliest foundation is the Blue Coat hospital, established in 1708, for orphans and fatherless children born within the borough. The building, erected in 1717, is a quaint and characteristic specimen of the architecture of the period. It now maintains two hundred and fifty boys and one hundred girls. There is an orphan asylum, established in 1840, for boys, girls, and infants, and a seamen's orphan asylum, commenced in 1858, for boys and girls. The Roman Catholics have similar establishments. The medical charities are large and flourishing. The royal infirmary has had a school of medicine attached, which has been very successful, and is now merged in the new University College. The medical charities are aided by simultaneous collections in the churches and chapels on "Hospital Sunday," the first Sunday in the year, the amount averaging about £10,000.

Literature, Art, and Science.—The free library, museum, and gallery of arts, established and managed by the city council, was originated in 1850. The library building was erected by Sir William Brown at a cost of £40,000. The Derby museum, containing the collections of Edward, the thirteenth earl, were presented by his son. The Mayer museum of historical antiquities and art was non-

tributed by Mr Joseph Mayer, F.S.A. Sir Andrew Walker erected the art gallery which bears his name at an expense of £35,000. The Fiction circular reading-room, and the Rotunda lecture-room were built by the corporation at the cost of £25,000. The library contains nearly 100,000 volumes. An annual exhibition of paintings has been established, the sales from which average about £12,000 per annum. A permanent gallery has also been formed, which is now being enlarged at a cost of about £12,000.

The literary and philosophical society was established in 1812, and still flourishes. There are also philomathic, geological, chemical, historic, and various other societies for the cultivation of almost every branch of knowledge and inquiry. An art club has been established with great success, and possesses an excellent club-house and gallery. The royal institution, established by Roscoe in 1817, possesses a fine gallery of early art, and is the centre of the various literary institutions of the town.

Education.—Elementary education has always met with cordial support in Liverpool, and is now carried on with vigour by the school board, supplemented by voluntary schools. For middle class and higher education there have existed for many years three institutions, which have been very successful, viz., the school attached to the royal institution, the collegiate institution in Shaw Street, and the Liverpool institute high school. A further effort has been successfully made resulting in the foundation of University College, the inaugural meeting of which was held on January 14, 1882. This college is affiliated to the Victoria university of the north-west of England. The sum of £135,000 has been raised by voluntary subscription, to which £30,000 have been contributed by the corporation. Seven chairs have been endowed, and professors appointed, and a suitable building has been provided.

Recreation and Social Life.—There are eight theatres, besides many minor music halls and places of amusement. The most fashionable and exclusive is the Philharmonic Hall, which is a large handsome building open only to proprietors, whose concerts take place every fortnight during the season. The Philharmonic concerts, and the balls at the Wellington Rooms (the Almshouses of Liverpool), afford the principal opportunities for the gatherings of the fashionable world. The Alexandra theatre, the new Court theatre, the Prince of Wales theatre, and Hengler's circus are all that could be desired in point of decoration and the *mises en scene*. The minor houses are conducted on the whole with great propriety and success.

Population.—According to the census of 1881 (preliminary report) the number of inhabitants within the parliamentary and the municipal borough—the limits of which are continuous—amounted to 552,425 persons, 271,640 being males and 280,785 females. At the end of the 17th century the population of Liverpool was 5145, but since then it has steadily increased as follows:—

1710	8,168	1811	94,876
1720	10,446	1821	126,000
1738	23,000	1831	205,672
1769	84,000	1871	488,425
1785	100,000	1881	552,425
1801	177,658		

If the boroughs of Bootle and Birkenhead, which are component parts of the port, are included, Liverpool has now a population of about three quarters of a million.

Trade and Commerce.—The progress of the commerce of Liverpool during the present century is almost without a parallel. In 1800 the tonnage of ships entering the port was 450,060, in 1880 it reached 7,938,620 tons. In 1800 4746 vessels entered, averaging 94 tons; in 1880 there were 20,246, averaging 440 tons. The only British port which can at all come into competition with Liverpool is London, the total tonnage of which, comprising exports and imports, amounted in 1880 to 10,479,106 tons, against 14,496,384

in Liverpool. A large proportion of this, however, is a coasting trade, indicated by the smaller size of the ships, averaging 340 tons each in London as compared with 440 tons in Liverpool. The coasting trade in Liverpool has rather fallen off owing to the superior advantages of railway traffic. The proportion of steamers to sailing ships has very largely increased of late years. The return for 1881 gives 5,684,469 tons of steam navigation to 2,379,466 tons in sailing ships. If we take the value of the imports as a criterion, London is far in advance of Liverpool, the values in 1880 being £141,442,907 and £107,460,187, but the London imports consist, to a great extent, of what the Liverpool imports, such as tea, silk, indigo, wines, &c., whilst the Liverpool imports principally consist of grain, food, and raw produce, the materials for manufacture. If we look at the exports the balance is reversed, Liverpool, in 1880, having exported the value of £84,029,851, against £52,600,928 from London. In the number of ships registered as belonging to the port, Liverpool stands first in the world, the tonnage belonging to Liverpool being 1,561,871, against 1,120,869 in London, and 1,005,884 in the whole of the ports on the Clyde.

The commerce of Liverpool extends to every part of the world, but probably the intercourse with America stands pre-eminent, there being five lines of steamers to New York alone, besides lines to Philadelphia, Boston, Halifax, Canada, New Orleans, &c. The size of the ships has greatly increased, having reached 8000 tons burden, with 10,000 horse-power.

The imports into Liverpool comprise produce of every description from every region under the sun. Cotton, however, is the great staple, almost the whole trade of the commodity centring here. Grain comes next, American and Australian corn occupying a large proportion of this market. Within the last few years an enormous trade in American provisions, including live cattle, has sprung up. Tobacco has always been a leading article of importation. In regard to exports, Liverpool possesses decided advantages; lying so near the great manufacturing districts of Lancashire and the West Riding of Yorkshire, this port is the natural channel of transmission for their goods, and, if everything else fails, there are always coal and salt from Wales and Cheshire ready to make up a cargo. The consequence is that many ships, after discharging their home-ward cargoes at London and the eastern ports, come round in ballast to Liverpool for an outward cargo.

Manufactures.—The manufactures of Liverpool are not extensive. Attempts have been repeatedly made to establish cotton-mills in and near the city, but have resulted in uniform failure. Engineering works, especially as connected with marine navigation, have naturally grown up, and have been carried on successfully on a large scale. Shipbuilding, in the days of the old wooden walls, in the early part of the present century, was active and prosperous. Several frigates and sloops-of-war for Government having been built here, but the keen competition of the Clyde and the north of England drew away a large portion of the trade. There are now four shipbuilding establishments on the Mersey. In the year 1880-81 there were launched from these yards thirty-three iron ships, with a tonnage of 58,971 tons. At one period the soap manufacture filled a large space in the industry of Liverpool, but it has almost entirely departed. During the latter half of last century and the beginning of the present, the pottery and china manufacture flourished in Liverpool. John Sadler, a Liverpool manufacturer, was the inventor of printing on pottery, and during the early period of Joseph Wedgwood's career, all his goods which required printing had to be sent to Liverpool. A large establishment, called the Herculaneum Pottery, was founded in an suburb on the bank of the Mersey, and was carried on with success for many years, but the whole trade has long disappeared. One manufacture established at an early period, still continues to flourish—the watch and chronometer trade. Litherland, the inventor of the lever watch, was a Liverpool manufacturer, and Liverpool-made watches have always been held in high estimation. There are several extensive sugar refineries, and two large tobacco manufactures.

Docks.—The docks of Liverpool on both sides of the Mersey are under the same trust and management, and equally form part of the port of Liverpool. On the Liverpool side they extend along the margin of the estuary of 6 miles, of which 14 miles is in the borough of Bootle. The Birkenhead docks have not much to boast of, they extend a long way backward. The water area of the Liverpool docks and basins is 5984 acres, with a linear quayside of 22 miles. The Birkenhead docks, including the great float of 120 acres, contain a water area of 180 acres, with a linear quayside of 8 miles. The system of floating docks was commenced by the corporation in 1708. With the advancing demands of commerce the docks were extended north and south. They constituted from the

ties: a public trust, the corporation never having derived any revenue from them, though the common council of the borough were the trustees, and in the first instance formed the committee of management. Gradually the dock ratifiers acquired influence, and were introduced into the governing body, and ultimately, by the Act of 1856, the corporation was entirely superseded. Under the present constitution, the management is vested in the Mersey Docks and Harbour Board, consisting of twenty-eight members, two of whom are nominated by the Board of Trade and the rest elected by the dock ratifiers, of whom a register is kept and annually revised. The affairs of the board are of considerable magnitude. The revenue is derived from tonnage rates on ships, dock rates on goods, dues on goods, with various minor sources of income. These amounted in the year ending July 1, 1881, to £1,226,497. The amount of debt outstanding is £16,284,861, for which a rate of interest averaging 4½ per cent. is paid.

Down to 1843 the docks were confined to the Liverpool side of the Mersey. Several attempts were made to establish docks in Cheshire had been frustrated by the Liverpool corporation, who bought up the land and kept it in their own hands. In 1848 a scheme was privately conceived for the construction of docks at Birkenhead. Plans were prepared by Mr. Rendel, C.E., the money subscribed, and arrangements made with the Admiralty. The corporation being kept in ignorance of the proceedings, the plan was then made by private individuals to purchase 300,000 square yards of land on the margin of an inlet called Walley Pool. The common council, which had been reformer in 1836, unaccountably fell into the snare, and in the ensuing session of parliament a rival scheme of docks for Birkenhead was brought out and passed. The great expectations which were entertained of their successful competition with Liverpool have been signally falsified. After a twelve years' struggle and litigation, the Birkenhead dock affairs had fallen into a hopeless state of insolvency, without any prospect of recovery, and in 1855 the docks were transferred to the corporation of Liverpool on payment to the bondholders of 13s. in the pound on their claims. Under the Act of 1855, settling the future constitution of the dock board, the Birkenhead docks were transferred to the Mersey Docks and Harbour Board. The result on the whole has been disastrous. The amount expended on the Birkenhead docks does not exceed 100,000,000, but the returns for this immense outlay do little more than defray the working expenses, the difference having to be made up from the revenue on the Liverpool side, so that, in consequence of this unfortunate rivalry, the shipping frequenting the port is taxed to the amount of £370,000 per annum, which other wise might have been expended on other mercantile vessels of 120 tons, though it contributes little to the revenue, is valuable as a depot for ships lying up, so as not to interfere with the working docks. In addition to the floating docks, there are in Liverpool eighteen graving docks and three in Birkenhead, and two graving on the Liverpool side.

The great landing stage of Liverpool is unique in its dimensions and utility. It was originally constructed in 1857, from the plans of Mr. J. Cubitt, and greatly enlarged and extended in 1874, making the entire cost £278,000. The grand fabric had just been completed, and was waiting to be inaugurated by the Duke of Edinburgh, when on the 28th July 1874 it accidentally caught fire, and the timber being impregnated with kerosene, the flames spread with unexampled rapidity, and in a few hours the whole was destroyed. It was again constructed with improvements. Its length is 2668 feet, or about seven of a mile, and its breadth 80 feet. It is supported on floating pontoons rising and falling with the tide, connected with the quay by seven bridges, besides a floating bridge for heavy traffic 550 feet in length. The southern half is devoted to the traffic of the Mersey ferries, of which there are eight—New Brighton, Egremont, Seacombe, Birkenhead, Thunders, Rock Ferry, New Ferry, and Eastham. The northern half is used for sea-going steamers, and for the tenders of the great "liners." The warehouses for storing produce form a very prominent feature in the commercial part of the city. Down to 1841 these were entirely in private hands, distributed as chance might direct, but in that year a determined effort was made to construct docks with warehouses around on the margin of the quays. This met with considerable opposition from those interested, and led to a municipal revolution, but the project was ultimately carried out in the construction of the Albert dock and warehouses, which were opened by Prince Albert in 1845. Other docks since constructed have been similarly surrounded. The Albert warehouses form an immense area of land standing between the dock and the river, impeding from their huge dimensions, but otherwise the very incarnation of bad ignominy.

Grain warehouses on a large scale have been constructed by the dock board both at Liverpool and Birkenhead. The machinery for elevating, distributing, drying, and discharging is of the most complete and thorough kind. The total amount received from the warehouses in the year 1880-81 was £242,384.

History.—There are no archaeological difficulties attending the origin of the town, which is clearly defined by documentary evidence. The part of the country in which Liverpool is situated was not very

distinguished in the earlier periods of English history. No Roman remains have been discovered within a considerable distance. Under the Saxons the site formed part of the kingdom or province of Deira, the river Mersey (Mersa-sea) forming the boundary between the eighth century colonies of Northumbria and Mercia. During the Danish invasions of the Mersey, as is indicated by the names of the villages and townships in the district. After the Conquest, the site of Liverpool formed part of the fief (inter Ripam et Merham) granted by the Conqueror to Roger de Poitou, one of the great family of Magna comery. After various forfeitures and receipts from the crown, it was ultimately handed over by Henry II. to Warne, the keeper of the castle and prison of Lancaster. In a deed executed by King John, then earl of Mortuagne, about 1190, confirming the grant to his then other manors to Henry Fitzwarne, son of the former grantee, the name of *Liverpool* first occurs.

The name is split in a variety of ways, and much ingenuity has been exercised in the endeavour to explain its etymology. Probably the most plausible is the derivation from Cymric *Llyfyr-pool*, "the expanse of the pool," or "the pool of the confinement," which exactly expresses the peculiarity of the original site. It is, however, open to the objection that the Welsh language had died out in the locality long before Liverpool was founded.

The immediate origin of Liverpool was owing to the following circumstances. After the partial conquest of Ireland by Strongbow, earl of Pembroke, under Henry II., the principal ports of communication were Bristol for the west and Chester for the east. The gradual silting up of the river Dee soon so obstructed the navigation as to render Chester a very unsuitable place of embarkation. A quay was then constructed at Shotwick, about 8 miles below Chester, with a castle to protect it from the incursions of the neighbouring Welsh, but a better site was sought and soon found. Into the shallow waters of the Mersey, a small stream, fed by a peat moss on the elevated land to the eastward, ran in an oblique direction from north-east to south-west, forming at its mouth an open pool or sea lake, of which many existed on both sides of the river. The triangular piece of land thus separated formed a moorland of red sandstone rock, rising in the centre about 50 feet above the sea-level, sloping on three sides to the water. The pool was admirably adapted as a harbour for the vessels of that period, being well protected, and the tide rising from 15 to 21 feet. King John repurchased the manor from Henry Fitzwarne, giving him another in exchange, and here he erected a castle of great utility. The gradual plan of round bastions and bastionary walls, with an inner bailli and buildings. He also founded a town by the erection of burgage tenements, one hundred and sixty-eight in number, and in 1207 he issued the following letter patent or charter:—

Carta Regis Johannis.

Pro omnibus et singulis burgis apud Liverpoli infra viceriam, et Scitis quod concessimus omnibus qui burgagia apud Liverpoli cepit nosse liberos omnes libertates et liberos consuetudines in de Liverpoli quos aliqui habet burgages super nosse habet in terra nostra. Et nos vobis mandamus quod secure et in pace nostra sine ulla vendita ad burgagia nostra recipiatis ad hospitales. Et in iudicio testemur nos litteras nostras vobis velle transmittimus. Teste Simon de Patishill apud Winton xxviii die Aug anno regni nostri nono.

Charter of King John.

"The king to all who may be willing to have burgages at the town of Liverpool, &c. Know ye that we have granted to all who shall take burgages at Liverpool that they shall have all liberties and free customs in the town of Liverpool which any free borough on the sea hath in our land. And we command you that securely and in our peace you may come thence to receive our inhabitant burgages. And in testimony hereof we transmit to you these our letters patent. Witness, Simon de Patishill, at Winchester, the 28th day of August, in the ninth year of our said king's reign."

From the Patent Rolls and the sheriff's accounts we learn that considerable use was made of Liverpool in the reign of John for shipping stores and reinforcements to Ireland and Wales. In 1216 the town was garrisoned for the king during the rising which took place after the granting of the Great Charter.

In 1259 a charter of incorporation was granted by Henry III., authorizing the formation of a merchants' guild, with a house and other liberties and free customs, with sea and soil, toll and thane, &c., and freedom from toll in all the other seaports. Charters were subsequently granted by successive monarchs down to the reign of William and Mary, which last was the last charter of incorporation of the Municipal Reform Act (1835). In 1580 when the new diocese of Liverpool was created, the borough was transformed into a city by royal charter.

The crown revenues from the burgage rents and the royal customs were leased in fee-farm from time to time, sometimes to the corporation, at other times to private persons. The first lease was from Henry III. in 1250, at £10 per annum. In the same year the borough with all its appurtenances was bestowed, with other lands, on Ranulf, earl of Chester. During the subsequent two centuries the fee was repeatedly forfeited and regranted, until it finally passed into the hands of John of Gaunt, duke of Lancaster, and from the accession of his son Henry IV. it merged in the crown. In 1628 Charles I., in great straits for means which were refused by parliament, offered for sale about a thousand manors among which Liverpool was included. The corporation

lege, Oxford, where after a career of special distinction he graduated M.A. in 1753. Almost immediately on entering parliament as member for Cokeremouth in 1761, he was appointed under-secretary of state under Lord Bute, and, as he soon shared equally with that nobleman the favour of the king, his political advancement was rapid and uninterrupted while the friends of the king remained in office. By Grenville he was in 1763 appointed secretary of state; in the Grafton administration he, in 1766, obtained a seat at the Admiralty Board; and from 1778 till the close of Lord North's ministry he was secretary at war. On the accession of Pitt to power in 1784, he became president of the Board of Trade, retaining office till Pitt's resignation in 1801. Besides direct political power he also enjoyed a large share both of substantial and honorary political rewards. In 1773 he became member of the privy council, and obtained the vice-treasurership of Ireland, which he afterwards exchanged for the clerkship of the pells; and from 1786 to 1802 he was chancellor of the duchy of Lancaster. In 1786 he was created Baron Hawkesbury, and ten years afterwards earl of Liverpool. He died 17th December 1808. Lord Liverpool was generally believed to be the chief political adviser of George III. His prudence, practical talents, and knowledge of the details both of home and foreign politics rendered him a specially safe and useful member of a cabinet.

He was the author of several political works, which display industry and discrimination, but, with the exception of his well-known *Treatise on the Coins of the Realm*, 1805, are without striking merits. His other writings are—*National and Constitutional Force in England*, 1756; *Treatise between Great Britain and other Powers*, 1848-1783, 3 vols., 1785; *The Conduct of Great Britain in respect to Neutral Nations*, 1785, 3 vols., 1801.

LIVERPOOL, ROBERT BAYNES JENKINSON, SECOND EARL OF (1770-1828), son of the above by his first wife Amelia, daughter of Mr Watts, governor of Bengal, was born June 7, 1770. He was educated at Charterhouse and at Christ Church, Oxford, where he had Canning, afterwards his close political associate, for a contemporary. In 1791 he entered parliament as member for Rye, but he first held office in 1801 as foreign secretary in Addington's administration, when he conducted the negotiations for the abortive treaty of Amiens. On the accession of Pitt to power in 1804, he obtained the home office, and till his elevation to the House of Peers he acted as leader of the party in the House of Commons. He declined the premiership on the death of Pitt in 1806, and remained out of office till the accession of Perceval in 1809, when he again became home secretary. After the assassination of Perceval in 1812 he became prime minister, and retained office till compelled in February 1827 to resign by the illness (paralysis) which terminated his life, 4th December 1828. The political career of Lord Liverpool was entirely of a negative character so far as legislation was concerned; the only principle which regulated his statesmanship was persistent opposition to every kind of change, especially in the direction of increased religious or political liberty. From the beginning he strongly resisted Catholic emancipation, and he was also prominent in delaying the emancipation of the slaves. The energy of Castlereagh and Canning secured the outward success of the foreign policy of the cabinet, but in his home policy he was always unfortunate and retrograde. The Pains and Penalties Bill against Queen Caroline greatly increased his unpopularity, first originated by the severe measures of repression employed to quell the general distress, which had been created by undue taxation and was aggravated by blind adherence to protection. Though, therefore, actuated throughout by an honesty beyond all question, and though always commanding the sincere respect of his opponents by his dignified and considerate bearing, Lord Liverpool was destitute of wide and genial

sympathies, and of true political insight, and his resignation of office was followed almost immediately by the complete and permanent reversal of his domestic policy.

LIVERWORTS. The Liverworts or *Hepatice* constitute a group of the higher *Cryptogamia*, allied to the mosses. Their shoots are either *thalloid*, in some genera (*Marchantia*) highly differentiated in structure, in others (*Anthoceros*) of simple homogeneous texture, with an upper and lower surface, the latter fixed to the ground by capillary rootlets, and generally margined with minute scales; or they are *foliose*, the central stem bearing on each side a row of leaves, consisting of one series of cells invested with a structureless epidermis, and destitute of nerves, such as prevail in the leaves of mosses. Frequently on the inferior aspect a third row of leaf-like scales is found, differing from the former, and known as stipules, bracteoles, or amphigastria. Hence the shoots, although typically trifloral, often appear bilateral. The reproductive organs of the *Hepatice* are of two kinds—sexual and asexual.

I. The sexual germs of the mosses and *Hepatice* were first described by Hedwig just one hundred years ago (1782). They consist, as in the higher plants, of germ-cells and sperm-cells. As the fronds approach maturity the terminal leaves become modified so as to form an involucre, within which a special covering appears, the coleole or perianth, surrounding the pistillidia; this is tubular, conical, or compressed in form, with the mouth plicate and generally dentate.

On section of the coleole a number of minute flask-shaped bodies are found, attached to the apex of the stem, which have been named archigonia or pistillidia. After fertilization one of these enlarges, active cell formation proceeding from the central cell at the base, within which appears the germ-cell, which in time becomes the capsule, the ultimate contents producing spores arranged in fours, and elongated cells bearing within spiral filaments (elaters). Until the maturity of the spores, the sporangium remains at the base of the coleole, but at length the outer coat (calyptra) ruptures near the summit, and by the rapid evolution of the cells of the fruit-stalk (seta) the capsule is borne upwards. At this stage, which is of brief duration, the fronds look as if dotted with black-headed pins on white stalks. Released from pressure, the hygrometric action of the elater soon ruptures the wall of the capsule, which divides, in the majority of species, into four valves, and the spores are scattered around.

The antheridia are sometimes found imbedded in crypts within the substance of the thallus (*Riccia*), or in special receptacles either sessile or raised above the surface of the same (*Marchantia*). In the foliose *Hepatice* they are usually seated in the axils of modified leaves (perigonia), sometimes appearing beneath the fertile involucre (monocleous), or on special branches of the same plant (paracleous), or they occur on separate plants (dioecious). The antheridia are much smaller than the capsules, spheroidal or ovoid in form, and seated on a short footstalk. They are invested with a single coat of tubular cells. Before maturity they are greenish, but when ripe their colour turns to yellow. On pressure they rupture irregularly, and allow the escape of crowds of lenticular cells, which revolve actively under the microscope until the ciliated phytozoa within them are released.

The phytozoa of mosses were first figured by Unger (1834), who described them as consisting of a thick body, and a thin thread-like prolongation, which goes in advance when the body is in motion, and is spiral in form. Thuret has since shown that the so-called "tail" bears two long oscillating cilia. Hofmeister first observed the formation of the free germinative vesicle within the basal cell of the pistillidium as the direct result of fertilization.

II. *Asexual Germs*.—Beyond the true fructification, in the majority of *Hepaticæ*, certain bodies are met with, which are known as gemmæ, but which differ from each other in complexity and significance.

(1) In some *Marchantia* basket-like or crenate receptacles are found, containing lenticular bodies, which, under favourable conditions, will produce new fronds.

(2) On the borders of the leaves, especially near the apex of the shoots, proliferation from the ordinary cellular tissue is met with in most *Hepaticæ*, in the form of detached cells or tufts of such cells. These are generally described as gemmæ, but resemble more closely the *gonocidia* of lichens, and probably aid in the diffusion of dioecious species, which from the absence of ♂ or ♀ plants would otherwise become extinct.

(3) Another process has been ascribed to gemmation, but has been more happily named by Dr A. Braun *rejuvenescens* (*Verjüngung*). In decayed or apparently withered fronds, certain cells, after a period of rest, assume new activity and multiply so as to give rise to new individuals (*Antloeros*, *Riccia*, &c.).

Distinction between Hepaticæ and Musci.—There is scarcely a character in the definition of *Hepaticæ* which might not refer to some genus of mosses, although the definition as a whole may be sufficiently distinctive, and practically there is no difficulty in distinguishing one from the other.

In *Musci* the urn-case or capsule generally opens by means of a lid, and the mouth is surrounded by a peristome divided into four, eight, or more teeth. A columella is nearly always present, and the spore ripens in a sac between the former and the walls of the capsule. From the early elongation of the fruit rudiment, the calyptra is ruptured at an earlier stage, the upper part investing the urn-case like a cap, during the development of the spores, the lower remnant remains at the base of the seta (which, as well as the capsule, is composed of more lignous texture than in *Hepaticæ*) as the vaguella. The spore gives rise to a coniferous protuberance often extensively branched, and from this the buds arise. The leaves are imbricated on all sides of the stem, and the phylloaxis is usually 3, 4, or 5. The leaves are frequently strengthened by a midrib, and the rootlets are divided by numerous septa.

Edaphite.—The *Hepaticæ* are common in bogs, and form a relatively important average of the alpine vegetation, being abundant in moist equable and insular places, e.g., Ireland, Scotland, New Zealand. They are also met with in more tropical zones, such as South America, India, Java, and the West Indies.

Classification.

I. *Marchantiaceæ*.—Fronds thalloid, prostrate, furcate, epidermis pierced with numerous stomata, inner section areolate, occupied by green gemmal cells, lower surface simply cellular, emitting long rootlets, papillæ within.

(a) *Marchantia*.—Capsules aggregate on a stalked receptacle e.g., *Marchantia*, *Aspidella*, *Regetella*, *Dumortiera*, *Limnoria*, &c.

(b) *Tarponia*.—*Anthridia* immersed; involucre like a split pea; capsule nearly sessile, below the apex.

(c) *Levier*.—*Anthridia* and *pidellidia* immersed, the latter emitting the spores by the decay of the walls, spores without elaters: e.g., *Riccia*, *Ricciella*, &c.

II. *Jungmanniaceæ*.—Capsule solitary terminal on the primary shoots or on short lateral ones, splitting into four valves.

* *Filices*

(a) Leaves subcircular: e.g., *Jungmannia*, *Scoparia*, *Lophocolea*, &c.

(b) Leaves subovate: e.g., *Lijemna*, *Prullantia*, *Schiema*, *Lepidozia*, &c.

* *Frondosæ*: e.g., *Folia*, *Blasia*, *Petalophyllum*, &c.

III. *Anthocerotæ*.—Capsule horn or pod-like, opening by one or two valves, columella central, spores intermingled with deformed elaters: e.g., *Anthoceros*, *Monoecia*.

Use.—At the present time the *Hepaticæ* are of little practical use to man. In the dark ages of medicine, when the doctrine of "signatures" was in fashion, the strongly-marked epidermic cells were supposed to resemble the structure of the liver, and the species were esteemed "a sovran remedy" in liver complaints. The *Hepaticæ fontana* (*Marchantia polymorpha*) of Casper Baubine, which grows near springs, walls, and watery places, very low, almost like a moss, and puts out flowers about June, not unlike *stare*. It is wonderfully commended by Schroder, in those disorders of the liver which arise from too much heat (*English Dispensary*, 1788). A few species possess a pungent, bitter taste (*Porolia*) resembling that of *Sedum rosea*. Many also evolve a rank odour, observable in the woods

and fields after rain, and incorrectly referred to the smell of moist earth.

Beyond the beauty of tint and outline, which light up many a dreary ravine, they supply abundant material for the microscope, enabling us by the translucency of thams, and their easy preservation, so long as moisture is supplied, to study cell and leaf-structure, and the wonders of reproduction, as no other class will do.

Lastly, many fern-growers have of late included the *Hepaticæ* and *Musci* in their lists of favourites, the variety adding immeasurably to the interest of their collections. Most of the species are readily cultivated in a cold frame or fernery, the atmosphere of which must be kept moist and equable. In the renowned ferneries of Mr. Backhouse of York, A. Stansfeld of Tordrorden, and the Glanville Gardens, Dublin, species have long been cultivated, many foreign to the climate, and introduced with foreign plants. (B. C.)

LIVINGSTON, EDWARD (1764-1836). American jurist and statesman, was born in Clermont, Columbia county, New York, May 26, 1764. He was a great-grandson of Robert Livingston, the first possessor under royal patent of "Livingston Manor," a tract of land on the Hudson, comprising the greater part of the present counties of Dutchess and Columbia. Having graduated at Princeton in 1781, he began to practise law in New York city, and rapidly rose to distinction as an advocate. He was a member of congress during 1794-98, and in 1801 was appointed United States district attorney for the State of New York, and while retaining that position was also elected mayor of New York city, then an office of high dignity and emolument. In the summer of 1803 New York was visited with a violent epidemic of yellow fever, during which Livingston displayed great courage and energy in his endeavours to prevent the spread of the disease, and to relieve the widespread distress. He suffered an attack of the fever in its most violent form, during which the people of the city gave many proofs of their attachment and anxiety. He recovered to find his private affairs, which he had neglected, in some confusion, and he was at the same time deeply indebted to the Government for public funds which had been lost through the mismanagement of a confidential clerk. Livingston at once surrendered all his property, and, having resigned his office, removed to Louisiana, which had then just been ceded by France to the United States. He soon acquired a large law practice in New Orleans, and repaid the Government in full. Almost immediately upon his arrival in Louisiana he was appointed by the legislature to prepare a provisional code of judicial procedure, which was continued in force from 1806 to 1826. During the short war with England in 1814-15, Livingston was active in rousing the mixed population of New Orleans to resistance, and acted as adviser and aide-de-camp to Jackson. In 1821, by appointment of the legislature, Livingston began the preparation of a new code of criminal law and procedure, since widely known in Europe and America as the "Livingston Code." It was prepared in both French and English, as required by the necessities of practice in Louisiana, and, though substantially completed in 1824, and in greater part then adopted by the State, it was not printed entire until 1833. It was at once reprinted in England, France, and Germany, attracting wide interest and praise from the most distinguished sources by its remarkable simplicity and vigour, and more especially by reason of its philanthropic provisions, which have noticeably influenced; the penal legislation of several countries. Livingston was a member of congress during 1829-33, was afterwards senator, and for two years secretary of state under President Jackson. From 1833 to 1835 he was minister plenipotentiary to France, and conducted with success negotiations of considerable difficulty and importance. He died May 23, 1836.

See *Livingston's Life* by C. H. Hunt (New York, 1864), and his complete *Works* (2 vols., 1877).

LIVINGSTON, ROBERT R (1746-1813), American statesman, brother of Edward Livingston noticed above, was born at New York, November 27, 1746. He graduated at King's College, New York, at the age of nineteen, became a practitioner of law, and in 1773, recorder of the city, but was soon displaced by loyalist influence because of his sympathies with the revolution. In 1776 he was a member of the committee of congress which drew up the Declaration of Independence, and in 1777 was a prominent member of the convention at Kingston, which framed the first constitution of New York. Upon the adoption of that instrument in the same year he became the first chancellor of the State, which office he held until 1801, whence he is best known as "Chancellor" Livingston. He administered the oath of office to Washington at his first inauguration to the presidency in New York, April 30, 1789. In 1801 he was appointed by President Jackson as minister to France, and in 1803 effected in behalf of his Government the purchase from France of the vast territory then known as Louisiana, comprising the entire territory between the Mississippi and the Rocky Mountains, from the Spanish to the British possessions. This was, perhaps, the most important transfer of territory by purchase ever made, but none of those who participated in it realized its importance. Napoleon's agent obtained ten million francs more than he had been instructed to accept for the cession, and Jefferson and Livingston were at the time bitterly censured for rashly concluding so useless a purchase. In 1804 Livingston withdrew from public life, and after spending a year in travel in Europe, returned to New York, where he occupied his remaining years in promoting various improvements in agriculture. He also assisted Fulton in his invention of the steamboat. He died in February 1813.

LIVINGSTONE, DAVID (1813-1878), missionary and explorer, was born on March 19, 1813, at the village of Dlantry Works, in Lanarkshire, Scotland. David was the second child of his parents Neil Livingston (for so he spelled his name, as did his son for many years) and Agnes Hunter. His parents were poor and self-respecting, typical examples of all that is best among the humbler families of Scotland. At the age of ten years David left the village school for the neighbouring cotton-mill, and by strenuous efforts he qualified himself at the age of twenty-three to undertake a college curriculum. He attended for two sessions the medical and the Greek classes in Anderson's College, and also a theological class. In September 1838 he went up to London, and was accepted by the London Missionary Society as a candidate. During the next two years he resided mostly in London, diligently attending medical and science classes, and spending part of his time with the Rev. Mr. Cecil at Ougar in Essex, studying theology and learning to preach. He took his medical degree in the Faculty of Physicians and Surgeons in Glasgow in November 1840. Livingston had from the first set his heart on China, and it was a great disappointment to him that the Society finally decided to send him to Africa. To an exterior in these early years somewhat heavy and uncouth, he united a manner which, by universal testimony, was irresistibly winning, with a fund of genuine but simple humour and fun that would break out on the most unlikely occasions, and in after years enabled him to overcome difficulties and mellow refractory chiefs when all other methods failed.

Livingstone sailed from England on December 8, 1840. From Algoa Bay he made direct for Kuruman, the mission station, 700 miles north, established by Hamilton and Moffat thirty years before, and there he arrived on July 31, 1841. The next two years Livingston spent in travelling about the country to the northwards, in search of a suitable outpost for settlement. During these two

years he had already become convinced that the success of the white missionary in a field like Africa is not to be reckoned by the tale of doubtful conversions he can send home each year,—that the proper work for such men was that of pioneering, opening up and starting new ground, leaving native agents to work it out in detail. The whole of his subsequent career was a development of this idea. He selected the valley of Mabotsa, on one of the sources of the Limpopo river, 200 miles north-east of Kuruman, as his first station. It was shortly after his settlement here that he was attacked by a lion which crushed his left arm, and nearly put an end to his career. The arm was imperfectly set, and it was a source of trouble to him at times throughout his life, and was the means of identifying his body after his death. To a house, mainly built by himself at Mabotsa, Livingston in 1844 brought home his wife, Mary Moffat, the daughter of Moffat of Kuruman. Here he laboured till 1846, when he removed to Chocuanne, 40 miles further north, the chief place of the Bakwain tribe under Sechele. In 1847 he again removed to Kolobeng, about 40 miles westwards, the whole tribe following their missionary. With the help of and in the company of two English sportsmen, Mr. Oswell and Mr. Murray, he was able to undertake a journey of great importance to Lake Ngami, which had never yet been seen by a white man. Crossing the Kalahari Desert, of which Livingston gave the first detailed account, they reached the lake on August 1, 1849. In April next year he made an attempt to reach Sebitane, who lived 200 miles beyond the lake, this time in company with his wife and children, but again got no further than the lake, as the children were seized with fever. A year later, April 1851, Livingston, again accompanied by his family and Mr. Oswell, set out, this time with the intention of settling among the Makololo for a period. At last he succeeded, and reached the Chobe, a southern tributary of the Zambesi, and in the end of June discovered the Zambesi itself at the town of Sesheke. Leaving the Chobe on August 13, the party reached Capetown in April 1852. Livingston may now be said to have completed the first period of his career in Africa, the period in which the work of the missionary had the greatest prominence. Henceforth he appears more in the character of an explorer, but it must be remembered that he regarded himself to the last as a pioneer missionary, whose work was to open up the country to others.

Having, with a sad heart, seen his family off to England, Livingston left the Cape on June 8, 1852, and reached Linyanti, the capital of the Makololo, on the Chobe, on May 23, 1853, received in royal style by Sekeletu, and welcomed by all the people. His first object in this journey was to seek for some healthy high land in which to plant a station. Ascending the Zambesi, he, however, found no place free from the destructive tsetse insect, and therefore resolved to discover a route to the interior from either the west or east coast. To accompany Livingston in his hazardous undertaking twenty-seven men were selected from the various tribes under Sekeletu, partly with a view to open up a trade route between their own country and the coast. The start was made from Linyanti on November 11, 1853, and, by ascending the Leeba, Lake Dilolo was reached on February 20, 1854. On April 4 the Coango was crossed, and on May 31 the town of Loanda was entered, much to the joy of the men,—their leader, however, being all but dead from fever, semi-starvation, and dysentery. Livingston speaks in the warmest terms of the generosity of the Portuguese merchants and officials. From Loanda Livingston sent his astronomical observations to Madagat at the Cape, and an account of his journey to the Royal Geographical Society, which in May 1855 awarded him its highest honour, its gold medal.

Loanda was left on September 20, 1854, but Livingstone lingered long about the Portuguese settlements. Making a slight detour to the north to Chibango, the party reached Lake Dilolo on June 13. Here Livingstone made a careful study of the watershed of the country in what is perhaps the most complicated river system in the world. He "now for the first time apprehended the true form of the river systems and the continent," and the conclusions he came to have been essentially confirmed by subsequent observations. The return journey from Lake Dilolo was by the same route as that by which the party came. Their reception all along the Barotse valley was an ovation, and Linyanti was reached in the beginning of September.

For Livingstone's purposes the route to the west was unavailable, and he decided to follow the Zambezi to its mouth. With a numerous following, he left Linyanti on November 8, 1855. A fortnight afterwards he made the great discovery with which, in popular imagination, his name is more intimately associated than with anything else he did,—the famous "Victoria" falls of the Zambezi, which, after a second examination in his subsequent journey, he concluded to be due to an immense fissure or fault right across the bed of the river, which was one means of draining off the waters of the great lake that he supposed must have at one time occupied the centre of the continent. He had already formed a true idea of the configuration of the continent as a great hollow or basin-shaped plateau, surrounded by a ring of mountains. Livingstone reached the Portuguese settlement of Tette on March 2, 1856, in a very emaciated condition, and after six weeks, left his men well cared for, and proceeded to Kilimane, where he arrived on May 20, thus having completed in two years and six months one of the most remarkable and fruitful journeys on record. The results in geography and in natural science in all its departments were abundant and accurate; his observations necessitated a reconstruction of the map of central Africa. Men of the highest eminence in all departments of science testified to the high value of Livingstone's work. In later years, it is true, the Portuguese, embittered by his unsparing denunciations of their traffic in slaves, attempted to depreciate his work, and to maintain that much of it had already been done by Portuguese explorers. When Livingstone began his work in Africa it was virtually a blank from Karuman to Timbuctoo, and nothing but envy or ignorance can throw any doubt on the originality of his discoveries.

On December 12 he arrived in England, after an absence of sixteen years, and met everywhere with the welcome of a hero. He told his story in his *Missionary Travels and Researches in South Africa* (1857) with straightforward simplicity, and with no effort after literary style, and no apparent consciousness that he had done anything extraordinary. Its publication brought what he would have considered a competency had he felt himself at liberty to settle down for life. In 1857 he severed his connexion with the London Missionary Society, with whom, however, he always remained on the best of terms, and in February 1858 he accepted the appointment of "Her Majesty's consul at Kilimane for the eastern coast and the independent districts in the interior, and commander of an expedition for exploring eastern and central Africa."

The Zambezi expedition, of which Livingstone thus became commander, sailed from Liverpool in H.M.S. "Pearl" on March 10, 1858, and reached the mouth of the Zambezi on May 14, and the party ascended the river from the Kongone mouth in a steam launch, the "Ma-Robert," reaching Tette on September 8. The remainder of the year was spent in examining the river above Tette, and especially the Kobabasa rapids. Most of the year 1859 was spent in the exploration of the river Shire and Lake

Nyassa, which was discovered in September; and much of the year 1860 was spent by Livingstone in fulfilling his promise to take such of the Makalolo home as failed to go. In January of next year arrived Bishop Mackenzie and a party of missionaries sent out by the Universities Mission to establish a station on the upper Shire.

After exploring the river Korrums for 30 miles in his new vessel the "Pioneer," Livingstone and the missionaries proceeded up the Shire to Chibias; there they found the slave trade rampant, desolating the country and paralysing all effort. On July 15 Livingstone, accompanied by several native carriers, started to show the bishop the country. Several bands of slaves whom they met were liberated, and after seeing the missionary party settled in the highlands of Magomero to the south of Lake Shirwa, Livingstone spent from August to November in exploring Lake Nyassa. While the boat sailed up the west side of the lake to near the north end, the explorer marched along the shore. He returned more resolved than ever to do his utmost to rouse the civilized world to put down the desolating slave-trade. On January 30, 1862, at the Zambezi mouth, Livingstone welcomed his wife and the ladies of the mission, with whom were the sections of the "Lady Nyassa," a river steamer which Livingstone had had built at his own expense, absorbing most of the profits of his book, and for which he never got any allowance. When the mission ladies reached the mouth of the Euphrates of the Shire, they were stunned to hear of the death of the bishop and of Mr. Burrap. This was a sad blow to Livingstone, seeming to have rendered all his efforts to establish a mission futile. A still greater loss to him was that of his wife at Shupanga, on April 27, 1862.

The "Lady Nyassa" was taken to the Rovuma. Up this river Livingstone managed to stave 156 miles, but further progress was arrested by rocks. Returning to the Zambezi in the beginning of 1863, he found that the desolation caused by the slave trade was more horrible and widespread than ever. It was clear that the Portuguese officials were themselves at the bottom of the traffic. Kirk and Charles Livingstone being compelled to return to England on account of their health, the doctor resolved once more to visit the lake, and proceeded some distance up the west side and then north-west as far as the watershed that separates the Loangwa from the rivers that run into the lake. Meanwhile a letter was received from Earl Russell recalling the expedition by the end of the year. In the end of April 1864 Livingstone reached Zanzibar in the "Lady Nyassa," and on the 30th he set out with nine natives and four Europeans for Bombay, which was reached after an adventurous voyage of a month, and on July 23 Livingstone arrived in England. He was naturally disappointed with the results of this expedition, all its leading objects being thwarted through no blame of his. For the unfortunate disagreements which occurred, and for which he was blamed in some quarters, he must be held acquitted, as he was by the authorities at home; though it is not necessary to maintain that Livingstone was exempt from the trying effects on the temper of African fever, or from the intolerance of lukewarmness which belongs to all exceptionally strong natures. Still the results at the time, and especially those of the future, were great. The geographical results, though not in extent to be compared to those of his first and his final expeditions, were of high importance, as were those in various departments of science. Details will be found in his *Narrative of an Expedition to the Zambezi and its Tributaries*, published in 1865.

By Murdison and his other staunch friends Livingstone was as warmly welcomed as ever. When Murdison proposed to him that he should go out again, although he seems to have had a desire to spend the remainder of his

days at home, the prospect was too tempting to be rejected. He was appointed H.M. consul to central Africa without a salary, and Government contributed only £500 to the expedition. The chief help came from private friends. During the latter part of the expedition Government granted him £1000, but that, when he learned of it, was devoted to his great undertaking. The Geographical Society contributed £500. The two main objects of the expedition were the suppression of slavery by means of civilizing influences, and the ascertainment of the watershed in the region between Nyassa and Tanganyika. At first Livingstone thought the Nile problem had been all but solved by Speke, Baker, and Burton, but the idea grew upon him that the Nile sources must be sought farther south, and his last journey became in the end a forlorn hope in search of the "fountains" of Herodotus. Leaving England in the middle of August 1855, via Bombay, Livingstone arrived at Zanzibar on January 28, 1856. He was landed at the mouth of the Rovuma on March 23, and started for the interior on April 4. His company consisted of thirteen sepoys, ten Johanna men, nine African boys from Nassick school, Bombay, and four boys from the Shire region, besides camels, buffaloes, mules, and donkeys. This imposing outfit soon melted away to four or five boys. Rounding the south end of Lake Nyassa, Livingstone struck in a north-north-west direction for the south end of Lake Tanganyika, over country much of which had not previously been explored. The Loangwa was crossed on December 15, and on Christmas day Livingstone lost his four goats, a loss which he felt very keenly, and the medicine chest was stolen in January 1856. Fever came upon him, and for a time was his almost constant companion; thus, with the fearful dysentery and dreadful ulcers and other ailments which subsequently attacked him, and which he had no medicine to counteract, no doubt took fatally on even his iron frame. The Chambeze was crossed on January 28, and the south end of Tanganyika reached March 31. Here, much to his vexation, he got into the company of Arab slave dealers, by whom his movements were hampered; but he succeeded in reaching Lake Moero. After visiting Lake Mofwa and the Luabala, which he believed was the upper part of the Nile, he, on July 18, discovered Lake Bangweolo. Proceeding up the west coast of Tanganyika, he reached Ujiji on March 14, 1859, "a ruckle of bones." Supplies had been forwarded to him at Ujiji, but had been knavishly made away with by those to whose care they had been entrusted. Livingstone recrossed Tanganyika in July, and through the country of the Manyema he tried in vain, for a whole year, to reach and cross the Luabala, baffled partly by the natives, partly by the slave hunters, and partly by his long illnesses. It was, indeed, not till March 29, 1871, that he succeeded in reaching the Luabala, at the town of Nyangwe, where he stayed four months, vainly trying to get a canoe to take him across. It was here that a party of Arab slaves, without warning or provocation, assembled one day when the market was busiest and commenced shooting down the poor women, hundreds being killed or drowned in trying to escape. Livingstone had "the impression that he was in hell," but was helpless, though his "first impulse was to pistol the murderers." The account of this scene which he sent home roused indignation in England to such a degree as to lead to determined and to a considerable extent successful efforts to get the sultan of Zanzibar to suppress the trade. In sickened disgust the weary traveller made his way back to Ujiji, which he reached on October 13. Five days after his arrival in Ujiji he was cheered and inspired with new life, and completely set up again, as he said, by the timely arrival of Mr H. M. Stanley, the richly laden almoner of Mr Gordon Bennett, of the *New York Herald*. Mr Stanley's residence

with Livingstone was almost the only bright episode of these last sad years. With Stanley Livingstone explored the north end of Tanganyika, and proved conclusively that the Luasia runs into and not out of it. In the end of the year the two started eastward with an ample supply of goods, and bade him farewell. Stanley left on March 15, 1872, and after Livingstone had waited wearily at Unyamwebe for five months, a troop of fifty-seven men and boys arrived, good and faithful fellows on the whole, selected by Stanley himself. Thus attended, he started on August 15 for Lake Bangweolo, proceeding along the east side of Tanganyika. His old enemy dysentery soon found him out. In January 1873 the party got among the endless spongy jungle on the east of Lake Bangweolo, Livingstone's object being to go round by the south and away west to find the "fountains." Vexatious delays took place, and the journey became one constant wade below, under an almost endless pour of rain from above. The doctor got worse and worse, but no idea of danger seems to have occurred to him. At last, in the middle of April, he had unwillingly to submit to be carried in a rude litter. On April 28 Chitambo's village on the Luabala, in Itala, on the south shore of the lake, was reached. The last entry in the journal is April 27:—"Knocked up quite, and remain—recover—sent to buy milk goats. We are on the banks of the Mollamo." On April 30 he with difficulty wound up his watch, and early on the morning of May 1 the boys found "the great master," as they called him, kneeling by the side of his bed, dead. His faithful men preserved the body in the sun as well as they could, and wrapping it carefully up, carried it and all his papers, instruments, and other things across Africa to Zanzibar. It was borne to England with all honour; and on April 18, 1874, was deposited in Westminster Abbey, amid tokens of mourning and admiration such as England accords only to her greatest sons. Government bore all the funeral expenses. His faithfully kept journals during these seven years' wanderings were published under the title of the *Last Journals of David Livingstone in Central Africa*, in 1874, edited by his old friend the Rev. Horace Waller.

In spite of his sufferings and the many compulsory delays, Livingstone's discoveries during these last years were both extensive and of prime importance as leading to a solution of African hydrography. No single African explorer has ever done so much for African geography as Livingstone during his thirty years' work. His travels covered one-third of the continent, extending from the Cape to near the equator, and from the Atlantic to the Indian Ocean. Livingstone was no hurried traveller, he did his journeying leisurely, carefully observing and recording all that was worthy of note, with rare geographical instinct and the eye of a trained scientific observer, studying the ways of the people, eating their food, living in their huts, and sympathizing with their joys and sorrows. It will be long till the tradition of his sojourn dies out among the native tribes, who almost, without exception, treated Livingstone as a superior being; his treatment of them was always tender, gentle, and gentlemanly. But the direct gains to geography and science are perhaps not the greatest results of Livingstone's journeys. He conceived, developed, and carried out to success a noble and many-sided purpose, with an unflinching and self-sacrificing energy and courage that entitle him to take rank among the great and strong who single-handed have been able materially to influence human progress, and the advancement of knowledge. His example and his death have acted like an inspiration, filling Africa with an army of explorers and missionaries, and raising in Europe so powerful a feeling against the slave trade that it may be considered as having received its death-blow. Personally Livingstone was a pure and tender-hearted man,

full of humanity and sympathy, simple-minded as a child. The motto of his life was the advice he gave to some school children in Scotland,—"Fear God, and work hard."

See, besides his own narrative and Dr Blaikie's *Life*, the publications of the London Missionary Society from 1840, the *Proceedings of the Royal Geographical Society*, the despatches to the Foreign Office sent home by Livingstone during his last two expeditions, and Mr H M Stanley's *How I Found Livingstone*. (J. S. K.)

LIVYUS ANDRONICUS occupies the position of the oldest among the recognized poets of Rome. He determined the course which Roman literature followed for more than a century after his time. The imitation of Greek comedy, tragedy, and epic poetry, which produced great results in the hands of Nævius, Plautus, Ennius, and their successors, received its first impulse from him. To judge, however, by the very insignificant remains of his writings, and by the testimonies of Cicero and Horace to his merits, he can have had no preclusion either to original genius or to artistic accomplishment. His real claim to distinction was that he was the first great schoolmaster of the Roman people, and the first acknowledged medium through which the genius of Greece acted on the Roman mind, and found for itself a rude expression in the Latin language. His name, in which the Greek *Andronicus* is combined with the gentle name of one of the great Roman houses, while indicative of his own position as a manumitted slave, is also significant of the influences by which Roman literature was fostered,—viz., the culture of men who were either Greeks or "semi-Greeks" by birth and education, and the protection and favour afforded to them by the more enlightened members of the Roman aristocracy. He is supposed to have been a native of Tarentum, and to have been brought while still a boy, after the capture of that town in 272 B.C., as a slave to Rome. He lived in the household of a member of the *gens Livia*, probably of that branch of it to which M. Livius Salinator, the colleague of C. Claudius Nero in the year of the battle of the Metaurus, belonged. We learn from Suetonius that, like Ennius after him, he obtained his living by teaching Greek and Latin; and it was probably as a schoolbook, rather than as a work of literary pretension, that his translation of the *Odyssey* into Latin Saturnian verse was executed. This work was still used in schools when Horace was taught at Rome by the famous grammarian and disciplinarian Orbilius. From the few fragments of the translation that have been preserved it may be inferred that it was owing to the conservatism of educational methods, rather than to its fitness to impart to boys in the Ciceronian age instruction either in Greek literature or in the Latin language, that it enjoyed this distinction. But at the time when it appeared it must have satisfied a real want. In the wars with Pyrrhus and Tarentum the Romans had for the first time come into close contact with the Greeks; and during the First Punic War (from 261 to 241 B.C.), in which Sicily was the chief battleground of the combatants, this contact was much closer. The knowledge of Greek became essential to men in a high position, as a means of intercourse with Greeks; and at the same time the new ideas and new interests of Greek literature began to exercise something of that stimulating and refining power over the minds of the leading men which it exercised in a later generation over Scipio Africanus, T. Quintus Flaminius, M. Fulvius Nobilior, and others like them. But the presence of the Roman armies in southern Italy and Sicily must have accustomed many who had no means of obtaining a literary education to the representations of the Greek tragic and comic poets. Although the great creative age of the Athenian drama was passed, the passion for the representation of the old plays still continued, and was not confined to Athens. The number of theatres of which the remains are still seen in Sicily—as at Segesta, Syracuse, Catania,

Taormina—indicate that, in the island in which Epicharmus had produced his old Doric comedies, the representation of tragedy and comedy continued to be a most important element in the life of the people. But the Romans and Italians had an indigenous drama of their own, known by the name of *Satura*, which prepared them for the reception of the more regular Greek drama. The distinction between this *Satura* and the plays of Euripides or Menander was that it had no regular plot. This Latin drama first received from Livius Andronicus; but it did so at the cost of its originality. In the year 240, the year after the end of the First Punic War, he produced at Rome a translation of a Greek play (it is uncertain whether a comedy or tragedy), and this representation marks the beginning of Roman literature. In this translation he discarded the native Saturnian metre, and adopted the iambic, trochaic, and cretic metres, to which Latin more easily adapted itself than either to the hexameter or to the lyrical measures of a later time. He continued to produce plays for more than thirty years after this time. The titles of some of his tragedies are *Achilles*, *Agisthus*, *Equus Trojanus*, *Hermione*, *Tereus*,—all suggestive of subjects which were treated by the later tragic poets of Rome. The titles of some of his comedies are *Gladiolus*, *Ludus*, &c. In the year 207, when, if he was a captive after the taking of Tarentum, he must have been of a great age, he was appointed to compose the hymn of thanksgiving for the victory of the Metaurus. Another tribute of national recognition paid him was that, as a compliment to him, the "college" or "guild" of poets obtained a place of seating in the temple of Minerva on the Aventine.

A good account of his remains is to be found in Wordsworth's *Fragments and Specimens of Early Latin*. The fragments of his dramas are to be found in Ribbeck's *Fragmentum Latinorum Reliquiae* and *Compositum Latinorum Reliquiae* (W. Y. 8.)

LIVNY, a district town of Russia, in the government of Orel, 87 miles east-south-east of the chief town of the government, at the confluence of the rivers Lypevka and Sosna. It has railway connexion with the line between Orel and Gryn. The town is an important centre for trade in grain, hemp, tallow, skins, and cattle. A large amount of grain is purchased in the neighbouring governments, and the flour is sent to Moscow and the neighbouring towns, as well as to the Baltic ports. Hemp is sent to St Petersburg, and cattle to Moscow, or they are killed for the preparation of tallow. The 13,000 inhabitants of Livny find employment in trade and in the flour-mills, and hemp, tallow-candle, and oil works. The district of Livny is one of the most fertile and populous of central Russia, and is remarkable for its numerous large villages.

Livny was founded in 1596, at the junction of the three highways to Astrakhan, to Little Russia, and to the Caucasus, along which the Tartars usually made their incursions on Russian provinces. It was several times destroyed by Tartars during the 16th and 17th centuries. In the great internal wars of the first half of the 16th century, Livny was a centre where all kinds of discontented persons and murderers met. Its fort, or kreml, with thick earthen and wooden walls, existed until 1784.

LIVONIA, or LIVLAND (*Liflandia* of the Russians), one of the three Baltic provinces of Russia, is bounded by the Gulf of Riga on the W., Esthonia on the N., the governments of St Petersburg, Pskov, and Vitebsk on the E., and Courland on the S. A group of islands, situated at the entrance of the Gulf of Riga, of which Osel, Mohu, Runo, and Paternoster are the largest, belong to this government. It covers, with the islands, a surface of 18,160 square miles, but of this the part of Lake Peipus, or *Lochudskoye*, which belongs to it occupies 1090. Its surface is diversified by several plateaus, those of Iianhoff and of the Lvonian As having an average height of 700 feet, whilst several summits reach from 800 to 1000 feet or more (such as the Munna-Mägi, 1063 feet; Hailing-

kains, 1038 feet, Vella-Maggi, 946 feet, Tufolsberg, 847 feet). The edges of the plateaus are intersected by deep valleys, which give a hilly character to the country; the hilly tract between the Duna and its tributary the Līvianian Aa has received from its picturesque narrow valleys, covered with deep forests and numerous lakes, the name of "Wendish Switzerland." The plateau of Odenpa, watered by the tributaries of the Embach river, which flows for 93 miles from lake Wierz-yarvi into Lake Peips, occupies an area of 2880 square miles, and has an average height of 500 feet. More than a thousand lakes are scattered over Livonia, of which that of Wierz-yarvi, having a surface of 105 square miles (114 feet above sea-level), is the largest, marshes and peat-bogs occupy as much as one-tenth of the province. Of the very numerous rivers which water Livonia, only the Duna, which flows for 80 miles along its frontier, and the Embach are navigable.

The geological structure of Livonia has been elaborately examined. The Silurian formation which covers Esthonia, and much resembles the Norwegian Silurian, appears in the northern part of Livonia, the remainder of the province consisting of Devonian strata. The whole is covered with a night sheet of glacial deposits, sometimes 400 feet thick. The typical bottom moine, with boulders of all sizes up to 20 feet in diameter, brought from Finland, extends all over the country, reaching even to the summit of Munna-Maggi. Glacial fluviols, striae, and elongated troughs are met with everywhere, running mostly from north-west to south-east, as well as *æter*, which have the same direction and consist of moraine nucleus covered with stratified sands and clays; sand-downs cover large tracts on the shores of the Baltic. As in Esthonia, no traces of marine deposits are found higher than 100 or 150 feet above the present sea-level. The soil is not very fertile. Forests cover about two-fifths of the surface of this government, several of them having a diameter of 150 to 250 miles. The climate is rather severe. The mean temperatures are 43° Fahr. at Riga (winter, 23°; summer, 63°), and 42½° at Dorpat. The intensity and direction of winds are very variable; the average number of rainy and snowy days is one hundred and forty-six at Riga (rainfall 24½ inches); fogs are not uncommon.

The population of Livonia, which was but 621,600 in 1816, reached 1,000,876 in 1870, and is now about 1,121,000 in 1882. Though it is often described as a German province, only about 7 per cent of the population (84,120 in 1880) are Germans, the great bulk being *Ehsts* or *Esthians* (47 per cent) and *Letts* (41 per cent.). The Russians number about 36,000, Poles 5000, and Jews 7000. The Livonians, who have given their name to the country, and who formerly extended far east to Sobeg in the government of Vitbeak, have nearly all passed away; only a few thousands (2050 in 1868) inhabit the forests at the utmost extremity of the peninsula of Courland. Their native language, of Finnish origin, is rapidly disappearing, their present language being rather a *Lettsish*. Sjögren, in 1846, had much difficulty in making a grammar and dictionary of it from the mouths of old people. The *Ehsts* who greatly resemble the Finns of Tavastland, have maintained their ethnic features, their customs, national traditions, national songs and poetry, and their harmonious language. There is now a marked revival of national feeling, favoured by "Young Esthonia," together with a tendency towards a union with Finland. No less than eight political papers are published in the Esthonian language. The prevailing religion is the Lutheran (746,664 in 1868), about 80,000 *Ehsts* in Livonia and Esthonia, and 50,000 *Letts* (see LITHUANIA), as well as the Russians, belong to the Greek Church (150,874 in 1868); of the Russians, however, a considerable proportion are *raekomists* (nonconformists), who have migrated to the Baltic provinces in consequence of persecutions, their last number about 14,600, of whom 8000 are found in the neighbourhood of Riga. About 6000 are Catholics. The Germans belong to the nobility, or to the burger class in the towns.

The efforts of the German conquerors to Germanize the country have completely failed. The *Ehsts* and *Letts* openly display their traditional hatred against the invaders. The teaching in primary schools is carried on in Esthonian and Lettsish, German prevails in colleges and higher schools. The Russian Government has for

some time been labouring for "Russification" the Russian civil code was introduced in the Baltic provinces in 1885, and the use of Russian, instead of German, in official correspondence and in law courts was ordered in 1897, but not generally thought of as practising, the fact that the privileges given by the military law to those who have received primary education extend only to those who know Russian contributes to the extension of that language.

Nearly all the soil belongs to the nobility, the extent of peasants' estates being only 15 per cent. Serfdom was abolished in 1819, when the peasants received personal liberty, remaining, however, under the jurisdiction of their landlords, who maintained also the right to have a predominant influence in the nomination of ministers. Since 1849 the contribution in forced labour which the peasants were compelled to pay to landlords has been gradually, though imperfectly, commuted to a money payment, and the peasants have received the right to purchase their allotments. But, owing to later limitations of this law, as well as to the high price of allotments and to the establishment of a minimum size of 80 acres, the redemption of the land is going on very slowly. The class of peasant proprietors being restricted to a small number of healthy peasants, the great bulk have remained *Knochts*, that is, tenants at will; they are very miserable, and about one-fourth of them are continually wandering in search of work. They readily emigrate, even to such unfertile provinces as Novgorod and Vitbeak, and from time to time the emigration takes the shape of a mass movement, which the Government stops. The average size of landed estates is from 9500 to 11,000 acres, far above the general average for Russia. The estates of the nobility are generally as well cultivated as in western Europe, while the peasants' farms are mostly in a deplorable state. In 1877 21 4 per cent of the surface of Livonia was under crop, yielding 1,949,800 quarters of grain, and 1,849,300 measures of rye. There were at the same time 148,000 horses, 373,000 cattle, 312,000 sheep, and 150,000 pigs. The shores of the Baltic yield valuable fisheries. Manufactures are steadily increasing. The distilleries yield about 1,400,000 gallons of spirits, part of which is exported; the beer breweries (two hundred) produce ten worth about 850,000 roubles. There are woollen, cotton, and silk mills, saw, glass, and paper, glass, candle, tobacco, and machinery works—the chief manufacturing districts being Pernau and Riga. Livonia carries on a large export trade, especially through Riga and Pernau, in flax, linseed, hemp, grain, timber, and wooden ware; the Duna is of course the chief channel for the exports. During the last 10 years, however, Libau has entered into brisk competition with the more northern ports of Livonia. The imports, especially through Riga, are also most important, the custom-house of Livonia having had in 1881 an income of 6,000,000 silver roubles. The government is divided in eleven districts: Riga (104,500), Wolmar (32,800), Dorpat (32,800), Riga (12,500), Fellin (65,000), Arensburg in the island Oel (8150), Walk (3850), Fellin (2900), Werro (2050), Lemsal (1450), and Schloek (800). The capital of the government is Riga.

The first historical notices of Livonia are by Tacitus and Jordanes, but none of the time of Alexander the Great, found on the island of Oel, show that the coasts of the Baltic were at an early time in commercial relations with the civilized world. The chronicler Nestor mentions as inhabitants of the Baltic coast the Tchud, the Laves, the Narova, Leligals, Semigallians, and Koré. It is probably about the 9th century that was founded the first tributary to the Varjago-Russian states. As they reacquired their independence, Yaroslav I. undertook in 1093 a campaign against them, and founded Yornoff (Dorpat). The first Germans penetrated into Livonia in the 11th century, and in 1158 several Bremen merchants landed at the mouth of the Duna. In 1186 the emperors of the archbishop of Bremen began to preach the Christian religion among the *Ehsts* and *Letts*, and in 1200 the archbishop of Livonia established his residence at the mouth of the Duna, at Riga. In 1202 or 1204 Innocent III. recognized the Order of Brothers of the Sword (*Schwertbrüder*), the residence of its grandmaster being at Riga, and the order, spreading the Christian religion by sword and fire among the natives, carried on from that time a series of uninterrupted wars against the Russian republics and Lithuania, as well as a struggle against the influence of the archbishop of Riga, which last was supported by the importance acquired by Riga as a centre for trade, intermediate between the Hanseatic towns and those of Novgorod, Pskov, and Pologda. The first active interference of Lithuania in the affairs of Livonia dates from the times which immediately followed the great outbreak of peasants on Oel; Olgier devastated them all southern Livonia. The order happening to purchase the Danish part of Esthonia, in 1247, began to fight, fresh forces the war against the bishop of Riga, as well as against Lithuania, Poland, and the Russians. The wars against those powers were terminated respectively in 1435, 1466, and 1483. About the end of the 15th century the master of the order, Plettenberg, acquired a position of great importance, and in 1537 he was recognized as prince of the empire by Charles V. On the other hand, the authority of the bishops of Riga was soon completely

destroyed (1666). The war of the order with John IV. in 1560 led to a division of Livonia, its northern part, Dorpat included, being taken by Russia, and the southern part falling under the dominion of Poland. From that time Livonia formed a subject of dispute between Poland and Russia, the latter only formally abdicating its rights to the country in 1862. In 1621 it was the theatre of a war between Poland and Russia, and was conquered by the latter power, enjoying thus for twenty-five years a milder rule. In 1654, and again at the beginning of the 17th century, it became the theatre of war between Poland, Russia, and Sweden, and at last was finally conquered by Russia. The official concession was confirmed by the treaty of Nydztal in 1721, Russia guaranteeing the privileges of the nobility and citizens, and the freedom of the evangelical confession. (P. A. K.)

LIVY, the Roman historian, belonged by birth to those regions of northern Italy which had already given to Roman literature Catullus, Cornelius Nepos, and Virgil. He was born in 69 B.C., the year of Caesar's first consulship, and was thus eleven years younger than Virgil and six years younger than Horace. His native city Padua (Patavium) could challenge comparison, in the days of Augustus, even with such great centres of industry as Alexandria or Gades; and, while its active municipal life, and long traditions of hard won independence, may have quickened Livy's sympathies with republican freedom, its ancient connexion with Rome naturally helped to turn his attention to the study which became the work of his life. For Padua claimed, like Rome, a Trojan origin, and Livy is careful to place Antenor, the founder of Padua, side by side with Æneas. A more real bond of union was found in the dangers to which both had been exposed from the assaults of the Celts (Livy, x. 2), and Padua must have been drawn to Rome, as the conqueror of her hereditary foes, by much the same motives as those which led the Greeks in southern Italy to seek Roman aid against the Oscan invader. Moreover, at the time of Livy's birth, Padua had long been in possession of the full Roman franchise, and it is possible that the historian's family name had been taken by one of his ancestors out of compliment to the great Livian gens at Rome, whose connexion with Cisalpine Gaul is a well-established fact (Livy, xxvii. 35; Suet., *Tib.* 3), and by one of whom his family may have been enfranchised.

Livy's easy, independent life at Rome, and his aristocratic leanings in politics, have been taken as proof that he was the son of well-born and opulent parents, and it is certain that he was able to afford the luxury of a good education, for he was widely read in Greek literature, and a student both of rhetoric and philosophy. We have also evidence in his writings that he had prepared himself for his great work by researches into the history of his native town. His youth and early manhood, spent perhaps chiefly at Padua, were cast in stormy times, and the impression which they left upon his mind was ineffaceable. He was ten years old when Cæsar crossed the Rubicon and civil war began. In his fifteenth year came the murder of the great dictator, of whom he afterwards declared that he knew not "whether it were better for him to have been born or not," and one year later the murder of Cicero, to whose memory he paid an eloquent tribute. Of the part taken by Padua in the troubles which distracted the empire from 49 B.C. till the decisive victory at Actium we know nothing beyond the fact that in 43 B.C. it closed its gates against Antony, and was afterwards punished for doing so by Asinius Pollio. Livy's personal sympathies were with Pompey and the republican party (Tac., *Ann.*, iv. 34); but far more lasting in its effects was his experience of the licence, anarchy, and confusion of these dark days. The rule of Augustus he seems to have accepted as a necessity, but he cannot, like Horace and Virgil, welcome it as inaugurating a new and glorious era. While he endeavours to stifle his recollections of the horrors

he had witnessed, by fixing his whole mind on older and better times, he writes of the present with despondency as a degenerate and declining age; and, instead of triumphant prophecies of world-wide rule, such as we find in Horace, Livy contents himself with pointing out the dangers which already threatened Rome, and exhorting his contemporaries to learn, in good time, the lessons which the past history of the state had to teach.

It was probably about the time of the battle of Actium that Livy established himself in Rome, and there he seems chiefly to have resided until his retirement to Padua shortly before his death. We have no evidence that he travelled much, though he must have paid at least one visit to Campania (xxviii. 56), and he never, so far as we know, took any part in political life. Nor, though he enjoyed the personal friendship and patronage of Augustus (Tac., *Ann.*, iv. 34), and stimulated the historical zeal of the future emperor Claudius (Suet., *Claud.*, xli.), can we detect in him anything of the courtier. There is not in his history a trace of that rather gross adulation in which even Virgil does not disdain to indulge. His republican sympathies were freely expressed, and it should be added, as freely pardoned by Augustus. We must imagine him devoted to the great task which he had set himself to perform, with a mind, as he tells us himself in his preface, free from all disturbing cares, and in the enjoyment of all the facilities for study afforded by the Rome of Augustus, with its liberal encouragement of letters, its newly-founded libraries, and its brilliant literary circles. As his work went on, the fame which he had never coveted came to him in ample measure. He is said to have declared in one volume of his history that he had already won glory enough, and the younger Pliny (*Epist.*, ii. 3) relates that a Spaniard came all the way from Gades merely to see him, and, thus accomplished, at once returned home satisfied. The accession of Tiberius (14 A.D.) materially altered for the worse the prospects of literature in Rome, and Livy may have feared for himself the fate which afterwards befell Crenatius Cordus, who was tried before the senate, for having in his annals spoken of Brutus and Cassius as the last of the Romans (Tac., *Ann.*, iv. 34). However this may have been, Livy retired to Padua, and died there in the third year of the reign of Tiberius (17 A.D.), at the ripe age of seventy-six. When we have added that he had at least one son (Quintil., x. 1), who was possibly also an author (Pliny, *Nat. Hist.*, i. 5, 6), and a daughter married to a certain L. Magnus, a rhetorician of no great merit (Seneca, *Controu.*, x. 29, 2), we have reached the end of all that is known with certainty of Livy's personal history; and the apocryphal nature of the details which have been added by later admirers has been too often exposed to make it necessary to deal with them here.¹

But for us, as for Livy himself, the interest of his life centres in the work to which the greater part of it was devoted. For we must decline to believe with Niebuhr that his history was all written in his later years. On the contrary, various indications point to the period from 27 to 30 B.C., at that during which the first decade was written. In the first book (i. 19) the emperor is called Augustus, a title which he assumed early in 27 B.C., and in ix. 18 the omission of all reference to the restoration, in 20 B.C., of the standards taken at Carrus seems to justify the inference that the passage was written before that date. In the third decade, the allusion in xxviii. 12 to victories in Spain may, as Weissenborn thinks, refer to Agrippa's campaigns in 19 B.C., but the words "*ductus auspicioque Augusti Cæsarum*" point more naturally to those of Augustus

¹ For Livy's life see the introduction to Weissenborn's edition, Berlin, 1871, and the article in Smith's *Dictionary of Biography*.

himself, 37-35 B.C. In the epitome of book lix, there is a reference to a law of Augustus which was passed in 18 B.C. The books dealing with the civil wars must have been written during Augustus's lifetime, as they were read by him (*Tac. Ann.* iv. 34), while there is some evidence that the last part of the work, from book cxxi. onwards, was published after his death (14 A.D.).

Livy's history begins with the landing of Æneas in Italy, and closes with the death of Drusus, 9 A.D., though it is possible that he intended to continue it as far as the death of Augustus. The original title of the work is unknown, but of its general plan it is possible to speak with more certainty. The division into decades is certainly not due to the author himself, and is first heard of at the end of the 5th century; on the other hand, the division into "libri" or "volumina" seems to be original. It is referred to by Livy himself (x. 31, "per quantum jam volumen"; cxxi. 1, "multa volumina"), as well as by Pliny (*N. H.*, *pref.*) and by later writers. That the books were grouped and possibly published in sets is rendered probable both by the prefaces which introduce new divisions of the work (vi. 1, xxi. 1, xxxi. 1) and by the description in one MS of books cix.-cxvi. as "bellosum civilium libri octo." Such arrangement and publication in parts were moreover common with ancient authors, and in the case of a lengthy work almost a necessity.

Of the 142 "libri" composing the history, the first 15 carry us down to the eve of the great struggle with Carthage, a period, as Livy reckons it, of 488 years (xxi. 1); 16 more (xvi.-xxx) cover the 63 years of the two great Punic wars. With the close of book xlv we reach the conquest of Macedonia in 167 B.C. Book lvi. described the tribunate of Tiberius Gracchus, 133 B.C. In book lxxxix. we have the dictatorship of Sulla (81 B.C.), in ciii. Cæsar's first consulship (69 B.C.), in cix.-cxvi. the civil wars to the death of Cæsar (44 B.C.), in ccxv. the defeat of Brutus and Cassius at Philippi, in ccxxiii. and ccxxv. the battle of Actium and the accession of Augustus. The remaining eight books give the history of the first twenty years of Augustus's reign.

Such an outline was the vast work of which Martial (xiv. 190) complains that his whole library could not contain it. But a small portion of it, however, has come down to modern times, only thirty-five books are now extant (i.-x., xx.-xlv.), and of these xli. and xlii. are incomplete. The lost books seem to have disappeared between the 7th century and the revival of letters in the 15th,—a fact sufficiently accounted for by the difficulty of transmitting so voluminous a work in times when printing was unknown, for the story that Pope Gregory I. burnt all the copies of Livy he could lay his hands on rests on no good evidence. Only one important fragment has since been recovered,—the portion of book xx. discovered in the Vatican in 1773, and edited by Niebuhr in 1820. Very much no doubt of the substance of the lost books has been preserved both by such writers as Plutarch and Dion Cassius, and by epitomizers like Florus and Eutropius. But our knowledge of their contents is chiefly derived from the so-called "periœchæ" or epitomes, of which we have fortunately a nearly complete series, the epitomes of books cxxvii. and cxxviii. being the only ones missing. These epitomes have been ascribed without sufficient reason to Florus (2d century); but, though they are probably of even later date, and are disappointingly meagre, they may be taken as giving, so far as they go, a fairly authentic description of the original. They have been expanded with great ingenuity and learning by Freinsheim in Drakenborch's edition of Livy.¹

The reserved text of the extant thirty-five books of Livy is taken from different sources, and no one of our MSS contains them all. The MSS of the first decade, some thirty in number, are with one exception derived, more or less directly, from a single archetype, viz. the recension made in the 4th century by the two Nicomachi, Flavianus and Dexter (not by one only, as Niebuhr thought), and by Victorinus. This is proved in the case of the older MSS by written subscriptions to that effect, and in the case of the rest by internal evidence. Of all these descendants of the Nicomachean recension, the oldest is the Codex Parisinus of the 10th century, and the best the Codex Mediceus or Florentinus of the 11th. An independent value attaches to the ancient palimpsest of Verona, of which the first complete account was given by Aicimicus as recently as 1858 (*Biblioth. Mondadori*, January). It contains the third, fourth, fifth, and fragments of the sixth book, and, according to Mommsen, whose conclusions are accepted by Madvig (*Ætius Læmæus*, 2d ed. 1877, p. 37), it is derived, not from the Nicomachean recension, but from an older archetype common to both.

For the third decade our chief authority is the Codex Puteanus, an uncial MS of the 8th century, now at Paris. For the fourth we have two leading MSS,—Codex Bambergenus, 11th century, and the slightly older Codex Moguntinus, which is only known through the Mainz edition of 1618-19. What remains of the fifth decade depends on the Lausannensis or Vindobonensis from the monastery of Lorsch, dated at Basel in 1581. It belongs to the 6th century.

If we are to form a correct judgment on the merits of Livy's history, we must, above all things, bear in mind what his aim was in writing it, and this he has told us himself in the celebrated preface which Niebuhr rather unaccountably denounces as "the worst part of his work" (*Introd. Lect.*, p. 60). He set himself the task of recording the history of the Roman people, "the first in the world," from the beginning. The task was a great one, and the fame to be won by it uncertain, yet it would be something to have made the attempt, and the labour itself would bring a welcome relief from the contemplation of present evils; for his readers too this record will, he says, be full of instruction: they are invited to note especially the moral lessons taught by the story of Rome, to observe how Rome rose to greatness by the simple virtues and unselfish devotion of her citizens, and how on the decay of these qualities followed degeneracy and decline.

He does not therefore write, as Polybius wrote, for students of history. With Polybius the greatness of Rome is a phenomenon to be critically studied and scientifically explained; the rise of Rome forms an important chapter in universal history, and must be dealt with, not as an isolated fact, but in connexion with the general march of events in the civilized world. Still less has Livy anything in common with the naive anxiety of Dionysius to make it clear to his fellow Greeks that the irresistible people who had mastered them was in origin, in race, and in language Hellenic like themselves.

Livy writes as a Roman, to raise a monument worthy of the greatness of Rome, and to keep alive, for the guidance and the warning of Romans, the recollection alike of the virtues which had made Rome great and of the vices which had threatened her with destruction. In so writing he was in close agreement with the traditions of Roman literature, as well as with the conception of the nature and objects of history current in his time. To a large extent Roman literature grew out of pride in Rome, for, though her earliest authors took the form and often the language of their writings from Greece, it was the greatness of Rome that inspired the best of them, and it was from the annals of Rome that their themes were taken. And this is naturally true in an especial sense of the Roman historians, the long list of annalists begins at the moment when the great struggle with Carthage had for the first time brought Rome into direct connexion with the historic peoples of the ancient world, and when Romans themselves awoke to the importance of the part reserved for Rome to play in universal history. To write the annals of Rome became at once a task worthy of the best of her citizens. Though

¹ The various recensions since current of complete copies of Livy in Constantinople, China, and elsewhere are noticed by Niebuhr, *Introd. Lect.*, p. 87, Eng. transl. See also Pauly, *Real-Encyclopædie*, s. v.

other forms of literature might be thought unbecoming to the dignity of a free-born citizen, this was never so with history. On the contrary, men of high rank and tried statesmanship were on that very account thought all the fitter to write the chronicles of the state they had served. And history in Rome never lost either its social prestige or its intimate and exclusive connexion with the fortunes of the Roman people. It was well enough for Greeks to busy themselves with the manners, institutions, and deeds of the "peoples outside." The Roman historians, from Fabius Pictor to Tacitus, cared for none of these things. This exclusive interest in Rome was doubtless encouraged by the peculiar characteristics of the history of the state. The Roman annalist had not, like the Greek, to deal with the varying fortunes and separate doings of a number of petty communities, but with the continuous life of a single city. Nor was his attention drawn from the main lines of political history by the claims of art, literature, and philosophy, for just as the law which bound Romans together was that of citizenship, not of race or culture, so the history of Rome is that of the state, of its political constitution, its wars and conquests, its military and administrative system.

Livy's own circumstances were all such as to render these views natural to him. He began to write at a time when, after a century of disturbance, the mass of men had been contented to purchase peace at the price of liberty. The present was at least inglorious, the future doubtful, and many turned gladly to the past for consolation. This retrospective tendency was favourably regarded by the Government. It was the policy of Augustus to obliterate all traces of recent revolution, and to connect the new imperial regime as closely as possible with the ancient traditions and institutions of Rome and Italy. The *Æneid* of Virgil, the *Fasts* of Ovid, suited well with his own restoration of the ancient temples, his revival of such ancient ceremonies as the *Ludi Sæculares*, his efforts to check the un-Roman luxury of the day, and his jealous regard for the purity of the Roman stock. And, though we are nowhere told that Livy undertook his history at the emperor's suggestion, it is certain that Augustus read parts of it with pleasure, and even honoured the writer with his assistance and friendship.

Livy was deeply penetrated with a sense of the greatness of Rome. From first to last its majesty and high destiny are present to his mind. Æneas is led to Italy by the fates that he may be the founder of Rome (l. i; comp. i. 4, "debeatur fati tante origo urbis"). Romulus after his ascension declares it to be the will of heaven that Rome should be mistress of the world; and Hannibal marches into Italy, that he may "set free the world" from Roman rule. But, if this ever-present consciousness often gives dignity and elevation to his narrative, it is also responsible for some of its defects. It leads him occasionally into exaggerated language (e.g., xiii. 33, "nullus unquam terrarum rei cum Romanos effugiebat"), or into such misstatements as that in xxi. 99, where he explains the course taken by the Romans in renewing war with Carthage by saying that "it seemed more suitable to the dignity of the Roman people." Often his jealousy for the honour of Rome makes him unfair and one-sided. In all her wars not only success but justice is with Rome (e.g., the war with Persius of Macedonia; see Cobet in *Mnemosyne* for 1881). When Hieronymus of Syracuse deserts Rome for Hannibal, Livy says nothing of the complaints against Rome, by which, according to Polybius, he justified his change of policy. To the same general attitude is also due the omission by Livy of all that has no direct bearing on the fortunes of the Roman people. "I have resolved," he says (xxix. 48), "only to touch on foreign affairs so far as they are bound up with those of Rome." The operations of the Rhodians in Asia Minor (197 B.C., xxxiii. 20)

he curtly dismisses in a sentence, that he may pass "ad æque propria Romani belli sunt," and so again (xli. 25) "it is not worth my while to recount in detail the wars of foreigners with each other; it is as much and more than I can do to record the doings of the Roman people." As the result, we get from Livy very defective accounts even of the Italic peoples most closely connected with Rome. Of the past history and the internal condition of the more distant nations he encountered he tells us little or nothing, even when he found such details carefully given by Polybius.

Scarcely less strong than his interest in Rome is his interest in the moral lessons which his history seemed to him so well qualified to teach. This didactic view of history was a prevalent one in antiquity, and it was confirmed no doubt by those rhetorical studies which in Rome as in Greece formed the chief part of education, and which taught men to look on history as little more than a storehouse of illustrations and themes for declamation. But it suited also the practical bent of the Roman mind, with its comparative indifference to abstract speculation or purely scientific research. It is in the highest degree natural that Livy should have sought for the secret of the rise of Rome, not in any large historical causes, but in the moral qualities of the people themselves, and that he should have looked upon the contemplation of these as the best remedy for the vices of his own degenerate days. It is possible too that the simplicity and even austerity of manners for which Padua was afterwards celebrated may have characterized its citizens in Livy's time, and that he was thus especially fitted to appreciate the purity, reverence, and loyalty of early Rome. But, whatever the cause, there is no doubt of the fact. He is never tired of insisting on the virtues of past days, or of contrasting them with the vices of the present. He dwells with delight on the unselfish patriotism of the old heroes of the republic. In those times children obeyed their parents, the gods were still sincerely worshipped, poverty was no disgrace, sceptical philosophies and foreign fashions in religion and in daily life were unknown. But this ethical interest is closely bound up with his Roman sympathies. His moral ideal is no abstract one, and the virtues he prizes are those which in his view made up the truly Roman type of character. "Munus Romani ingenii homo" is the sentence of condemnation he passes (xxii. 58) on a Roman soldier who broke faith with Hannibal. Camillus is praised as "vir ac vere Romanus" (xxii. 14); "to do and to suffer bravely" is Roman (li. 12). The prominence thus given to the moral aspects of the history tends to obscure in some degree the true relations and real importance of the events narrated, but it does so in Livy to a far less extent than in some other writers. He is much too skilful an artist either to resolve his history into a mere bundle of examples, or to overload it, as Tacitus is sometimes inclined to do, with reflexions and axioms. The moral he wishes to enforce is usually either conveyed by the story itself, with the aid perhaps of a single sentence of comment, or put as a speech into the mouth of one of his characters (e.g., xxiii. 49; the devotion of Decius, viii. 10, comp. vii. 40; and the speech of Camillus, v. 54); and what little his narrative thus loses in accuracy it gains in dignity and warmth of feeling. In his portraits of the typical Romans of the old style, such as Q. Fabius Maximus, in his descriptions of the unshaken firmness and calm courage shown by the fathers of the state in the hour of trial, Livy is at his best; and he is so largely in virtue of his genuine appreciation of character as a powerful force in the affairs of men.

This enthusiasm for Rome and for Roman virtues is, moreover, saved from degenerating into gross partiality by the genuine candour of Livy's mind and by his wide sympathies with every thing great and good. Seneca has

described him as "candidissimus omnium magnorum ingenium aestimator" (*Suetonius*, vi. 21). Quintilian (x. 1, 101) places him on a level with Herodotus as a writer "clarissimi candoris," and this candid admiration is not reserved exclusively for Romans. *Hasdrubal's* devotion and valour at the battle on the Metaurus are described in terms of eloquent praise (xxvii. 49, "there, as became the son of Hamilcar and the brother of Hannibal, he fell fighting"); and even in Hannibal, the lifelong enemy of Rome, he frankly recognizes the great qualities that balanced his faults. Nor though his sympathies are unmistakably with the aristocratic party, does he scruple to censure the pride, cruelty, and selfishness which too often marked their conduct (ii. 54; the speech of *Cenuleus*, iv. 3; of *Sextus* and *Licinus*, vi. 36), and, though he feels acutely that the times are out of joint, and has apparently little hope of the future, he still believes in justice and goodness. He is often righteously indignant, but never satirical, and such a pessimism as that of *Tacitus* and *Juvenal* is wholly foreign to his nature.

Though he studied and even wrote on philosophy (*Seneca*, *Epist.* 100), *Livy* is by no means a philosophic historian. We learn indeed from incidental notices that he inclined to Stoicism and disliked the Epicurean system. With the scepticism that despised the gods (x. 40) and denied that they meddled with the affairs of men (xlii. 13) he has no sympathy. The immortal gods are everywhere the same (xlii. 3); they govern the world (xxvii. 46) and reveal the future to men by signs and wonders (xlii. 13), but only a debased superstition will look for their hand in every petty incident (xxvii. 23, "minimis etiam rebus prava religio inserit deos"), or abandon itself to an indiscriminate belief in the portents and miracles in which popular credulity delights (xxviii. 11, xxi. 63, "multa ex hieme prodigia . . . aut quod evenire solat, motis semel in religionem animis, multa nunciata et temere credita"). The ancient state religion of Rome, with its temples, priests, and auguries, he not only reverences as an integral part of the Roman constitution, with a sympathy which grows as he studies it (xlii. 13, "et mihi vetustas res scribenda, nescio quo pacto antiquus sit animus"), but, like *Varro*, and in true Stoic fashion, he regards it as a valuable instrument of government (i. 19, 21), indispensable in a well-ordered community. As distinctly Stoical is the doctrine of a fate to which even the gods must yield (ix. 4), which disposes the plans of men (i. 42) and blinds their minds (v. 37), yet leaves their will free (xxxvii. 46).

But we find no trace in *Livy* of any systematic application of philosophy to the facts of history. He is as innocent of the leading ideas which shaped the work of *Polybius* as he is of the cheap theorizing which worries us in the pages of *Dionysius*. The events are graphically, if not always accurately, described; but of the larger causes at work in producing them, of their subtle action and reaction upon each other, and of the general conditions amid which the history worked itself out, he takes no thought at all. Nor has *Livy* much acquaintance with either the theory or the practice of politics. He exhibits, it is true, political sympathies and antipathies. He is on the whole for the nobles and against the commons; and, though the unfavourable colours in which he paints the leaders of the latter are possibly reflected from the authorities he followed, it is evident that he despised and disliked the multitude (xxiv. 35, "aut servit humiliter aut superbe dominatur"). Of monarchy he speaks with a genuine Roman hatred, and we know that in the last days of the republic his sympathies were wholly with those who strove in vain to save it. He betrays too an insight into the evils which were destined finally to undermine the imposing fabric of Roman empire. The

decline of the free population, the spread of slavery (vi. 12, vii. 25), the universal craving for wealth (iii. 26), the employment of foreign mercenaries (xxv. 33), the corruption of Roman race and Roman manners by mixture with aliens (xxxix. 3), are all noted in tones of solemn warning. But his retired life had given him no wide experience of men and things. It is not surprising, therefore, to find that he fails altogether to present a clear and coherent picture of the history and working of the Roman constitution, or that his handling of intricate questions of policy is weak and inadequate.

If from the general aim and spirit of *Livy's* history we pass to consider his method of workmanship, we are struck at once by the very different measure of success attained by him in the two great departments of an historian's labour. He is a consummate artist, but an unskilled and often careless investigator and critic. The materials which lay ready to his hand may be roughly classed under two heads:—(1) the original evidence of monuments, inscriptions, &c., (2) the written tradition as found in the works of previous authors. It is on the second of these two kinds of evidence that *Livy* almost exclusively relies. Yet that even for the very early times a certain amount of original evidence still existed is proved by the use which was made of it by *Dionysius*, who mentions at least three important inscriptions, two dating from the regal period and one from the first years of the republic (iv. 26, iv. 68, x. 32). We know from *Livy* himself that the breastplate dedicated by *Cossus* (428 a.d.) was to be seen in his own day in the temple of *Jupiter Feretrius*, nor is there any reason to suppose that the "libri lintei," quoted by *Licinius Macer*, were not extant when *Livy* wrote. For more recent times the materials were plentiful, and a rich field of research lay open to the student in the long series of laws, decrees of the senate, and official registers, reaching back, as it probably did, at least to the commencement of the 3d century a.d. Nevertheless it seems certain that *Livy* never realized the duty of consulting these relics of the past, even in order to verify the statements of his authorities. Many of them he never mentions; the others (*e.g.*, the libri lintei) he evidently describes at second hand. Antiquarian studies were popular in his day, but the instances are very few in which he has turned their results to account. There is no sign that he had ever read *Varro*; and he never alludes to *Verrius Flaccus*. The haziness and inaccuracy of his topography make it clear that he did not attempt to familiarize himself with the actual scenes of events even that took place in Italy. Not only does he confuse *Thermopylae*, the capital of *Attolia*, with *Thermopylae* (xxxiii. 35), but his accounts of the Roman campaigns against *Volsci*, *Aequi*, and *Sammites* swarm with confusions and difficulties; nor are even his descriptions of *Hannibal's* movements free from an occasional vagueness which betrays the absence of an exact knowledge of localities.

The consequence of this indifference to original research and patient verification might have been less serious had the written tradition on which *Livy* preferred to rely been more trustworthy. But neither the materials out of which it was composed, nor the manner in which it had been put together, were such as to make it a safe guide. It was indeed represented by a long line of respectable names. The majority of the Roman annalists were men of high birth and education, with a long experience of affairs, and their defects did not arise from seclusion of life or ignorance of letters. It is rather in the conditions under which they wrote and in the rules and traditions of their craft that the causes of their shortcomings must be sought.

It was not until the 6th century from the foundation of the city that historical writing began in Rome. The father of Roman history, *Q. Fabius Pictor*, a patrician and a senator, can scarcely have published his annals before the close of the Second Punic War, but these annals covered the whole period from the arrival of *Evander* in Italy down at least to the battle by *Lake Trasimene* (217 a.d.). Out of what materials, then, did he put together his account of

the earlier history? Recent criticism has succeeded in answering this question with some degree of certainty. A careful examination of the fragments of Fabius (see H. Peter, *Historicum Romanorum Reliquiae*, Leipzig, 1870, and Nitzsch, *Röm. Annalistik*, Berlin, 1878) reveals in the first place a marked difference between the hasty period, and that which followed the establishment of the republic. The history of the former stretches back into the regions of pure mythology. It is little more than a collection of fables told with scarcely any attempt at criticism, and with no more regard to chronological sequence than was necessary to make the tale run smoothly or to fill up such gaps as that between the flight of Aeneas from Troy and the supposed year of the foundation of Rome. But from its very commencement the history of the republic was a different aspect. The mass of floating tradition, which had come down from early days, with its tales of border raids and forays, of valiant chiefs, and deeds of patriotism, is now rudely fitted into a framework of a wholly different kind. This framework consists of slight notices of important events, wars, prodigies, consecration of temples, &c., all recorded with extreme brevity, precisely dated, and couched in a somewhat archaic style. They were taken probably from one or more of the stetes regentes, such as the annals of the pontiffs, or those kept by the aediles in the temple of Ceres. These have official outline of the past history of his city was by Fabius filled in from the rich store of tradition that lay ready to his hand. The manner and spirit in which he effected this combination were no doubt wholly marvellous. Usually he seems to have transferred both annalistic notices and popular traditions to his pages much in the shape in which he found them. But he unquestionably gave undue prominence to the tales of the prowess and glory of the Fabii, and probably also allowed his own strong antioptic sympathies to colour his version of the early political controversies. These faults of partiality were, according to Polybius, a conspicuous blot in Fabius's account of his own times, which was, we are told, full and in the main accurate, and, like the earlier portions, consisted of official annalistic notices, supplemented, however, not from tradition, but from his own experience and from contemporary sources. But even here Polybius charges him with favouring Rome at the expense of Carthage, and with the undue exaltation of the great head of his house, Q. Fabius Cunctator.

Nevertheless the comparative fidelity with which Fabius seems to have reproduced his materials might have made his annals the starting point of a critical history. But unfortunately intelligent criticism was exactly what they never received. It is true that in some respects a decided advance upon Fabius was made by subsequent annalists. M. Porcius Cato (234-183 b.c.) widened the scope of Roman history to include that of the chief Italian cities, and made the first serious attempt to settle the chronology. In his history of the Punic was Caelius Antipater (c. 180 b.c.) added fresh material, drawn probably from the works of the Sicilian Greek Silenus, while Licinius Macer (70 b.c.) distinguished himself by the use he made of the most "litterate books." No doubt, too, the later annalists, at any rate from Caelius Antipater onwards, improved upon Fabius in treatment and style. But in more essential points we can discern no progress. One annalist after another quietly adopted the established tradition, as it had been left by his predecessors, without any serious alterations of its main outline. Of independent research and critical analysis we find no trace, and the general agreement upon main facts is to be attributed simply to the regularity with which each writer copied the one before him. But, had the later annalists contented themselves with merely reproducing the earlier ones, we should at least have had the old traditions before us in a simple and tolerably genuine form. As it was, while they slavishly cling to its substance, they succeeded as a rule in destroying all traces of its original form and colouring. L. Calpurnius Piso, tribune in 149 b.c. and consul in 138 b.c., prided himself on reducing the old legends to the level of common sense, and importing into them the valuable moral lessons for his own generation. By Caelius Antipater the methods of rhetoric were first applied to history, a disastrous precedent enough. His inserted speeches, enlivened his pages with chance tales, and aimed, as Cicero tells us, at not merely making his tale more attractive, but to instruct his readers. His successors carried still further the practice of dressing up the rather bald chronicles of earlier writers with all the ornaments of rhetoric. The old traditions were altered, almost beyond the possibility of recognition, by exaggerations, interpolations, and additions. Fresh incidents were introduced, new motives suggested, and speeches composed in order to infuse the required life and freshness into these dry bones of history. At the same time the political bias of the writers, and the political ideas of their day were allowed, in some cases perhaps half unconsciously, to affect their representations of past events. Annals of the Gracchi age imported into the story of patriotism and pietism the elements of the economic controversies of their own day, and painted the first tribunes in the colours of the two Gracchi or of Saturninus. In the next generation they dexterously forced the venerable records of the early republic to pronounce in favour of the ascendancy of the

senate, as established by Sulla. To political bias was added family pride, for the gratification of which the archives of the great houses, the funeral pyres, or the imagination of the writer himself supplied an ample store of doubtful material. Pedigrees were invented, imaginary consuls and fictitious triumphs inserted, and family traditions and family honours were formally incorporated with the history of the state.

Things were not much better even where the annalists were dealing with recent or contemporary events. Here indeed their materials were naturally fuller and more trustworthy, and less room was left for fanciful decoration and capricious alteration of the facts. But their methods are in the main unchanged. Yet they found written they copied, the gaps they supplied, where personal experience failed, by imagination. No better proof of this can be given than a comparison of the annalist's version of history with that of Polybius. In the fourth and fifth decades of Livy the two appear side by side, and the contrast between them is striking. Polybius, for instance, gives the number of the army at Cynoscephalae as 8000, the annalists raise it as high as 40,000 (Liv. xxiii. 10). In another case (xxiii. 6) Valerius Antias, the chief of sinners in this respect, inserts a decisive Roman victory over the Macedonians, in which 12,000 of the latter were slain and 100 taken prisoners, an achievement recorded by no other authority. In some parts of those two decades, however, Livy gives us only the annalist's story. Of the campaigns in Cisalpine Gaul, Liguria, and Spain, as described by him on their authority, Nissen will remark (*Gr. und Röm. Gesch.* 94), "One would think that the Gauls, Ligurians, and Spaniards were there for the sole purpose of being slaughtered in thousands by the Romans. Year after year they rise in revolt against Rome, lose some 40,000 men in the struggle, and finally submit, only to begin the same game afresh the next year."

Such was the written tradition on which Livy mainly relied. We have next to examine the manner in which he used it, and here we are met at the outset by the difficulty of determining with exactness what authorities he is following at any one time, for of the importance of full and accurate references to the sources of the chapters together he gives us no clue at all. More often still he contents himself with such vague phrases as "they say," "the story goes," "some think," or speaks in general terms of "ancient writers" or "my authorities." Even where he mentions a writer by name, it is frequently clear that the name is merely a name, the whose lead he is following at the moment, but that he is not actually as differing from Livy's guide for the time being on some point of detail (compare the references to Piso in the first decade, l. 55, n. 52, &c.). It is very rarely that Livy explicitly tells us whom he selects as his source (e.g. Fabius, xx. 7; Polybius, xxiii. 10). By a careful analysis, however, of those portions of his work which admit of a comparison with the text of his acknowledged authorities (e.g. fourth and fifth decades, see Nissen, *Untersuchungen*, Berlin, 1858), and elsewhere by comparing his version with the known fragments of the various annalists, and with what we are told of their style and method of treatment, we are able to form a general idea of his plan of procedure. As to the first decade, it is generally agreed that in the first and second books at any rate he follows much older and simpler writers as Fabius Pictor and Calpurnius Piso (the only one whom he there refers to by name), to whom, so far as the first book is concerned, Niebuhr (*Introd. Lect.* p. 23) would add the poet Ennius. With the close of the second book or the opening of the third we come upon the first traces of the use of later authors. Valerius Antias is first quoted in ii. 6, and many of his landmarks are visible here and there throughout the rest of the decade (viii. 38, ix. 27, x. 8-6). In the fourth book the principal authority is apparently Licinius Macer, and for the period following the sack of Rome by the Gauls Q. Claudius Quadrigarius, whose annals began at this point in the first century. We have besides a single instance of the use of the quarian Censorius, and two (iv. 28, x. 9) of Q. Julius Tubero, one of the last in the list of annalists. Passing to the third decade, we find ourselves at once confronted by a question which has been long and fully discussed—the relation between Livy and Polybius. Did Livy use Polybius at all, and, if so, to what extent? (See for details Haller, *Gründriss zur Vorlesung üb. d. Röm. Literaturgeschichte*, p. 195.)

It is conceded on all hands that Livy in this decade makes considerable use of other authorities than Polybius (e.g. Fabius, xxiii. 1; Caelius Antipater, xxiii. 38, 46, 47, xxiii. 41, &c.), but he only once mentions Polybius (xxv. 45, "Polybius huiusmodi sperandus auctor"), and that, if he used him, he did so to a much less extent than in the fourth and fifth decades, and in a very different manner. It is also agreed that we can detect in Livy's account of the Hannibalic war two distinct documents, derived originally, the one from a Roman, the other from a non-Roman source. But from these generally accepted premises two opposite conclusions have been drawn. On the one hand, it is maintained (e.g., by Leachmann, Q. Peter, H. Peter, *Hist. Rom. Reliq.*) that those parts of Livy's narrative which point to a non-Roman authority (e.g. Hannibal's

movements (prior to his invasion of Italy) are taken by Livy directly from Polybius, with occasional reference of course to other writers, and with the omission (as in the later decades) of all matters uninteresting to Livy or his Roman readers, and the addition of rhetorical touches and occasional comments. It is urged that Livy, who in the fourth and fifth decades shows himself so sensible of the great merits of Polybius, is not likely to have ignored him in the third, and that his more limited use of him in the latter case is fully accounted for by the closer connexion of the history with Rome and Roman affairs, and the comparative excellence of the available Roman authorities, and, lastly, that the points of agreement with Polybius, not only in matter but in expression, can only be explained on the theory that Livy is directly following the great Greek historian. On the other hand, it is maintained (especially by Schweigler, Nitzsch, and K. Bötcher) that the extent and nature of Livy's agreement with Polybius in this part of his work point rather to the use by both of a common original authority. It is argued that Livy's mode of using his authorities is tolerably uniform, and that his mode of using Polybius in particular is known with certainty from the later decades. Consequently the theory that he used Polybius in the third decade requires us to assume that in this one instance he departed widely, and without sufficient reason, from his usual course of procedure. Moreover, in the passages where the agreement with Polybius is most apparent, there are so many discrepancies and divergences in detail, and so many unaccountable omissions and additions, as to render it inconceivable that he had the text of Polybius before him. But all these are made intelligible if we suppose Livy to have been here following directly or indirectly the same original sources that were used by Polybius. The earliest of these original sources was probably Silenus, with whom may possibly be placed, for books xxi, xxii, Fabius Pictor. The latter Livy certainly used directly for some parts of the decade. The former he almost certainly knew only at second hand, the intermediaries almost certainly being Calpurnius Antipater. This writer, who confined himself to a history of the Second Punic War, in seven books, is expressly referred to by Livy eleven times in the third decade; and in other passages where his name is not mentioned Livy can be shown to have followed him. Livy, x. 48, 50, 51; xxv. 9. In the latter books of the decade his chief authority is possibly Valerius Antias.

In the fourth and fifth decades the question of Livy's authorities presents no great difficulties, and the conclusions arrived at by Nissen in his masterly *Historia des Quellen der Abfassung des Livy'schen Geschichtswerkes* have been almost generally accepted. These may be shortly stated as follows. In the portions of the history which deal with Greece and the East, Livy follows Polybius, and these portions are easily distinguishable from the rest by their superior clearness, accuracy, and fulness. On the other hand, for the history of Italy and western Europe, Livy falls back on Roman annalists, especially, it seems, on Claudius Quadrigarius and Valerius Antias,—a most unfortunate choice,—and from them too he takes the annalistic mould into which his matter is cast.

Livy's general method of using these authorities was certainly not such as would be deemed satisfactory in a modern historian. He is indeed free from the grosser faults of deliberate injustice and falsification, and he resists that temptation to invent to which "the minds of authors are only too much inclined" (xxii. 7). Nor is he unconscious of the necessity for some kind of criticism. He distinguishes between rumour and the precise statements of recognised authorities (cf. xvi. 46, v. 21, vi. 8). The latter he reproduces in the main faithfully, but with a certain exercise of discretion. Where they disagreed, he calls attention to the fact, occasionally pronouncing in favour of one version rather than another (ii. 41, xxi. 48), though he sometimes decides groundlessly, or attempting to reconcile and explain discrepancies (vi. 13, 38). Where he detects or suspects the insertion of fabulous matter he has no scruple in saying so (e.g., i. 7, v. 21, "insertum hinc loco fabula"). Gross exaggerations, such as those in which Valerius Antias indulged, he roundly denounces (xxvii. 38, "exaggeratio numero non alius intemperanter?"), and with equal plainness of speech he condemns the family vanity which had so conspicuously corrupted and distorted the truth. "I suppose," he says (viii. 40), "that the record and memorial of these matters hath been depraved and corrupted by these funeral orations of praeses. . . . while every house and family dwelteth in Italy, and such like records, I mean neither to aver nor disprove" (xxvii. 37), and of the whole history he pronounces to the seek of Rome by the Gauls (390 s.c.) he writes that it was obscure "both in regard of exceeding antiquity, and also for that in those days there were very few writings and monuments, the only faithful safeguard and true remembrance of deeds past, and besides, whatsoever was registered in the commentaries of the

praetors and in other public or private records, the same for the most part, when the city was burned, perished withal." Further than this, however, Livy's criticism does not go. Where his written authorities are not palpably inconsistent with each other or with probability he accepts and transcribes their record without any second inquiry, nor does he ever attempt to get behind this record in order to discover the original evidence on which it rested. His acceptance in any particular case of the version given by an annalist by no means implies that he has by careful inquiry satisfied himself of its truth. At the most it only implies a comparison with other reasons, equally second-hand, but either less generally accepted or less in harmony with his own views of the situation; and in many cases the reasons he gives for his preference of one account over another are amply unscientific (e.g., xxvi. 49, "media similitudo visit"). Livy's history, then, rests on no foundation of original research or even of careful verification. It is a compilation, and even as such it leaves much to be desired. For we cannot credit Livy with having made such a preliminary survey of his authorities as would enable him to determine their relations to each other, and fuse their various narratives into a consistent whole. It is clear, on the contrary, that his endeavours in this direction were of a comparatively small one, that of these he selected one, and transcribed him with the necessary embellishments and other slight modifications until impelled by various reasons to drop him. He then, without warning, takes up another, whom he follows in the same way. The result is a curious mosaic, in which pieces of all colours and states of preservation are put together, and in which even the great artistic skill displayed throughout fails to conceal the lack of internal unity. Thus many of Livy's inconsistencies are due to his having placed together two versions, each of which gave a differently coloured account of the same event. Mommsen has clearly shown that this is what has happened in his relation of the legal proceedings against the elder Africanus in book xxviii. (*Röm. Forschungen*, i.), and in the story of the first secession, as he tells it, the older version which represented it as due to political and the later which explained it by economical grievances are found side by side. Similarly a change from one authority to another leads him not infrequently to copy from the one a statement inconsistent with those he took from the former, to forget what he has previously said, or to treat as known a fact which has not been mentioned before (cf. i. 1, xxiv. 6, and *Wissenstein's Introduction*, p. 57). In other cases where the same event has been placed by different annalists at different years, or where the versions of it varied, it is evident from Livy's treatment. Thus the four campaigns against the Volsci (ii. 17-20) as, as Schweigler (*R. G.*, i. 13) rightly says, simply variations of one single expedition. Other instances of such "doublets" are the two single combats described in xxiii. 46 and xxv. 18, and the two battles of Cannae in Spain (xxvii. 10 and 11). It is hardly possible to doubt too much of the chronological confusion above alluded to. Livy is due to the fact that he follows now one now another authority, heedless of their differences on this head. Thus he vacillates between the Catonian and Varroian reckoning of the years of the city, and between the chronologies of Polybius and the Roman annalists.

To these defects in his method must be added the fact that he does not always succeed even in accurately reproducing the authority he is for the time following. In the case of Polybius, for instance, he allows himself great freedom in omitting what strikes him as irrelevant, or tedious, or unnecessary to his Roman readers, a process in which much valuable matter disappears. In other cases his desire to give a vividness and point to what he doubtless considered the matter held and dry style of Polybius leads him into abridgements and inaccuracies. Thus by the treaty with Antiochus (188 s.c.) it was provided that the Greek communities of Asia Minor "shall settle their mutual differences" (xxvii. 37), and so forth. Livy correctly transcribes Polybius, but he adds with a rhetorical flourish, "or, if both parties prefer it, by war" (xxvii. 38). Elsewhere his blunders are apparently due to haste, ignorance, or sheer carelessness, thus, for instance, when Polybius speaks of the Etolians as settling at their capital Thermopylae, Livy (xxvii. 38) not only substitutes Thessaly, but gratuitously informs his readers that here the Pylians assembled were held Thians partly to carelessness, partly to misanthropia; he makes and unmakes (xxv. 6 s.c.) of Polybius's account of the battle of Gynocephalia, while in xxviii. 7 he mistakes *epopeis* ("silestis") for *epopae* ("dooms"), and makes nonsense of the passage accordingly. Finally, Livy cannot be altogether acquitted on the charge of having here and there modified Polybius in the interests of Rome, as when he gives an air of magnanimous moderation to the spoliation of Ambracia (189 s.c.), by adding, after describing the carrying away of all statues, houses, and pictures, "nulla preterea factum violantura" (xxviii. 9, comp. xlii. 19; and *Nissen's History*, i. 31).

Serious as these defects in Livy's method appear if viewed in the light of modern criticism, it is probable that they were easily pardoned, if indeed they were ever

discovered, by his contemporaries. For it was on the artistic rather than on the critical side of history that stress was almost universally laid in antiquity, and the thing that above all others was expected from the historian was not so much a scientific investigation and accurate exposition of the truth, as its skilful presentation in such a form as would charm and interest the reader. In this sense Cicero, *De Legg.* i, 2, speaks of history as an "opus oratorum," and Quintilian, x, 1, as "a prose poem" (*carmen solum*); and so we find that in the judgment of ancient critics it is by their artistic merits that historians stand or fall. Tried by this standard, Livy deservedly won and held a place in the very first rank. Asinius Pollio entered at his Patavinity, and the emperor Caligula denounced him as verbose, but with these exceptions the opinion of antiquity was unanimous in pronouncing him a consummate literary workman. The classical purity of his style, the eloquence of his speeches, the skill with which he depicted the play of emotion, and his masterly portraiture of great men, are all in turn warmly commended, and in our own day we question if any ancient historian is either more readable or more widely read. It is true that for us his artistic treatment of history is not without its drawbacks. The more trained historical sense of modern times is continually shocked by the obvious untruth of his colouring, especially in the earlier parts of his history, by the palpable unreality of many of the speeches, and by the narrative with which he omits everything, however important, which he thinks will weary his readers. But in spite of all this we are forced to acknowledge that, as a master of what we may perhaps call "narrative history," he has no superior in antiquity, for, inferior as he is to Thucydides, to Polybius, and even to Tacitus in philosophic power and breadth of view, he is at least their equal in the skill with which he tells his story. He is indeed the prince of chroniclers, and in this respect not unworthy to be classed even with Herodotus (*Quint.* x, 1). Nor is anything more remarkable than the way in which Livy's fine taste and sense of proportion, his true poetic feeling and genuine enthusiasm, saved him from the besetting faults of the mode of treatment which he adopted. The most superficial comparison of his account of the earliest days of Rome with that given by Dionysius shows from what depth of tediousness he was preserved by these qualities. Instead of the wearisome prolixity and the misplaced pedantry which make the latter almost unreadable, we find the old tales briefly and simply told. Their primitive beauty is not marred by any attempt to force them into an historical mould, or disguised beneath an accumulation of the insipid inventions of later times. At the same time they are not treated as mere tales for children, for Livy never forgets the dignity that belongs to them as the prelude to the great epic of Rome, and as consecrated by the faith of generations. Perhaps an even stronger proof of the skill which enabled Livy to avoid dangers which were fatal to weaker men is to be found in his speeches. We cannot indeed regard them, with the ancients, as the best part of his history, for the majority of them are obviously unhistorical, and nearly all savour somewhat too much of the rhetorical schools to be perfectly agreeable to modern taste. To appreciate them we must take them for what they are, pieces of declamation, intended either to enliven the course of the narrative, to place vividly before the reader the feelings and aims of the chief actors, or more frequently still to enforce some lesson which the author himself has at heart. The substance no doubt of many of them Livy took from his authorities, but their form is his own, and, in throwing into them all his own eloquence and enthusiasm, he not only acted in conformity with the established traditions of his art, but found a welcome outlet for feelings and ideas

which the fall of the republic had deprived of all other means of expression. To us, therefore, they are valuable not only for their eloquence, but still more as giving us our clearest insight into Livy's own sentiments, his lofty sense of the greatness of Rome, his appreciation of Roman courage and firmness, and his reverence for the simple virtues of older times. But, freely as Livy uses this privilege of speechmaking, his correct taste keeps his rhetoric within reasonable limits. With a very few exceptions the speeches are dignified in tone, full of life, and have at least a dramatic propriety, while of such incongruous and laboured absurdities as the speech which Dionysius puts into the mouth of Romulus, after the rape of the Sabine women, there are no instances in Livy.

But, if our estimate of the merits of his speeches is moderated by doubts as to his right to introduce them at all, no such scruples interfere with our admiration for the skill with which he has drawn the portraits of the great men who figure in his pages. We may indeed doubt whether in all cases they are drawn with perfect accuracy and impartiality, but of their life-like vigour and clearness there can be no question. With Livy this portrait-painting was a labour of love. "To all great men," says Seneca, "he gave their due ungrudgingly," but he is at his best in dealing with those who, like Q. Fabius Maximus, "the Delayer," were in his eyes the most perfect types of the true Roman. Over their pictures he lingers with loving care. Each act of their lives, and every speech that is put into their mouths, adds something to the completeness of the sketch, or brings into stronger relief its characteristic features, and thus the desired impression is produced more indelibly than by pages of critical analysis or panegyric.

The general effect of Livy's narrative is no doubt a little spoiled by the awkward arrangement, adopted from his authorities, which obliges him to group the events by years, and thus to disturb their natural relations and continuity. As the result his history has the appearance of being rather a series of brilliant pictures loosely strung together than a coherent narrative. But it is impossible not to admire the copious variety of thought and language, and the evenly flowing style which carried him safely through the dreariest periods of his history; and still more remarkable is the dramatic power he displays when some great crisis or thrilling episode stirs his blood. The sentences with which he begins his account of the sack of Rome by the Gauls are impressive in their solemn simplicity:—"In the same year one M. Cæcilius, a plebeian, gave notice to the tribunes that in the new road where now there standeth a chapel, above the temple of Vesta, there was in the still time of the night a voice heard, louder than any man's, commanding that the magistrates should be told that the Gauls were coming" (vi. 32). With genuine tragic irony he describes how, as the hour of their fate drew nigh, the minds of the Romans were blinded (vi. 37), and how they forgot their ancient cunning in counsel and their courage in the fight, till "full unhappily and in an ill hour" they were scattered by the winds by their foes. Equally vivid is his picture of the self-devotion of the senators who refused to save themselves by flight—"then the elders that had triumphed aforetime, and been consuls, openly gave out and said that they would live and die together with them." . . . But we have not space to follow the story to its triumphant close, when the banished Camillus arrived to save the country which had driven him into exile. Nor can we do more than refer to the description of the forced march of the consul Claudius in the Second Punic War, of the battle by the river Metaurus, and the death of Hannibal.

Livy, however, is not always at his best. For the full exercise of his powers he seems to require either the

stimulus supplied by the absorbing interest of the particular events he is describing, or the absence of any authority so full and so little to be disregarded as to fetter his freedom. Certain it is that in his accounts of the kingly period, and of the Hannibale war, he is seen to much better advantage than in the fourth and fifth decades. We may naturally suppose too that his energies flagged as the work progressed; and in the extant fragments of the unsteady first book other critics besides Niebuhr have detected the signs of failing strength.

In style and language Livy represents the best period of Latin prose writing. He has passed far beyond the bald and meagre diction of the early chroniclers. In his hands Latin acquired a flexibility and a richness of vocabulary unknown to it before. If he writes with less finish and a less perfect rhythm than his favourite model Cicero, he excels him in the varied structure of his periods, and their adaptation to the subject-matter. It is true that here and there the "creamy richness" of his style becomes verbosity, and that he occasionally draws too freely on his inexhaustible store of epithets, metaphors, and turns of speech, but these faults, which did not escape the censure even of friendly critics like Quintilian, are comparatively rare in the extant parts of his work. From the tendency to use a poetic diction in prose, which was so conspicuous a fault in the writers of the silver age, Livy is not wholly free. In his earlier books especially there are numerous phrases and sentences which have an unmistakably poetic ring, recalling sometimes Ennius and more often his contemporary Virgil (see for instance Teuffel, p. 482, n. 14). But in Livy this poetic element is kept within bounds, and serves only to give warmth and vividness to the narrative. Similarly, though the influence of rhetoric upon his language, as well as upon his general treatment, is clearly perceptible, he has not the perverted love of antithesis, paradox, and laboured word-painting which offends us in Tacitus, and, in spite of the Venetian richness of his colouring, and the opious flow of his words, he is on the whole wonderfully natural and simple.

These merits, not less than the high tone and easy grace of his narrative and the eloquence of his speeches, gave Livy a hold on Roman readers such as only Cicero and Virgil besides him ever obtained. His history formed the groundwork of nearly all that was afterwards written on the subject. Plutarch, writers on rhetoric like the elder Seneca, moralists like Valerius Maximus, went to Livy for their stock examples. Florus and Eutropius abridged him; Orosius extracted from him his proofs of the sinful blindness of the pagan world; and in every school Livy was firmly established as a text-book for the Roman youth.

By far the most complete account of the various editions of Livy, and of all that has been written upon him, will be found in Emil Hübner's *Grandes ou Fortissimes über die Römische Literaturgeschichte*, 4th ed., Berlin, 1878. The most successful translation of his history is that by Philemon Holland, London, 1600 (H. F. P.).

LIZARD. The name Lizard (Lat., *lacerta*) originally referred only to the small European species of four-legged reptiles, but is now applied to a whole order (*Lacertina*) which is represented by extremely numerous species in all temperate and tropical parts of the globe. Lizards may be described as reptiles with a more or less elongate body terminating in a tail, and with the skin either folded into scales (as in snakes) or granular or tubercular; legs are generally present—usually four, rarely two in number—but sometimes they are reduced to rudiments or entirely hidden below the skin; the jaws are toothed, and the two mandibles firmly united in front by an osseous suture. Eyelids are generally present. The vent is a transverse slit, and not longitudinal as in Crocodilina. Other structural characteristics, especially of the skeleton, separate lizards from the other orders of reptiles; but will be better

understood if described in relation to the other members of that class. See REPTILES.

At a low estimate the number of described species of lizards may be given as about one thousand seven hundred.¹ They are extremely scarce north of 60° N. lat.; and in the southern hemisphere the southern point of Patagonia forms the furthest limit of their range. As we approach the tropics, the variety of forms and the number of individuals increase steadily, the most specialized and the most developed forms (the monitors and leguans) being restricted to the tropical regions where lizards abound. They have adapted themselves to almost every physical condition, except the extreme cold of high latitudes or altitudes. Those inhabiting temperate latitudes hibernate. The majority live on broken ground, rocks with or without vegetation; others are arboreal; to a few (certain monitors) the neighbourhood of water is a necessity, whilst others are true desert animals, in colour scarcely distinguishable from their surroundings. Some, like many geckos, live near or in houses, being enabled by a peculiar apparatus of their toes to run along perpendicular and even overhanging surfaces. No lizard enters the sea, with the exception of one species, the leguan of the Galapagos (*Amphibolophis*), which feeds on sea-weed. Some, like the majority of the geckos, are nocturnal.

The motions of most lizards are executed with great but not enduring rapidity. With the exception of the chameleon, all drag their body over the ground, the limbs being wide apart, turned outwards, and relatively to the bulk of the body generally weak. But the limbs show with regard to development great variation, and an uninterrupted transition from the most perfect condition of two pairs with five separate clawed toes to their total disappearance; yet even limbless lizards retain rudiments of the osseous framework below the skin. The motions of these limbless lizards are very similar to those of snakes, which they resemble in their elongate body passing into a long cylindrical and tapering tail.

In a great many lizards (*Lacertina*, skinks, geckoes) the muscles of the several vertebral segments of the tail are so loosely connected, and the axis of the vertebrae is so weak, that the tail breaks off with the greatest facility. The part severed retains its muscular irritability for a short time, wriggling as if it were a living creature. A lizard thus mutilated does not seem to be much affected by its loss, and in a short time the part is reproduced; but, whilst the muscles and also the integuments may be perfectly regenerated, the osseous part always remains replaced by a cartilaginous rod, without vertebral segmentation. This faculty is of great advantage to the lizards endowed with it; they are either species in which the tail has no special function, such as to assist in a particular kind of locomotion or to serve as a weapon of defence, or they are small species which lack other means of escape from their numerous enemies. The geckoes are even able to throw off their tail spontaneously, and are said to do this frequently when pursued by some other animal, which is satisfied with capturing the wriggling member, whilst the owner saves its life by a rapid flight.

The majority of lizards are carnivorous, the larger feeding on small mammals, birds, fishes, and eggs, the smaller on insects, worms, and other invertebrates. Not a few, however, are herbivorous, as the larger leguans, and many agamas. This difference in diet is quite independent of modifications of dentition. Generally the teeth are simply

¹ The two latest general works on lizards are those by Duméril and Bibron (*Érpetologie générale*, with atlas, tom. i.-ix., Paris, 1844-54, 8vo), and by J. E. Gray (*Catalogue of Lizards in the Collection of the British Museum*, London, 1846, 8vo). Both are now antiquated, and a new edition of either is much required.

it is green, with minute blackish spots. In Germany and France one other species only (*Lacerta muralis*) appears, but in the south of Europe the species of *Lacerta* are much more numerous, the largest and finest being *L. ocellata*, which grows to a length of 18 or 20 inches, and is brilliantly green, ornamented with blue eye-like spots on the sides. Even the small island-rocks of the Mediterranean, sometimes only a few hundred yards in diameter, are occupied by peculiar races of lizards, which of late years have attracted much attention from the fact that they, like other reptiles, have assumed under such isolated conditions a more or less dark, almost black, coloration.

Moloderna horridum is a Mexican lizard, which in its native country has the reputation of being a most poisonous reptile. Its anterior teeth are, indeed, provided with a deep groove, as in many poisonous snakes, and the submaxillary gland is enormously developed. Sumichrast has recently proved by actual experiment on mammals the fatal effects of the bite of this lizard, and J. Stein, a traveller in Mexico, who was bitten in the finger, suffered from symptoms similar to those resulting from the bite of a poisonous snake. It thus appears that the fear in which it is held by the natives is not due merely to its hideous appearance, as was formerly believed. Tubercles of a dirty brown and yellow colour, with which its body is covered, give it the appearance of a leopards skin. It is about 20 inches long, and is known by the name of "Escorpion."

The Glass-Snake (*Pseudopus pallasi*) or *Sheltopussil* (Russ.) is common in Dalmatia, Hungary, southern Russia, and the western parts of Central Asia. Externally it resembles a snake, the fore limbs being entirely absent, and the hind limbs reduced to small rudiments. It attains to a length of 2 or 3 feet, and feeds on insects, worms, mice, and small birds. In captivity it becomes perfectly tame. North America is inhabited by a very similar glass-snake (*Ophisaurus*), and North Africa by a third (*Hyalosaurus*). Limbless lizards are especially common in Australia, but their scutellation is so different from that of the glass-snakes of the northern hemisphere that they are placed in distinct families, which have been noticed in the systematic list (*Pygopodidae*, *Aprasiidae*, *Uroliidae*).

The family of skinks also includes many genera with rudimentary limbs or without any, the Slow-Worm or Blind-Worm (*Anguis fragilis*) being the one most generally known. It is distributed over the greater part of Europe, and rarely exceeds a length of 15 inches. Its eyes, although small, are perfectly developed and provided with eyelids. It is oviparous, the young, in the first year of their life, differ considerably from the old in their coloration, the back being of a milk-white colour, with a black line down the middle. In the south of Europe it gradually disappears, and its place is taken by the similarly shaped *Seps*, a genus distinguished from *Anguis* by the presence of four very small rudiments of limbs, which have no function.

The Skink, which has given the name to the whole family, is a small lizard (*Scincus officinalis*) of 6 or 8 inches in length, common in arid districts of North Africa and Syria. A peculiarly wedge-shaped snout, and toes provided with strong fringes, enable this animal to burrow rapidly in and under the sand of the desert. In former times large quantities of it were imported in a dry state into Europe for official purposes, the drug having the reputation of being efficacious in diseases of the skin and lungs; and even now it may be found in apothecaries' shops in the south of Europe, country people regarding it as a powerful aphrodisiac for cattle.

Of the family *Iguanidae* we refer to three genera only—*Iguana*, *Anolis*, and *Phrynosoma*. Herpetologists distinguish several species of *Iguana* or *Leguans*, which, however, do not appear to differ in their habits. They are found in the forest regions of tropical America only, in the neighbourhood of water, into which when frightened they jump from the overhanging branches of trees, to escape capture by swimming and diving. Feeding ex-

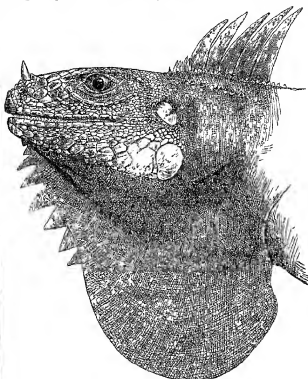


FIG. 3.—Head of Leguana (*Iguana rhinolepoides*).

clusively on leaves or fruits, they are themselves highly esteemed as food, and their eggs also are eagerly searched for by the natives. Iguanas grow to a length of from 2 to 5 feet, and are readily recognized by a row of long compressed and pointed scales which form a more or less high crest along the middle of the back and tail, and by a compressed and pendant dewlap at the throat. These large lizards are strictly arboreal, and of a brilliant coloration, in which green prevails.

The smallest lizards of this family belong to the genus *Anolis*, extremely numerous as regards species and individuals on bushes and trees of tropical America, and especially of the West Indies. They offer many points of analogy to the humming birds in their distribution, colours, and even disposition. Gesse (*A Naturalist's Sojourn in Jamaica*, pp. 75 *sq.*) has given a vivid and faithful description of their manners. Hundreds may be seen on a bright day, sporting themselves on the trees and fences, leaping from branch to branch, fearlessly entering houses, chasing each other, or engaging in combat with some rival. Like the iguanas, they (at least the males) are provided with a large, expandable dewlap at the throat, which is brilliantly coloured, and which they display on the slightest provocation. This appendage is merely a fold of the skin, ornamental and sexual, like the wattles of the throat of a gallinaceous bird, it has no cavity in its interior, and has no communication with the mouth or with the respiratory organs; it is supported by the posterior horns of the hyoid bone, and can be erected and spread at the will of the animal. The presence of such dewlaps in lizards is always a sign of an excitable temper. The

anolis possess the power of changing their colours in a most extraordinary degree, the brilliant iridescent hues of their body passing almost in an instant into a dull sooty brown in an irritated or alarmed animal. They are much fed upon by birds and snakes, and have, like all small much-persecuted lizards, a fragile tail, easily reproduced. They bring forth only one large egg at a time, but probably breed several times during the season.

The third iguanoid, *Phrynosoma*, is a testaceous form. Several species are known, inhabiting the plains of southwestern America and Mexico. Since the opening of the Pacific Railway, living specimens are frequently sent to Europe, and sold under the name of "California toads." Although they belong to the same family, a greater contrast than that between the nimble, slender, and long-tailed *Anolis* and the toad-like *Phrynosoma* can hardly be imagined. The body is short, broad, and depressed, ending in a short tail, covered with rough tubercles or spines, the short head is armed behind with long bony spikes, the colours are a motley of brown, black, and yellow. Their defence against birds lies chiefly in their outward appearance, as, whilst they rest quiet, they are difficult to distinguish from a stone overgrown with lichen, nor have we ever found their remains in the stomach of snakes, their spines proving a sufficient protection against these equally formidable enemies. They are said to move with rapidity in a wild state, but in confinement, especially when the animal believes itself observed, their movements are extremely sluggish and their manners uninteresting. It seems to be a common belief in California that they have the power of squirting a blood-red fluid from the corner of the eye to some distance; but nothing has been found, on anatomical examination, to establish the correctness of this assertion. They attain a length of from 6 to 8 inches.

Of the *Iguanids*, which represent the iguanas in the Old World, and which have been differentiated into a still greater number of distinct generic forms, several genera deserve more than a merely nominal notice. The perhaps most highly specialized form are the Dragons (*Draco*), a genus of small lizards from the East Indies, more common in the archipelago than on the continent, but absent in Ceylon. The character by which they are at once recognized is the peculiar additional apparatus for locomotion, formed by the much-prolonged five or six hind ribs, which are connected by a broad expansible fold of the skin, the whole forming a subsemicircular wing on each side of the body. The snakes are the only order of vertebrates in which the ribs serve as organs of locomotion, but, whilst in that order all the ribs are charged with a function for which no other special organ exists, in the dragons only a part of the ribs are modified for the purpose of assisting four well-developed limbs. The dragons are tree-lizards, they take long flying leaps from branch to branch, supported in the air by their expanded parachutes, which are laid backwards at the side of the animal while it is sitting or merely running. If the hind or fore limbs of a dragon were cut off, it would be helpless, and deprived of locomotion, but it could continue to move with velocity after the loss of its wings. Like the anolis, whose analogues they are in the Old World, they are provided with long highly ornamented dewlaps. These appendages are found in both sexes, one in the middle and one on each side of the throat, but they are much more developed in the mature male. The tail is very long and slender, not fragile, we have never seen a dragon in which this member was mutilated, it seems to be necessary for their peculiar locomotion, and probably its loss soon proves fatal to the animal. Cantor says that the transcendent beauty of their colours baffles description.

As the lizard lies in the shade along the trunk of a tree, its colours at a distance appear as a mixture of brown and grey, and render it scarcely distinguishable from the bark. Thus it remains with no signs of life except the restless

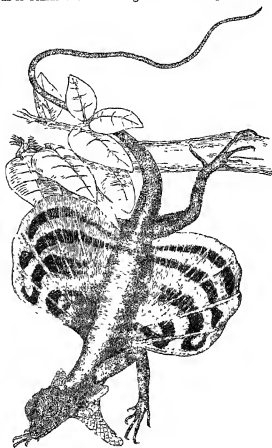


FIG. 4.—Dragon (*Draco temminckii*).

eyes watching passing insects, which, suddenly expanding its wings, it seizes with a sometimes considerable unerring leap. All the species attain a length of 7 or 8 inches, of which the tail takes at least one half. They deposit three or four eggs at a time.

Calotes is another genus of agamoids peculiar to the East Indies; it comprises numerous species well known in India by the name of "blood-suckers," a designation the origin of which cannot satisfactorily be traced. They are tree-lizards, extremely variable in their colours, which change, not only with the season, but also at the will of the animal. The males, and in some species also the females, possess a crest of compressed scales along the back.

Of the Australian agamas no other genus is so numerously represented and widely distributed as *Grammatophora*, the species of which grow to a length of from 8 to 18 inches. Their scales are generally rough and spinous, but otherwise they possess no strikingly distinguishing peculiarity, unless the loose skin of their throat, which is transversely folded and capable of inflation, be regarded as such. On the other hand, two other Australian agamoids have attained some celebrity by their grotesque appearance, due to the extraordinary development of their integuments. One (fig. 5) is the Frilled Lizard (*Chlamydosaurus*), which is restricted to Queensland and the north coast, and grows to a length of 2 feet, including the long tapering tail. It is provided with a frill-like fold of the skin round the neck, which, when erected, resembles a broad collar, not unlike the gigantic lace-collars of Queen

Elizabeth's time. The late Mr Krefft has made the observation that this lizard when startled, rises with the forelegs off the ground, and squats and jumps in kangaroo-fashion, thus reminding us of the peculiar locomotion ascribed to certain gigantic extinct reptiles. The other lizard is one which most appropriately has been called

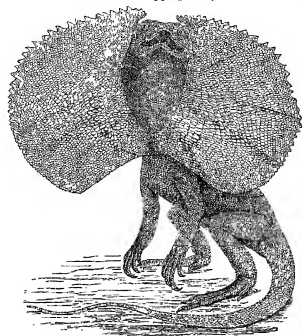


FIG 5.—Filled Lizard (*Chlamydosaurus kingi*)

Moloch horridus. It is covered with large and small spine-bearing tubercles; the head is small, and the tail short. It is sluggish in its movements, and so harmless that its armature and (to a casual observer) repulsive appearance are its sole means of defence. It grows only to a length of 10 inches, and is not uncommon in the flats of South and West Australia.

The majority of the ground-agamas, and the most common species of the plains, deserts, or rocky districts of Africa and Asia, belong to the genera *Stellio* and *Agama*. They resemble much the *Grammatophora* of the Australian region, their scales being mixed with larger prominent spines, which in some species are particularly developed on the tail, and disposed in whorls. Nearly all travellers in the north of Africa mention the *Hardibia* of the Atabs (*Stellio cordylus*), which is extremely common, and has drawn upon itself the hatred of the Mohammedans by its habit of nodding its head, which they interpret as a mockery of their own movements whilst engaged in prayer. *Uromastix* is one of the largest and most developed genera of ground-agamas, and likewise found in Africa and Asia. The body is uniformly covered with granular scales, whilst the short, strong tail is armed with powerful spines disposed in whorls. The Indian species (*U. hardwickii*) feeds on herbs only; the African species probably take mixed food.

The Chameleons are almost peculiar to the African region, and most numerous in Madagascar, where out of the thirty-six species known not less than seventeen occur. Only one species (*C. virgatus*) extends into India and Ceylon. No other member of the order of lizards shows such a degree of specialization as the chameleons. The tongue, eyes, limbs, tail, skin, lungs are modified in a most extraordinary manner to serve special functions in the peculiar economy of these animals. They lead an exclusively arboreal life, each of their feet is converted into a grasping

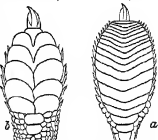
hand, by means of which, assisted by a long prehensile tail, they hold so fast to a branch on which they are sitting that they can only with difficulty be dislodged. Their movements are slow on the ground, and still more so in the water, where they are nearly helpless. As in ant-eaters, woodpeckers, or frogs, their tongue is the organ with which they catch their prey, it is exceedingly long, worm-like, with a club-shaped viscid end, they shoot it out of the mouth with incredible rapidity towards insects, which remain attached to it, and are thus caught. The globular eyes are



FIG 6.—Front foot of *Chamaeleon chamaeleon*

covered with a circular lid pierced by a small central hole, and are so prominent that more than one-half of the ball stands out of the head. Not only can they be moved in any direction, but each has an action independent of the other, one eye may be looking forwards, whilst an object behind the animal is examined with the other. The lungs of the chameleons are very capacious, and are inflated when the animal is angry or frightened. The faculty of changing colour, which they have in common with many other lizards, is partly dependent on the degree in which the lungs are filled with air, and different layers of chromatophores are pressed towards the outer surface of the skin. Some species are only a few inches long, whilst others attain to a length of 18 and 20 inches. The majority are oviparous, a few ovoviviparous.

Almost all the lizards belonging to the family of *Gekkos* may be recognised at first sight, the head is broad and depressed, the eyes large, the body depressed; the tail is thick at the base, tapering, generally somewhat deformed, as a specimen is rarely met with in which this member is not reproduced. The limbs are stout, rather short, with at least four of the toes well developed. *Gekkos* are found in almost every part of the globe between and near the tropics, frequenting houses, rocks, and trees; and some of the species are so numerous around and within human dwellings as to be most familiar objects to the inhabitants. Many are able



to run up and along the largest vertical surface of a wall or of any other perpendicular object, for this purpose the lower surface of their toes is provided with a series of movable plates or disks,¹ by the aid of which they adhere to the surface over which they pass. In forest-species this apparatus is generally less developed, or entirely absent, claws being of greater use for walking up the rough bark of a tree. *Gekkos*, with few exceptions, are nocturnal and, consequently, large-eyed animals, the pupil being generally contracted in a vertical direction, shaped like two rhombi placed with the angles towards each other. They are of small size, the largest species not exceeding 10 or 14 inches in length. They are carnivorous, destroying moths and all kinds of insects, and even the younger and weaker members of their own species. They have been seen devouring the skin which they cast off, and

¹ The mechanism resembles in some the adhesive organ of *Echinos* or sucking-fish, in others that of the legs of a fly.

their own wriggling tail. They are of a fierce disposition, frequently fighting among themselves, but house-geckos readily become habituated to the presence of man, occasionally to be fed at a certain time with rice, these little lizards will punctually make their appearance, and fearlessly take the proffered food. Another peculiarity of geckos is that they, or at least some genera, are endowed with a voice. The large *Gekko guttatus* and *G. monachus* of the East Indies utter a shrill cry, sounding like "toke" or "tok." The common species found in houses in the south of Europe are a species of *Hemidactylus* (*H. variegatus*) and *Tarentola*, the *terrentola* of the Italians. All geckos seem to be oviparous. (A C G)

LLAMA, sometimes spelt *Lama*, a word by which the Peruvians designated one of a small group of closely allied animals, which, before the Spanish conquest of America, were the only domesticated hoofed mammals of the country, being kept, not only for their value as beasts of burden, but also for their flesh, hides, and wool,—in fact, supplying in the domestic economy of the people the place of the horse, the ox, the goat, and the sheep of the Old World. The word is now sometimes restricted to one particular species or variety of the group, and sometimes used in a generic sense to cover the whole. Although they were often compared by early writers to sheep, and spoken of as such, their affinity to the camel was very soon perceived, and they were included in the genus *Camelus* in the *Systema Naturæ* of Linnaeus. They were, however, separated by Cuvier in 1800 under the name of *Lama*, changed by Illiger in 1811 to *Acridonta* (in allusion to the great length of neck, *ακρίς*), a term afterwards adopted by Cuvier, and almost universally accepted by systematic zoologists, although there has been of late a disposition to revive the earlier name.

The animals of the genus *Auchenia* or *Lama* are, with the two species of true camels (to which the generic term *Camelus* is now restricted), the sole existing representatives of a very distinct section of the "artiodactyle" or even-

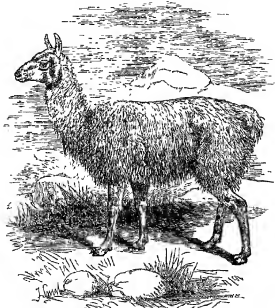


FIG. 1.—Llama (from an animal living in the Gardens of the Zoological Society of London)

toed ungulates, called *Tylopoda*, or "boss-footed," from the peculiar bosses or cushions placed on the under surface of their feet, and on which they tread. This section thus consists of a single family, the *Camelidae*, the other sections of the same great division being the *Stomax* or pigs,

the *Tragulina* or chevrotains, and the *Pecora* or true ruminants, to each of which the *Tylopoda* have more or less affinity, standing in some respects in a central position between them, borrowing as it were some characters from each, but in others showing great special modifications not found in any of the other sections.

Until within the last few years the existence of two genera having so very much in common as the camels and the llamas, and yet so completely isolated geographically, had not received any satisfactory explanation, for the old idea that they in some way "represented" each other in the two hemispheres of the world was a mere fancy without philosophical basis. The discoveries made mostly within the past ten years of a vast and previously unsuspected extinct fauna of the American continent of the Tertiary period, as interpreted by the able paleontologists Leidy, Cope, and Marsh, has thrown a flood of light upon the early history of this family, and upon its relations to other mammals. It is now known that llamas at one time were not confined to the part of the continent south of the Isthmus of Panama, as at the present day, for their remains have been abundantly found in the Pleistocene deposits of the region of the Rocky Mountains, and in Central America, some attaining a much larger size than those now existing. There have also been found in the same regions many camel-like animals exhibiting different generic modifications, and, what is more interesting, a gradual series of changes, coinciding with the antiquity of the deposits in which they are found, have been traced from the thoroughly differentiated species of the modern epoch down through the Pliocene to the early Miocene beds, where, their characters having become by degrees more generalized, they have lost all that especially distinguishes them as *Camelidae*, and are merged into forms common to the ancestral type of all the other sections of the Artiodactyles. Hitherto none of these ancestral forms have been found in any of the fossiliferous strata of the Old World, it may therefore be fairly surmised (according to the evidence at present before us) that America was the original home of the *Tylopoda*, and that the true camels have passed over into the Old World, probably by way of the north of Asia, where we have every reason to believe there was formerly a free communication between the continents, and then, gradually driven southward, perhaps by changes of climate, having become isolated, have undergone some further special modifications; while those members of the family that remained in their original birthplace have become, through causes not clearly understood, restricted solely to the southern or most distant part of the continent. There are few groups of mammals of which the paleontological history has been so satisfactorily demonstrated as the one of which we are treating.¹

The special characters which the llamas and camels have in common, and the combination of which distinguishes them from the rest of the Artiodactyles, are as follows. The premaxillæ have the full number of incisor teeth in the young state, and the outermost is permanent through life, an isolated lunulariform tooth. The canines are present in both jaws, and those of the mandible are differentiated from the long, procumbent, and spatulate incisors, being suberect and pointed. The crowns of the true molars belong to the "selenodont" type, and are very long or "hypselodont"; but one or more of the anterior premolars is usually detached from the series, and of simple pointed form. The hinder part of the body is much contracted, and the femur long and vertically placed, so that the knee-joint is lower in position, and the thigh altogether more detached from the abdomen than in most quadrupedal mammals. The limbs are long, but with only two digits (the third and fourth) developed on each, no traces of any of the others being present. The trapezoid and magnum of the carpus, and the cuboid and navicular of the tarsus are distinct. The two metatarsal bones of each limb are confluent for the greater part of their length, though

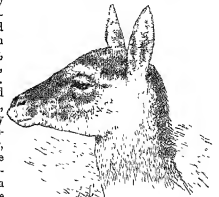
¹ See especially E. D. Cope, in Wheeler's *Report of the Survey West of the 100th Meridian*, iv. pt. 2, pp. 325-46, 1877.

separated for a considerable distance at the lower end. Then distal articular surfaces, instead of being pulley-like, with deep ridges and grooves, as in other Artiodactyls, are simple, rounded, and smooth. The proximal phalanges are expanded at their distal ends, and the wide, depressed middle phalanges are embedded in a broad cutaneous pad, forming the sole of the foot, on which the animal rests in walking instead of on the hoofs. The ungual phalanges are very small and nodular, not flattened on their inner or opposed surfaces, and not completely encased in hoofs, but bearing nails on their upper surface only. The cervical region is long and fleshy, and the vertebrae of which it is composed are remarkable for the position of the canal for the transmission of the vertebral artery, which does not perforate the transverse process, but passes obliquely through the anterior part of the pedicle of the arch (a condition only found in two other genera of mammals, *Macrauchenius* and *Myrdocophaga*). There are no horns or antlers. Though these animals ruminate, the stomach differs considerably in the details of its construction from that of the *Pecora*. The interior of the rumen or paunch has no villi on its surface, and there is no distinct pyloricum or rumen. Both first and second compartments are remarkable for the presence of a number of pouches or cells in their walls, with muscular septa, and a sphincter-like arrangement of their orifices, by which they can be shut off from the rest of the organ, and into which the fluid portion only of the contents of the stomach is allowed to enter. The placenta is diffuse as in the *Simia* and *Tragulina*, not cotyledonary as in the *Pecora*. Finally, they differ not only from other ungulates, but from all other mammals, in the fact that the red corpuscles of the blood, instead of being circular in outline, are oval as in the inferior vertebrate classes.

The following characters apply especially to the llamas. Dentition of adults—maxillars 2, canines 3, premolars 3, molars 3, total 82. In the upper jaw there is a compressed, sharp, pointed laminiiform incisor near the hinder edge of the premaxilla, followed in the male sex by a minute, sharp, pointed, curved two-cuspid in the anterior part of the maxilla. The isolated canine-like molar which follows in the canine is not present. The teeth of the molar series which are in contact with each other consist of two very small premolars (the first almost rudimentary) and three broad molars, constructed generally like those of the lower jaw, the third molar being the most and longest, spatulate, and procumbent; the outer ones are the smallest. Next to these is a curved, suberect canine, followed after an interval by an isolated minute and often deciduous simple conical premolar, then a contiguous series of one premolar and three molars, which differ from those of *Camelus* in having a small accessory column at the anterior outer edge. The skull generally resembles that of *Camelus*, the relatively larger brain-cavity and orbits and less developed cranial ridges being due to its smaller size. The nasal bones are shorter and broader, and are joined by the premaxilla. Vertebrae cervical 7, dorsal 12, lumbar 7, sacral 4, caudal 15 to 20. Ears rather long and pointed. No dorsal hump. Feet narrow, the toes being more separated than in the camels, each having a distinct plantar pad. Tail short. Hairy covering long and woolly. Size smaller and general form lighter than in the camels. At present and within historic times they are entirely confined to the western side and southernmost parts of South America, though fossil remains have been found in the caves of Brazil, in the pampas of the Argentine republic, and, as before mentioned, in Central and North America.

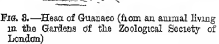
In essential structural characters, as well as in general appearance and habits, all the animals of this genus very closely resemble each other, so that the question as to whether they should be considered as belonging to one, two, or more species has been one which has led to a large amount of controversy among naturalists. The question has been much complicated by the circumstance of the great majority of individuals which have come under observation being either in a completely or partially domesticated state, and descended from ancestors which from time immemorial have been in like condition, one which always tends to produce a certain amount of variation from the original type. It has, however, lost much of its import-

ance since the doctrine of the distinct origin of species has been generally abandoned. The four forms commonly distinguished by the inhabitants of South America are recognized by some naturalists as distinct species, and have had specific designations attached to them, though usually with expressions of doubt, and with great difficulties in defining their distinctive characteristics. These are—(1) the llama, *Aschelus glama* (Linn.), or *Lama peruanus* (Niedemann); (2) the alpaca, *A. pacos* (Linn.), (3) the guanaco or huanoaco, *A. huanaco* (Molina), and (4) the vicugna, *A. vicugna* (Molina), or *A. vicugna*, (Cuv.) The first and second are only known in the domestic state, and are variable in size and colour, being often white, black, or piebald. The third and fourth are wild, and of a nearly uniform light-brown colour, passing into white below. They certainly differ from each other, the vicugna being



smaller, more slender, and having a shorter head than the guanaco. It may, therefore, according to the usual view of species, be considered distinct. It lives in herds on the bleak and elevated parts of the mountain range bordering the region of perpetual snow, amid steep rocks and precipices, occurring in various suitable localities throughout Peru, in the southern part of Ecuador, and as far south as the middle of Bolivia. Its manners very much resemble those of the chamois of the European Alps; and it is as vigilant, wild, and timid. The wool is extremely delicate and soft, and highly valued for the purposes of weaving, but the quantity which each animal produces is not great.

The guanaco has an extensive geographical range, from the high lands of the Andean region of Ecuador and Peru to the open plains of Patagonia, and even the wooded islands of Tierra del Fuego. It constitutes the principal food of the Patagonian Indians, and its skin is invaluable to them, as furnishing the material out of which their long robes are constructed. It is about the size of a European red deer, and is an elegant animal, being possessed of a long, slender, gracefully curved neck and fine legs. Dr Cunningham,* speaking from observation on wild animals, says—



* The stomach of the camel inhabiting the Arabian desert is commonly looked upon as a striking example of specialized structure, adapted or modified in direct accordance with a highly specialized mode of life, it is therefore very remarkable to find an organ exactly similar, except in some unessential details, in the llamas of the Peruvian Andes and the guanacos of the Pampas. No hypothesis except that of a common origin will satisfactorily account for this, and, granting that this view is correct, it becomes extremely interesting to find for how long a time two genera may be isolated and yet retain such close similarities in parts which in other groups appear readily subject to adaptive modifications.

* Natural History of the Strait of Magellan, 1871

"It is not easy to describe its general appearance, which combines some of the characters of a camel, a deer and a goat. The body, deep at the breast but very small at the loins, is covered with long, soft, very fine hair, which on the upper parts is of a kind of fawn-colour, and beneath varies from a very pale yellow to the most beautiful snow-white. The head is provided with large ears, in general carried well back, and is covered with short greyish hair, which is darkest on the forehead. Occasionally the face is awfully black. As a rule, it lives in flocks of from half a dozen to several hundreds, but solitary individuals are now and then to be met with. They are very difficult to approach sufficiently near to admit of an easy shot, as they are extremely wary, but, on being disturbed, cower off at a pace which soon puts a safe distance between them and the sportsman, even though he should be mounted. Despite their timidity, however, they are possessed of great curiosity, and will sometimes advance within a comparatively short distance of an unknown object, at which they will gaze fixedly till they take alarm, when they effect a speedy retreat. Their cry is very peculiar, being something between the belling of a deer and the neigh of a horse. It would be difficult to overestimate their numbers upon the Patagonian plains, for in whatever direction we walked we always came upon numbers of portions of their skeletons and detached bones."

Darwin, who has given a most interesting account of the habits of the guanaco in his *Naturalist's Voyage*, says that they readily take to the water, and were seen several times at Port Valdes swimming from island to island.

The llama is only known as a domestic animal, and is chiefly met with in the southern part of Peru. Burmeister, the latest and a very competent writer on the subject,¹ says that he is perfectly satisfied that it is the descendant of the wild guanaco, an opinion opposed to that of Tschudi. It generally attains a larger size than the guanaco, and is usually white or spotted with brown or black, and sometimes altogether black. The earliest and often quoted account of this animal by Augustin de Zarate, treasurer-general of Peru in 1544, will bear repeating as an excellent summary of the general character and uses to which it was put by the Peruvians at the time of the Spanish conquest. He speaks of the llama as a sheep, observing, however, that it is camel-like in shape, though destitute of a hump:—

"In places where there is no snow, the natives want water, and to supply this they fill the skins of sheep with water and make other living sheep carry them, for, it must be remarked, those sheep of Peru are large enough to serve as beasts of burden. They can carry about one hundred pounds or more, and the Spaniards used to ride them, and they would go four or five leagues a day. When they are weary they lie down upon the ground, and as there are no means of making them get up, either by beating or seating them, the lord must of necessity be taken off. When there is a man on one of them, if the beast is tired and urged to go on, he turns his head round, and discharges his saliva, which has an unpleasant odour, into the ruler's face. These animals are of great use and profit to their masters, for their wool is very good and fine, particularly that of the species called paca, which have very long fleeces, and the expense of their food is trifling, as a handful of maize suffices them, and they can go four or five days without water. Their flesh is as good as that of the fat sheep of Castile. There are now public shambles for the sale of their flesh in all parts of Peru, which was not the case when the Spaniards came first, for when an Indian had killed a sheep his neighbours came and took what they wanted, and then another Indian killed a sheep in his turn."

The disagreeable habit here noticed of spitting in the face of persons whose presence is obnoxious is common to all the group, as may be daily witnessed in specimens in confinement in the menageries of Europe. One of the principal labours to which the llamas were subjected at the time of the Spanish conquest was that of bringing down ore from the mines in the mountains. Gregory de Bolivar estimated that in his day as many as three hundred thousand were employed in the transport of the produce of the mines of Potosi alone, but since the introduction of horses, mules, and donkeys the importance of the llama as a beast of burden has greatly diminished.

The alpaca is believed by most naturalists to be a variety of the vicugna; others have, however, identified it with the guanaco, and some consider it as a distinct species. It is usually found in a domesticated or semi-domesticated state, being kept in large flocks which graze on the level heights of the Andes of southern Peru and northern Bolivia at an elevation of from 14,000 to 16,000 feet above the sea-level, throughout the year. It is not used as a beast of burden like the llama, but is valued only for its wool, of which the Indian blankets and ponchos are made. Its colour is usually dark brown or black. The characteristics of its wool, and the history of its introduction into British manufacturing industry, are described in the article ALPACA. (W. H. R.)

LLANDAFF, a city of Glamorgan, South Wales. See CARDIFF, within which parliamentary borough it is almost entirely included.

LLANDUDNO, a watering-place in Carnarvonshire, North Wales, situated on the Irish Sea, and at the mouth of the Conway, in a finely sheltered bay, 50 miles west of Chester by rail. It lies between Great Orme's Head and Little Orme's Head, two lofty promontories which rise precipitously from the sea to the height of several hundred feet. Round Great Orme's Head a public drive has been made, from which very picturesque views are obtained. The rock is greatly frequented by many varieties of sea birds, and is also the habitat of many rare plants. The old parish church of St Tudno, situated on a cliff overlooking the sea, has been replaced by a later structure (St George's), and the Church of Holy Trinity in the First Pointed style was erected in 1865. The chief attractions of the town are its picturesque and sheltered situation, and the fine facilities it affords for sea bathing. In the neighbouring coppice-mires various mineralogical specimens of interest have been found. On the summit of the head there are the remains of old circular buildings, some portions of an old fortress, and a rocking stone. The population of the urban sanitary district in 1871 was 2732, and in 1881 it was 4883, but these figures do not represent its summer population, which is nearly twice as great.

LLANELLY, a market-town, parliamentary borough, and seaport town of Carmarthenshire, South Wales, is situated on a creek of Carmarthen Bay, on the river Loughor, and on several railway lines, 11 miles west of Swansea, and 225 west-north-west of London. It is a prosperous manufacturing town. The church of St Elli or Llanelly is in the Early English style, with a square embattled tower. The other principal buildings are the town-hall and the Athenaeum. The town possesses extensive docks. It imports large quantities of copper ore, and carries on an export trade in its special manufactures. For the last five years the exports have averaged above £150,000 annually, and the imports £50,000. There are copper, silver, lead, and tin works, iron foundries, manufactures of pottery, chemical works, brick and tile works, flour-mills, and breweries; and in the vicinity there are extensive collieries. Llanelly is included in the Carmarthen district of parliamentary boroughs. The population of the urban sanitary district in 1871 was 14,973, which in 1881 had increased to 19,655.

LLANGOLLEN, a picturesque market-town of Denbighshire, North Wales, and a favourite summer resort, is beautifully situated in a fine vale surrounded by lofty mountains, on the right bank of the Dee, and on a branch line of the Great Western Railway, 9 miles south-west of Wrexham, and 22 south-west of Chester. The river is crossed by a peculiarly constructed bridge of five arches built in 1345. The church, dedicated to St Collen, is a plain but ancient structure, partly in the Early English style. Opposite the town, on the summit of a conical hill,

¹ *Description Physique de la République Argentine*, vol. iii p. 468, 1879.

are the remains of a very ancient fortress, the Castell Dinas Brán. The beautiful abbey of Valle Crucis, in a neighbouring dell, is one of the finest ecclesiastical ruins in Wales. Near it there is an ancient British monument, the "Pillar of Eliseg." The principal secular buildings of the town are the town-hall and the court-house. The industries include the manufacture of linen and wool, and in the vicinity there are collieries, lime-works, and iron-works. The population of the urban sanitary district in 1871 was 2798, and in 1881 it was 3124.

LORENTE, JUAN ANTONIO (1756-1823), the historian of the Spanish Inquisition, was born March 30, 1756, at Lunco de Soto, near Calahorra, Aragon, studied at Tarragona and Saragossa, received (by dispensation) priest's orders in 1779, and became vicar-general to the bishop of Calahorra in 1782. In 1785 he became commissary of the Holy Office at Logroño, and in 1789 its general secretary at Madrid. In 1805 he obtained a canonry at Toledo, and in 1805-8 his *Noticias Históricas sobre las tres Provincias Vascongadas* appeared. In the crisis of 1808 Llorente identified himself with the Bonapartists, and from 1809 onwards he was engaged in superintending the execution of the decree of suppression of the monastic orders, and in examining the archives of the Inquisition for his *History*, a work which appeared in 1817-18 at Paris, where its author had been residing since the return of Ferdinand VII. to Madrid in 1814, under the title *Histoire critique de l'Inquisition d'Espagne, depuis l'époque de son établissement par Ferdinand V. jusqu'au règne de Ferdinand VII., tirée des pièces originales du Conseil de la Suprême et de celles des tribunaux subalternes du Saint Office*. Translated within a few years into German, English, Dutch, Italian, and Spanish, it attracted much attention throughout Europe, and involved its author in considerable persecution and hardship, which, on the publication of his *Portraits politiques des Papes* in 1822, culminated in a peremptory order (December 1822) to quit France. His death, caused, or at least hastened, by the fatigues of the hasty journey to Spain, took place at Madrid on February 5, 1823. Both the personal character and the literary trustworthiness of Llorente have been very bitterly assailed; but, although he was very imperfectly equipped as an exact historian, there is no reason to doubt that he made an honest use of documents (now no longer extant) relating to the Inquisition, to which he had access at Madrid. An English (abridged) translation of the *History* appeared in 1826. A full list of the numerous writings of Llorente is given in the *Biographie Générale*.

LLOYDS, an association of merchants, shipowners, underwriters, and ship and insurance brokers, having its headquarters in a suite of rooms in the north-east corner of the Royal Exchange, London. Originally a mere gathering of merchants for business or gossip in a coffee-house kept by one Edward Lloyd in Tower Street, London, the earliest notice of which occurs in the *London Gazette* of 18th February 1688, this institution has gradually become one of the greatest and most perfect organizations in the world in connexion with commerce. The establishment existed in Tower Street up to 1692, in which year it was removed by the enterprising proprietor to Lombard Street, in the very centre of that portion of the old city of London most frequented by merchants of the highest class. Shortly after this event Mr Lloyd gave another proof of his enterprise and intelligence by the establishment of a weekly newspaper furnishing commercial and shipping news, in those days an undertaking of no small difficulty. This paper took the name of *Lloyd's News*, and, though its life was not a prolonged one, it was destined to be the precursor of the now ubiquitous *Lloyd's List*, the oldest existing paper, the *London Gazette* excepted, of the present

day. In Lombard Street the business transacted at Lloyd's coffee-houses steadily grew in extent and importance, but it does not appear that throughout the greater part of the 18th century the merchants and underwriters frequenting the rooms were bound together by any rules, or acted under any organization. By and by, however, the rapid increase of marine insurance business made a change of system and improved accommodation absolutely necessary, and accordingly, after finding a temporary resting-place in Pope's Head Alley, the underwriters and brokers finally settled down in the Royal Exchange in March 1774. One of the first improvements in the mode of effecting marine insurance springing out of this new state of things was the introduction of a printed form of policy. Hitherto various forms had been in use; and, to avoid the numerous disputes consequent on a practice so loose and unsatisfactory, the committee of Lloyd's proposed a general form, which was finally adopted by the members on the 12th of January 1779, and which remains in use, with only a few slight alterations, to this day. The two most important events in the history of Lloyd's during the present century are the reorganization of the association in 1811, and the passage of an Act in 1871 granting to Lloyd's all the rights and privileges of a corporation sanctioned by parliament. According to this Act of Incorporation, the three main objects for which the society exists are—first, the carrying out of the business of marine insurance, secondly, the protection of the interests of the members of the association; and thirdly, the collection, publication, and diffusion of intelligence and information with respect to shipping. In the promotion of the last-named object, obviously the foundation upon which the entire superstructure rests, an intelligence department has been gradually developed which for wideness of range and efficient working has no parallel among private enterprises in any country.

The rooms at Lloyd's are available only to subscribers and members. The former pay an annual subscription of five guineas without entrance fee, but have no voice in the management of the institution. The latter consist of non-underwriting members, who pay an entrance fee of twelve guineas, and of underwriting members, who pay a fee of one hundred pounds. Underwriting members are also required to deposit securities to the value of £5000 to £10,000, according to circumstances, as a guarantee for their engagements. The management of the establishment is delegated by the members to certain of their number selected as a "committee for managing the affairs of Lloyd's." With this body lies the appointment of all the officials and agents of the institution, the daily routine of duty being entrusted to a secretary and a large staff of clerks and other assistants. The mode employed in effecting an insurance at Lloyd's is very simple. The business is done entirely by brokers, who write upon a slip of paper the name of the ship and shipmaster, the nature of the voyage, the subject to be insured, and the amount at which it is valued. If the risk is accepted, each underwriter subscribes his name and the amount he agrees to take or underwrite, the insurance being effected as soon as the total value is made up. The sum paid by the insured to the underwriters is denominated the premium, a tax upon the profits of the merchant which the progress of science, of the art of shipbuilding, and of navigation has in these days reduced to a very moderate figure. (W. P. H.)

LOACH. The loaches (*Cobitidae*) are small fishes of the Carp family (*Cyprinidae*), with a generally cylindrical body, with very small or without any scales, with six or more barbels round the mouth, with a short dorsal and anal fin, and with the pharyngeal teeth in a single series. The air-bladder is double, as in other carps, the two divisions lying side by side, or one behind the other; but

it is always entirely or partially enclosed in a bony capsule formed by the anterior vertebra. The largest of the ninety species known grow to a length of 10 or 12 inches, but the majority are of much smaller dimensions. They are found in Europe and Asia only. The typical species are partial to fast-running streams with stony bottoms; they abound in the waters draining the central Alps of Asia, and extend far towards the north of the Euro-Asiatic region. The tropical forms from south of the Himalayas are not less common, and some of them have assumed a more compressed form of the body with a bright coloration. In Great Britain two species occur, viz., the common loach (*Nemachilus barbatulus*), and the more local *Cobitis taenia*, which is distinguished by a small spine below the eye. The former is esteemed as food in parts of the Continent where it occurs in sufficient abundance. See ICHTHYOLOGY.

LOANDA, or in full São Paulo de Loanda, the capital of the Portuguese settlements in western Africa, and the principal municipality of the Loanda district, one of the three into which Angola is divided, is situated on the mainland in 8° 48' S. lat. and 13° 7' E. long. The beautiful bay, protected from the surf by the long narrow island of pure sand from which the town takes its name, is backed by a line of low sandy cliff which at its southern end sweeps out with a sharp curve and terminates in the bold point crowned by Fort San Miguel. A good part of the town lies on the shore, but the more important buildings—the Government offices, the governor's residence, the palace of the bishop of Angola, and the admirable hospital—are situated on the higher grounds. Most of the European houses are large stone buildings of one story with red tile roofs. The streets, formerly full of loose fine sand, have in many cases been paved. The great defect of the situation is the want of water, which had to be brought for the most part in little boats from the Bengo and the Dande; but the Portuguese Government signed a contract in November 1877, by which a canal 4½ miles long was to be constructed, at a cost of 6,000,000 francs, from Tãdã-bondo (a point 37 miles from the mouth of the Bengo) to the city. Loanda is a busy place; the shops are well supplied with European goods, and large native markets are held in various parts of the town. While the slave trade to Brazil was still in full prosperity, the traffic of the port was of no small account; and after a period of great depression it is now developing in more legitimate directions. There is a regular service of steamers from Lisbon and Liverpool, and in 1877 746 vessels entered and 693 cleared. The population is from 10,000 to 12,000 (Lux gives 18,000 to 20,000), about a third being whites. From 1641 to 1648 Loanda was occupied by the Dutch.

See J. J. Monteiro, *Angola and the River Congo*, London, 1876; and Lux, *Von Loanda nach Kilmindani*, Vienna, 1880.

LOANGO, in the wider signification of the name, is a region on the west coast of southern Africa, which extends from the mouth of the Congo (Zaire) river in 6° S. lat. northwards through about two degrees, with no very definite limit in this direction, unless we adopt the Numbi river which falls into Chilunga Bay in 4° 9' S. lat., and was formerly considered the northern boundary of the Loango kingdom. In a narrower sense it is the country bounded on the S. by the Luemua, and on the N. by the Kuilu,—the district between the Luemua and the Chiloango being known as Chiloango or Little Loango, that between the Chiloango and the Congo as Kakongo and Angoy, and that to the north of the Kuilu as Chilunga. The whole country between 6° and 4° may be described as the lowland portion of the seaward versant of the Serra do Oyatal or Serra Complida, a range running almost parallel with the coast, from which its spurs and underfalls are distant only

30 or 40 miles. It has an irregularly undulating or hilly surface, slowly rising in somewhat indadute terraces, and is traversed from north-east to south-west by a number of considerable streams flowing in well-marked valleys. The coast-line in some stretches is low and swampy, while in others, as along Loango and Kabunda Bays, it presents a series of cliffs 40 to 50 feet high. Behind the region of alluvial deposits which prevails for some distance inland there is a broken belt of Tertiary rocks; but these soon give place to laterite, and beyond the laterite lie the mica-schists, talcs, and gneiss of which the mountains are composed. Of the Loango rivers the best explored is the Kuilu or Quilu. At its mouth, in 4° 29' S. lat., it is a noble stream 1100 feet wide, but the bar has hitherto proved an insuperable obstacle to the entrance of sea-going ships; near the Mayombe factory, which may be reached in fifteen hours from the coast, it begins to take the character of a mountain stream. Its principal affluent is the Nanga. Farther south are the Songolo and the Luemua. Of greater importance as a navigable route towards the interior is the Chiloango or Loango Luse (sometimes erroneously called the Kakongo), which disembores in 5° 12' S. lat. and 12° 6' E. long., and is formed about 15 miles inland by the junction of the Loango and the Lukulu, of which the one separates Loango proper from the Osobo country and the other the Osobo country from Kakongo.

Though a large proportion of the Loango coast region is occupied by primeval forest, with trees rising to a height of 150 and 200 feet, there is considerable variety of scenery—open lagoons, mangrove swamps, scattered clusters of trees, park-like regions, grassy well-watered underwood along the rivers, prairies of tall grass through which no pathway can be driven, and patches of cultivation. Among the more characteristic forms of vegetation are baobabs, silk-cotton trees, screw-pines, and palms—especially *Hyphene guineensis* (a fan-palm), *Raphia* (the wine-palm), and *Elms guineensis* (the oil-palm). Anomalous plants (only a few of which are the *palmdendrons*, an olive-myrtle-like tree, are common in the prairies, the papyrus shoots up to a height of 30 feet along the rivers (particularly the Luemua); the banks are fringed by the cottony *Hibiscus tiliaceus*, ipomoeas, and flagrant jasmains; and the thickets are bound together in one inextricable mass by a growth of many kinds. Among the fruit trees are the mango and the papaya, the orange has been successfully introduced at Vista and Kabunda, and the lemon continues to flourish well up the country. Negro-pepper (a variety of capsicum) and ginger grow wild, the natives, in addition to manioc (their staple sustenance) and bananas, cultivate groundnuts and tobacco; and the planters have European vegetables in their gardens.

The crocodile, the hippopotamus, and several kinds of apes—including the chimpanzee and the rare gorilla—are the most noteworthy larger animals, the birds are various and beautiful—gray parrots, shrikes, fly-catchers, rufous-colored birds, waver birds (seen in large colonies on the palm-trees), ice-birds, from the *Ceryle Sharpei* to the dwarfish *Alcedo cristata*, butterfly-finch, and helmet-birds (*Turdus pygmaeus*), not to mention doves, snipes, and other more familiar types. Snakes are extremely common—*Crotalus rhomboides*, *Atractaspis irregularis*, *Dendroaspis Jansoni*, *Dargyllia palmorum*, &c.; but they give comparatively little trouble. The curious climbing-fish, which frequents the mangroves, the *Pteroporus* or lung-fish, which lies in the mud in a state of lethargy during the dry season, the strange and poisonous *Tetrodon guttifer*, and the herring-like *Pellona africana*, often caught in great shoals—are the more remarkable of the fishes. Oysters are got in abundance from the lagoons, and the Portuguese catch the huge *Cardium arcticum* or heart-crab for table. Fleas and unfortunately also mosquitoes and sandflies are among the most familiar forms of insect life; the bird spider among the rarer. A kind of ant built very striking pent-house or umbrella-shaped nests rising on the tree trunks one above the other like the roofs of a Chinese pagoda.

Well-built and tall (average height of the men 5½ feet, of the women 5½), strongly dolichocephalous and very thick of skull, never black but of various shades of warm brown with the faintest suggestion of purple, the Balotes (as the natives of the Loango coast call themselves) are on the whole very favorable specimens of the Negro stock to which they belong. Their black curly hair never becomes white with age, and gray only in the case of very old people. Baldness is quite unknown, and many of the men wear beards. Physical deformity is extremely rare. Like the west-coast negroes in general the Balotes have a ghastly and grotesque belief in fetichism and witchcraft; and their gongs or priests employ the *casas* (*nkosses*)

ordel with such recklessness that for every grown-up person who dies a natural death three or four, it is estimated, perish by the judgment of the movable powers. A custom which readily catches the eye of the foreigner is that of setting their marriageable maidens forth to view in a little bower specially erected in front of the parents' dwelling—their skins stained red with a peculiar powder. Near Chunchos there is a curious tribe, the Masimari or Umasimari, known to Europeans as Black Jews on account of their strikingly Semitic features. The coast people proper or Bavilli look down on their more inland neighbours as less civilized, and these in their turn pay the same compliment to those beyond—the Bayombe and Bayaka, who occupy the most mountainous woodland on the borders of Loango, being reckoned as genuine savages.

The people are scattered throughout the country in small villages. Nkondo, probably the largest, contains only 360 to 400 huts, though it is the seat of one of the most influential "princes." There is no town or village of Loango,—the place of that name on Loango Bay being a more group of factories. Barr, Boan, or Boli, was the name of the former capital, Loangui or Loongale (visited in 1873 by Bastian) was the burial-place of the ancient kings; and Labu, which is still neutral in war, is that of the "princes." At one time included in the great Congo kingdom, Loango became independent about the close of the 16th century, and was still of considerable importance in the days of Abbé Prévost (1760), though Kakongo and other districts were practically independent. At present there is no central authority in the country, the petty local chiefs are local chiefs and nothing more; but the members of the blood royal are still honoured with special privileges, a large number of nominal titles remain in use, and a common tradition of greatness gives a sort of cohesion to the political conglomerate.

The slave trade was longer maintained in Loango than anywhere else on the West African seaboard; and since its extirpation palm oil and indiarubber have been the main objects of commerce. Perfect freedom of trade prevails, and there are Dutch, Portuguese, German, French, and English factories on the coast and up the rivers. The Portuguese have made considerable efforts to secure territorial supremacy; but they have hitherto failed, partly owing to direct French opposition, partly to the state of the country.

The following are the principal trading posts:—Bamama at the mouth of the Congo, the central post of the Rotterdam African Trading Company, whose comptoirs are scattered along a vast extent of the west coast, Muanda, with one of the best of the native villages; Vista; Kabinda, the natives of which are known as far south as Mossamedes for their enterprise and skill as hunters, sailors, &c.; Landane, the seat of Dutch, French, and Portuguese factories, and of a French mission from the Gaboon; and Chimocho or Tchimochoho (5° 9' 14" S lat., 12° 8' 46" E. long.), the post occupied by the German Exploring Expedition in 1873-74.

See, besides Merolla and Bates (Pittsburg, vol. ii.), Probst, *Statistik von Loango*, Paris, 1768 (also in Pittsburg); Degener, *Reise nach der westlichen Küste von Afrika*, Weimar, 1861; Bastian, *Die deutsche Expedition an der Loango-Küste*, Jena, 1874-76; and *Die Loango-Expedition*, by Dr. Paul Gieseler (1875), Julius Falkenstein (1876), and Fiedler-Löschke (1869).

LOBELIA, L., the typical genus of the tribe *Lobelieae*, of the order *Campanulaceae*, named after Matthias de Lobel, a native of Lille, botanist and physician to James I. It numbers about two hundred species, natives of nearly all the temperate and warmer regions of the world, excepting central and eastern Europe as well as western Asia. For the sections into which the genus is divided, see *Genera Plantarum*, by Bentham and Hooker, vol. ii. p. 561; and for species, De C. *Prod.*, vii. p. 567. Two species are British, *L. Dortmanna*, L., named after Dortmanna, a Dutch druggist, which occurs in gravelly mountain lakes; and *L. urens*, L., which is only found on heaths, &c., near Axminster (see Baxter's *Brit. Gen.*, No. 79). The genus is distinguished from *Campanula* by the irregular corolla and completely united anthers, and by the excessive acidity of the milky juices. The species earliest described and figured appears to be *L. cardinalis*, L., under the name *Trachelium americanum* var. *cardinalis plantae*, "the rich crimson cardinal's flower"; Parkinson (*Paradiisus*, 1629, p. 366) says, "It groweth neere the river of Canada, where the French plantation in America is seated"; De Candolle records it from New England to Carolina (*Prod.*, vii. 382). This species, as well as several others, are in cultivation as ornamental garden plants, e.g., the dwarf blue *L. Erinus*, L., from the Cape, which, with its varieties, forms a familiar bedding plant. *L. splendens*, Willd., and *L. fulgens*, Willd., growing from 2 to 4 feet high, from Mexico, have scarlet flowers; while *L. amena*, Mich., from North America, as

well as *L. siphilitica*, L., and its hybrids, from Virginia, have blue flowers. The last-named was introduced in 1666, according to Paxton (*Bot. Diet.*, p. 840), but is not mentioned by Parkinson. Certain species of *Lobelia* are used medicinally, the chief being *L. inflata*, L., a native of north-eastern America, called "Indian tobacco," as its effects are very similar to those of tobacco; for its localities, &c., see Pickering, *Chron. Hist. of Pl.*, p. 1015. It is expectorant and diaphoretic in small doses, but in full medicinal doses is nauseating and emetic. It is used for spasmodic asthma, and as an adjunct to diuretics. See Bentley and Trimen's *Med. Pl.*, No. 162; *Pharmacographia*, p. 357; and Pereira's *Mat. Med.*, vol. ii. pt. ii. p. 8. For active principles, see *Pharm. Journ.*, vol. x. pp. 270, 456. Another medicinal species is *L. siphilitica*, L., the blue cardinal, of which the root is used by the North American Indians for the purpose implied in the specific name. The value, however, is said to have no foundation in fact (Pearson, *Obs. on var. Art. of Mat. Med.*, p. 70), but see *Amer. Dispens.*, p. 494. A third species is *L. decurvens*, Cav., from near Arequipa in Peru, where the Indians use it as an emetic (*Pharm. Journ.* [1], vol. xiii. p. 14).

LOBO, LEBONIMO (1698-1678), a Jesuit missionary, was born in Lisbon in 1698, and entered the Order of Jesus at the age of sixteen. In 1621 he was ordered to repair as a missionary to India, and in 1622 he arrived at Goa. With the intention of proceeding to Abyssinia as a missionary, he left India in 1624, but after disembarking on the coast of Mombasa, and attempting to reach his destination by land, through the Galla country, was forced to return. Repeating the attempt in the ensuing year, in concert with Mendes, the newly-appointed patriarch of Ethiopia, and eight missionaries, Lobo landed on the coast of the Red Sea, and settled down in Abyssinia as superintendent of the missions in the state of Tigre, travelling about a good deal over the country, and thus obtaining much valuable information on its geography and people. He remained at his post for some years, until death deprived the Catholics of their protector, the emperor Segued. Forced by persecution to leave the kingdom, in 1634 Lobo left, along with his companions, into the hands of the Turks at Massowah, and was sent by them to India to procure a ransom for his imprisoned fellow-missionaries. This object he gained, and at the same time he endeavoured, though without avail, to persuade the Portuguese viceroy to send an armament against Abyssinia. Intent upon accomplishing this cherished project, he embarked for Portugal, and after he had been shipwrecked on the coast of Natal, and captured by pirates, arrived at Lisbon. Neither at this city, however, nor at Madrid and Rome, was any countenance given to Lobo's plan for Christianizing Abyssinia by the aid of arms. He accordingly returned to India in 1640, and was elected rector, and afterwards provincial, of the Jesuits at Goa. After some years he returned to his native city, and died there January 29, 1678.

Lobo wrote an account of his travels in Portuguese, which appears never to have been printed, but is deposited in the monastery of St Roque, Lisbon. Belthier Tellez made large use of the information therein in his *História Geral do Etyopia Alia* (Coimbra, 1660), which is often erroneously attributed to Lobo (see Machado's *Bibliotheca Lusitana*). Lobo's own narrative was translated from a MS. copy into French, under the title of *Voyage Historique de Anseville*, by the Abbé Legrand, Paris, 1728. In 1669 a translation by Sir Peter Wythe of several passages from a MS. account of Lobo's travels was published by the Royal Society, and this was translated into Thénard's *Relation des Voyages* in 1678. An English abridgment of Legrand's edition by Dr Johnson was published in 1786, and reprinted in 1788. In a *Mémoire posthume en réhabilitation des Pères Paez et Jerome Lobo*, Dr C. T. Debs maintains the accuracy of Lobo's statements as to the source of the Arab branch of the Nile against Bruce.

LOBSTER. See CRUSTACEA, and FISHES, vol. ix. p. 265.

LOCK—not being a canal lock—means the fastening of a door, or box, or drawer, which requires a key, or else some secret contrivance or manipulation, to open it. It is generally fixed to the door, but it may also be loose, and then it is called a padlock, which is internally like other locks, but externally has a half link or bow turning on a hinge at one end, while the other, after being put through a chain or staple on the door, enters the lock and is fastened by the bolt therein. The bolt may be moved by the key, or may close by a spring, but require a key to open it, as in the case of handcuffs, which are a pair of padlocks of this kind united by a short chain. A common door lock also comprises a spring latch which opens by a handle, and sometimes a small bolt held by friction either shut or open, which is moved by a smaller handle inside the room only, but neither of these is the lock proper, any more than a hook or a button, or a common lifting latch. Therefore, omitting them, a lock is as defined above.

The earliest lock of which the construction is known is the Egyptian, which was used four thousand years ago. In fig. 1, *aa* is the body of the lock, *bb* the bolt, and *cc* the key.

The three pins *p, p, p* drop into three holes in the bolt when it is pushed in, and so hold it fast, and they are raised again by putting in the key through the large hole in the bolt and raising it a little, so that the pins in the key push the locking pins up out of the way of the bolt.

The security of this is very small, as it is easy enough to find the places of the pins by pushing in a bit of wood covered with clay or tallow, on which the holes will mark themselves, and the depth can easily be got by trial.

Mr Chubb, the well-known lock-maker, used to show a wooden Chinese lock very superior to the Egyptian, and, in fact, founded on exactly the same principle as the Bramah lock, which long enjoyed the reputation of being the most secure lock ever invented, for it has sliders or tumblers of different lengths, and cannot be opened unless they are all raised to the proper heights, and no higher.

Until about a century ago no lock so good as this was known in England. The locks then in use (fig. 2) were nothing better than a mere bolt, held in its place, either shut or open, by a spring *b*, which pressed it down, and so held it at either one end or the other of the convex notch *aa*, and the only impediment to opening it was the wards which the key had to pass before it could turn in the keyhole. But it was always



Fig. 3



Fig. 4

possible to find the shape of the wards by merely putting in a blank key covered with wax, and pressing it against them, and when this had been done, it was by no means necessary to cut out the key into the complicated form of

the wards (such as fig. 3), because no part of that key does any work except the edge *bc* farthest from the pipe *a*, and so a key of the form fig. 4 will do just as well, and a small collection of skeleton keys, as they are called, of a few different patterns, were all the stock in trade that a lock-picker required.

The common single-tumbler lock (fig. 5) was rather better than this, as it requires two operations instead of one to open it. The tumbler *at* turns on a pivot at *t*, and has a square pin at *a*, which drops into a notch in the bolt *bb*, when it is either quite open or quite shut, and the tumbler must be lifted by the key before the bolt can be moved again. But this also is very easy, unless the lock is so made that the tumbler will go into another notch in the bolt if it is lifted too high, as in the lock we shall now describe, which was the foundation of all the modern improvements in lock-making.

Barron's Lock.—This was the first lock with several tumblers. It was patented in 1778. Fig. 6 is a front view, and fig. 7 a horizontal section. First consider it with reference to one tumbler *at* only. Unless the square pin *a* is lifted by the key to the proper height, and no higher, the bolt cannot move, and that alone adds very considerably to the difficulty of picking, except by a method not discovered for many years after.

But Barron added another tumbler, and unless both were raised at once to the proper height, and no higher, the lock could not be opened. The face, or working edge, of the key of a many-tumbled lock assumes this form (fig. 8), the steps corresponding to the different heights to which the tumblers have to be raised, and one of them acting on the bolt, and they may have a much wider range of difference than in this figure.

The key here drawn is also one with the wards of such a shape that no skeleton except itself can pass them. The form, however, can be got in the usual way by a wax impression; and as it weakens the key very much, and is expensive to cut, it is not often used.

Bramah's Lock.—The next lock of any importance was the celebrated one patented ten years after Barron's, by Joseph Bramah (see BRAMAH). In figs. 9 and 10 *aaaa* is the outer barrel of the lock, which is screwed to, or cast with, the plate, *cccc* is a cylinder, or inner barrel, turning within the other. It is shown sepa-

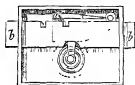


Fig. 5

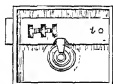


Fig. 6



Fig. 7



Fig. 8

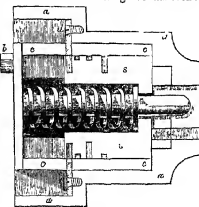


Fig. 9

rately at fig 11, and fig 12 is a cross section of it, the black ring being the keyhole, and the light spot in the

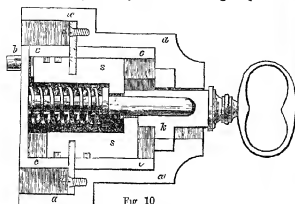


Fig 10

middle the drill-pin, which goes into the key. The short pin d in figs. 9, 10, 11 is set in the end of the cylinder,



Fig 11



Fig 12

near its edge; and, when the cylinder turns round, that pin shoots or draws the bolt, by acting in a slit of the form shown in fig 13. The security of the lock depends upon a number of sliders, a, s , of which the shape is shown in fig 14, and the cross section in fig 12. They are made of plates of steel doubled, and sprung open a little, so as to make them move with a little friction in the slits of the cylinder or revolving barrel in which they lie, and are pressed up against the cap of the lock by a spiral spring. They are shown so pressed up in fig 9, and pressed down by the key in fig 10. There is a deep groove cut round the barrel, and in each of the sliders there is a deep notch which can be pushed down to that place in the barrel by a key slit to the proper depth; and it is evident that when all the sliders are pushed down to that position the barrel will present the appearance of having no sliders on it. A steel plate (fig 15), made in two pieces in order to get it on, embraces the barrel at the place where the groove is, having notches in it corresponding to the sliders, and is fixed to the body of the lock by two screws marked d, d in figs. 9, 10, and 15. When the sliders are pushed up by the spring they fill the notches in the plate, and prevent the barrel from turning, but when they are pushed down by the key the notches in the sliders all lie in the plane of the plate, and so the barrel can turn with the key, and the pin d in the end of it drives the bolt as before described. The key has a bit, k , sticking out from the pipe, the use of which is to fix the depth to which it is to be pushed in, and then, as the bit slips under the cup of the lock, it keeps the key at the same depth while it is being turned.

This was the construction of the lock for a good many years, and Bramah pronounced it in that state "not to be within the range of art to produce a key, or other instrument, by which a lock on this principle can be opened." It was found, however, long before the defeat

of the improved challenge Bramah lock by Mr Hobbs in 1851, that the inventor had made the common mistake of pronouncing that to be impossible which he only did not see how to do himself. As it has been generally supposed that what is called the tentative method of lock-picking was unknown in England before it came over from America in the year of the Exhibition of 1851, we must remind our readers that it was described in the 7th edition of this work fifty years ago, though the lock-picking fraternity were not of sufficiently literary habits to make themselves acquainted with it. Mr Hobbs, it is true, carried the process further than had been supposed possible before, but all the Barron and Chubb and other many-tumblered locks, which were supposed impregnable, might long ago have been opened by anybody who had paid attention to the method by which the Bramah locks were known to have been picked some seventy years ago, before the introduction of the false notches designed in 1817 by Mr Russell, then one of Mr Bramah's workmen. If you apply backward pressure to the bolt of a tumbler lock when locked, or twisting pressure to the barrel of a Bramah lock, first pressing down the spiral spring, there will be a greater pressure felt against some of the tumblers or sliders than against others, in consequence of inevitable inequalities of workmanship; and if you keep the pressure up, and gently move any of the tumblers or sliders on which the pressure is felt, you will at last get it to some point where it feels loose. That may or may not be the exact place to which the key ought to lift it, but as soon as you feel it loose leave it alone, it will not fall again, as the friction is sufficient to prevent it, and, if necessary, you may fix it there by a proper instrument, or measure the depth and keep the measure till you begin again. Then try another tumbler which feels tight, and raise it till it also feels loose. And if you go on in that way, always leaving the loose tumblers alone, and raising the one which feels tight, they will at last all be got into the position of complete freedom, *i. e.*, to the place where the stump of the bolt can pass them. The operation is just the same in principle in the Bramah lock and in tumbler locks; only, as all the sliders are acted on by one spring in the Bramah as now made, you need only just push down that spring, and hold it there, and then the sliders may be moved freely either way by means of a hook or a small pair of self acting forceps to pull them up if they accidentally get pushed too far. At first each slider had a separate spring.

But if the sliders have some false notches in them not so deep as the true ones (see fig 14), and the corners of

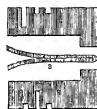


Fig 11

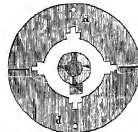


Fig 15

the notches in the plate d, d are cut out a little (as in fig 15), then you might by trial get all the sliders into such a position that the barrel could turn a very little, but no more; and when it is turned that little, you cannot push the sliders any further, and so (as was long supposed) the tentative process is defeated, and undoubtedly it is made much more troublesome, but it only requires more time and patience. You can still feel that the pressure is greater against some one or more of the tumblers or sliders than against others, and, whatever that is the case,

you know that it must be at a false notch, and not the true one, for a true one gives no pressure at all. Proceeding in this way, Mr Hobbs opened the challenge lock with eighteen sliders, or guards, which had hung in Messrs Bramah's window for many years, in nineteen hours, and would have done it sooner, but that one of his instruments broke in the lock. He afterwards repeated the operation three times within the hour, in the presence of the arbitrators; and a more recent one with eight sliders he opened in four minutes, by means of an instrument which is equivalent to a Bramah key with adjustable slits, which are set to the sliders as the operation of feeling them and getting their depths goes on. It is, moreover, to be remembered that thieves do not always confine themselves to the conditions of a challenge, in which force and injury to the lock are of course prohibited; and, if a lock can be easily opened by tearing out its entrails, it is of very little use to say that it would have defied all the arts of polite lock-picking. In this respect the Bramah lock is singularly deficient; for if the exposed cap or nozzle of the keyhole is cut off, as it easily may be, or if the hole is widened out by a centre-bit, the sliders can be all pulled out, and there is an end of the lock.

Inside and Outside Locks.—Locks for drawers, closets, iron chests, and the like are only required to lock on one side, and their keys are therefore generally made with a pipe, which slips on to a pin in the lock called the drill-pin, and turns on it. Doors which have to be locked sometimes on one side and sometimes on the other cannot have their keys made in this way, the key is solid, and its plug or stem, being thicker than the flat part or web, acts as an axis fitting into the upper part of the keyhole, though that hole does not completely enclose it. All keys for these inside and outside locks must be symmetrical, or alike on each side of a line through their middle, in order to fit the lock either way, which limits the variety of the tumblers in the case of many-tumbled locks. A Bramah lock, to open on both sides, must be made double, with one set of sliders to push in from one side of the door, and the other set from the other side, and, consequently, they are very seldom used for this purpose. It may be convenient to observe that when we use the term Bramah lock we mean a lock of that construction, for, the patent having long ago expired, such locks may be made by anybody, only Bramah's name must not be used. Messrs Morian's locks are the same as Bramah's, except that they make the number of sliders odd, while Messrs Bramah make it even.

Letter Locks.—At one time it used to be supposed that locks which could only be opened by setting a number of rings or disks to a particular combination of letters could not possibly be opened by anybody who was not in possession of the secret; and hence they were also called puzzle-locks. At first they were made with a fixed combination, which could not be changed. Afterwards the rings were made double, the inner one having the notch in it which the bolt had to pass, and the outer one capable of being fitted on to the inner in any position, by unscrewing some part of the lock, so that you might set them to any combination desired. This was the first instance of a changeable lock, of which we shall have more to say further on. But it was afterwards found that these puzzle locks have just the same vulnerable point as all our locks had until lately, viz., that the pressure of the bolt can be felt on some of the rings more than on the others, and Mr Hobbs says emphatically, in the *Elementary Treatise on Locks*, "wherever that is the case, that lock can be picked." Apart from this defect, these locks have very much gone out of use on account of their being troublesome to handle, and perhaps also from the risk of forgetting the combination to which the lock was set last, if it has been left for some

time, and therefore we do not think it necessary to go farther into the details of their construction.

Chubb's Locks.—Of the multitude of locks which have been made on the many-tumbler principle invented by Barron, none enjoyed so much celebrity before Hobbs's as Chubb's. This was partly due to superior workmanship and use of more tumblers than usual, and perhaps still more to the inventor having had the good fortune to hit upon the name "detector" for a certain part of the machinery, which, besides adding to the security against any mode of picking then known, also captivated the public with the idea of discovering if anybody had been tampering with the lock, though the operator might depart in ignorance that he had left any trace of his attempt behind him. It is remarkable that the detector was not even then a new invention, for a lock exactly the same in principle, but slightly different in arrangement, had been previously made by a Mr Ruxton, and is described in Price's treatise on *Locks and Keys*, &c., 1856. In the same way false notches were used in Sturt's tumbler lock above thirty years before they were reinvented, by Chubb and others, with the idea of defeating the tentative method of picking by them. In all lever or tumbler locks there is a square pin B, called the stump, rivetted to the bolt, which has to clear the passage in the tumblers called the gating. The original form of Chubb's detector is shown in fig. 16 by

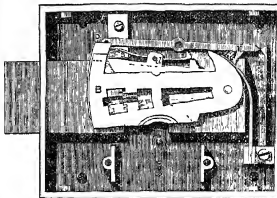


Fig 16

the lever DT, which turns on a pin in the middle, and is acted upon at its end T by a spring S, which will evidently allow some play to the lever on either side of the corner X, but the moment it is pushed past that point the spring will carry it further in the same direction, like what is called in clock-work a jumper. In its proper position that end always remains above the tuning-point; but, if any one of the tumblers is raised too high, the other end D of the detector, which reaches over all the tumblers, is lifted so far that the end T is sent down below the corner, and the tooth T then falls into a notch in the bolt, and so prevents it from being drawn back, even though all the tumblers are raised properly by the right key, which at once reveals that somebody has been trying to pick the lock. The way to open it then is to turn the key the other way, as if to overlock the bolt; you observe a short piece of gating near the end of the tumblers, to allow the bolt to advance just far enough to push the tooth of the detector up again by means of its inclination there, and then the lock can be opened as usual. In some more recent locks the tumbler is made in another form. The back tumbler, or the one which has to be raised highest, has a pin d reaching over all the others, and if any of them are overlifted that back tumbler is also, and then a square corner k in it gets past the end of the detector spring k', and is held up. It is set right by overlocking the bolt as before, the bolt itself raising the end k of the spring, and

letting the tumbler fall. This form of detector is, however, inferior to the other, as it informs the picker what he has done, by the back tumbler itself being held up, which he can feel directly.

But since Mr Hobbs's mode of picking locks became known all these detectors have become useless. Some persons have even gone so far as to say that the detector may be made a guide to picking. Whether this be so or not, the detector does not act unless some of the tumblers are raised too high, which they never are by a skillful operator on this plan, nor does it act (even if thrown by accident) against picking backwards, or feeling the way to shoot the bolt a little further, as if to free the detector, and in this way the measure of the key can be taken without any hindrance from the detector. Before 1851 tumbler locks were seldom made with false notches, except Strutt's, in which the tumblers were in the form of quadrants, with a very large angular motion, and a number of short or false notches and one deep one. But after that year Chubb and other makers of tumbler locks adopted false notches, together with revolving curtains, which cover the straight part of the keyhole as soon as the key is turned, and barrels going down from the back of the curtain to prevent a false key or pick from turning without turning the curtain, other obstacles were added, of which the object is in all cases to prevent the maintaining of pressure of the stump upon the tumblers at the same time that the tumblers themselves are moved, or, as Mr Hobbs called it, tickled, by some other instrument. These provisions undoubtedly make the locks more difficult to pick, but it is by no means safe to assume that a lock will never be picked, merely because it would take a first-rate hand a long time to do it or gradually make his key.

Hobbs's Lock.—The invention which most directly meets the defect of all previous locks is Mr Hobbs's "movable stump," which is not rivetted into the bolt as usual, but is set on the end *b* of a bent lever *abc* (fig. 17) which lies in a hollow of the bolt *A* behind it, turning on a pivot in the bolt itself, and kept steady by a small friction-spring *e*. The stump comes through a hole in the bolt large enough to let it have a little play, and the long end *a* of the lever stands just above the edge of a square pin *d*, which is fixed in the back plate of the lock.



Fig. 17.

When the lock is locked, if you push the bolt back, you produce no sensible pressure on the tumblers, but only just enough to turn this protector lever, as Mr Hobbs calls it, on its pivot *c*, and so bring down its end *a* in front of the square pin, and then the bolt can no more be pushed back than when held by Chubb's detector. The protector is set free again by merely pushing the bolt forward with the key, without reference to the tumblers. It was found, however, that in this state the protector could be prevented from acting by a method used by the inventor himself for another purpose, viz, pushing a piece of watch-spring through the keyhole, and up behind the bolt, so as to reach the protector at *a*, and keep it up while you push the bolt back, or, again, by pushing up the watch-spring between any two of the tumblers, and holding the end *b* of the protector with it, so as to press the stump against the tumblers. Both these devices, however, are prevented now by letting in a feather FF in a groove between the bolt and the back of the lock, which no watch-spring can pass, and also bringing a piece of the feather forward through the front gating of the tumblers just under the stump. In this form the lock is safe against any mode of picking at present known, unless the keyhole happens to be large enough to admit the inspecting method, which is this. A person in-

tending to pick the lock goes beforehand and smokes the bollocks, or lower edges of the tumblers, through the keyhole. When the key comes, it wipes off the black on each tumbler, according to the length of the bit which raises it, and then, when the picker returns, he throws a strong light into the keyhole, and, by means of a narrow reflector put into it, reads off, as it were, the length of bit required to raise each tumbler to the proper height. This operation may sound impossible, but it is an established method of lock-picking in America. It requires a largish keyhole, however, and it may be prevented by any kind of revolving cylinder which will conceal the view of the tumblers while the keyhole is open. The inspecting method might also be frustrated by making the acting part of the bollocks of all the tumblers no longer than would be reached by the shortest bit in the key. In that case, the long bits would not begin to act at their points, but on their sides, and would leave no measure of their length upon the tumblers.

A multitude of other many-tumbler locks acted on by springs, and with various kinds of detectors and revolving curtains, all more or less upon the same principles, may be seen described in Price's book above-mentioned, but we are not aware that any of them have ever come into general use, or are superior to Chubb's or equal to Hobbs's protector locks. There is another group of locks which involve fanciful and thick ugly keys, and for that or other reasons have not got much beyond patents and exhibitions. "Revolving curtains" have been proved to be less serious impediments to picking than they would seem, inasmuch as they must leave room for an instrument no thicker than the key itself to turn. The only kind of curtain that is not open to this objection must be one that absolutely prevents any touching of the bolt while any instrument at all is within the lock, and projects at all outside. Mr Hobbs accomplished that by the odd-looking contrivance of a key consisting only of its web, or flat or acting part, which is pushed into the lock, and then carried round by a fixed handle in another place, which closes the keyhole until it has come round again and delivered the key-web ready to be taken out by a proper hook. But this was too troublesome for common use. The same object is effected in another way by Sir E. Beckett's lock, which we shall presently describe.

Tucker's Locks.—There have been several locks on the disk principle invented in succession by Mr Tucker of Fleet Street, London, the first two of which had revolving disks, and in the last and more simple one, patented in 1855, though the disks no longer revolve, they slide between fixed plates without springs, and do not turn on a pin like common tumblers, and will stand in differently any where. It will be sufficient to describe the last of these inventions, as Mr Tucker himself states it to possess all the elements of security of the former ones, with the advantages of being much cheaper, because more simple in construction. In fig. 18 TT is one of the sliders, which are separated by thin fixed plates, and slide upon the guide-pins at TT, and have also friction-springs X pressing on them to keep

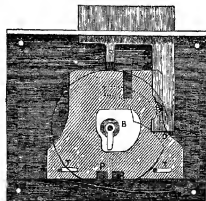


Fig. 18

sem steady S is the bolt stump, which can only enter I, the gating of the tumblers, when they are pushed the proper distance towards the left, which the key will do as soon as it turns towards the left, in the usual way of unlocking. But something else still prevents the bolt from sliding, and that is the flat curtain C, which turns with the key, and has also a barrel B, as in several of the others we have spoken of. This curtain prevents the stump from being pressed against the tumblers, being just big enough to keep it from touching them until it has turned nearly three quarters round, when the pin S, which stands up on the stump, can enter the opening D in the curtain shown by a dotted line in the drawing, to prevent confusion. But by the time the curtain has got so far round, any instrument in the keyhole would be prevented by the barrel from reaching the tumblers so as to push them back and feel the presence of the stump, at least so the inventor asserts, and we do not venture to contradict him, but it must be remembered that no revolving curtain and barrel have yet been able to prevent the instruments of the American lock-pickers from reaching and moving the tumblers at the same time that the barrel is being pressed the other way in order to keep up pressure on the bolt.

We have not yet explained how the bolt in this lock is drawn back when the curtain has got into the proper position for it. It is not done by the last bit in the key acting directly on the bolt as usual, but by a bit P fixed on the curtain itself, which acts upon the notch B in the bolt, as the key usually does. And thus same bit P performs another function in locking, viz., shooting all the tumblers into the position here shown by striking against a pin which is set in the bottom one, and comes up to the curtain, and so carries all the others with it by means of the square notch which is cut in all of them, except the one which has the pin in it. It must be observed that the curtain does not lie close upon the tumblers, but there is the thickness of the bolt, or of the bit P, between them. A spring locks into the curtain and prevents it from being retracted, except when this spring is pressed down by putting the key into the keyhole. One object of making the curtain, and not the key, to lock and unlock the bolt is that you guard against the risk of what is called short-locking, i.e., ending the bolt in any common tumbler-lock not quite far enough for the tumblers to drop. There are means by which a person intending afterwards to pick a lock might cause it to lock short, if he had previous access to it, or possession of the key, at least as locks are generally made, and then, of course, he has only to pull the bolt back, the tumblers having never fallen. Moreover, this arrangement of Tucker's lock allows it to be locked by any key that will turn in the keyhole, though it cannot be unlocked by any but the true key, or one which will move all the tumblers to the right place for the stump to enter them. If Tucker has also applied the curtain in his padlocks in such a way that the shackle has a tail reaching inwards and resting against the curtain at all times, except when it is in the proper position for opening, i.e., when this tail is opposite to a segment cut out of the curtain corresponding to the opening D in the lock just now described, but much larger. The object of this is to obtain greater strength than usual to resist all attempts to force the shackle open. The cheapness of these locks is due to the circumstance that all the principal parts can be stamped out of sheet brass, the curtain alone being cast with the barrel and bit on it, and its face turned, which is a cheaper operation than filing. In this respect it approaches to Mr Hobbs's style of lock-making; only he has carried the stamping and machine-finishing system much further; indeed, it is hardly exaggerating to say that he has abolished the use of the file, and left nothing to hand labour except the mere fitting

of the pieces together, and putting the tumblers in the right position to have the gating cut according to the key.

Nettlefold's Bolt.—We have already alluded to padlocks, and we shall do so no farther, because they are generally of exactly the same internal construction as other locks of the same maker. And, for the same reason, it is unnecessary to describe the various modifications of the fastening part of locks to adapt them to peculiar uses or positions, but there is one which does seem to be worth a short notice, viz., an invention of Mr Nettlefold, patented in 1839, for making the bolt hook into the striking plate, against which it locks. Fig 19 will explain the nature of the contrivance at once. We have inserted no tumblers, because it may be used with one kind of lock as well as another. It is convenient for writing-desks, sliding cupboards, and even for drawers, which can often be prized open by merely putting in a screwdriver above the lock, and forcing up the piece over

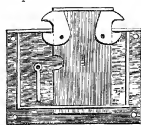


Fig 19

it just enough to let the bolt, which is generally short, pass. There are other ways of doing the same thing, such as making the bolt itself hooked, and giving it two motions, first vertical, to shoot it out, and then horizontal, to hook it into the striking plate, and some Bramah locks are made with a kind of annular bolt, which forms a rim to the cylinder, with a segment cut off in one place to let the striking plate come down, which is then taken hold of by the other part of the ring as it revolves. Bramah locks of portfolios, and articles of that kind, are usually made in this way, which is very cheap and simple.

Master-Keys.—It is often convenient to have a set of locks so arranged that the key of one will open none of the others, and yet the owner of the whole may have one master-key that will open them all. In the old locks with fixed wards this was done by making the wards of a slightly different form, and yet such that one skeleton key will pass them all, just as the skeleton-key in fig. 4 will serve for the warded key of fig. 3, and a multitude of others. In locks with sliders or tumblers, the way is to make one tumbler in each lock with a wider gating, so as not to require lifting so high as it does in the other locks of the set; then the key of that lock will raise that tumbler in that lock high enough to clear the stump, and yet the master-key, which has a longer bit in that place, will not raise it too high, because the gating is wide enough for both; but the special key of that lock will not open any other of the set which has not the same tumbler widened in the gating. Mr Chubb, many years ago, made a set of locks for the Westminster Bridewell, with keys for the different grades of officers. The owner of the head key can stop out any of the under keys, and any attempt is made to pick any lock, and the detector is thrown, it cannot be released by any of the subordinate keys, though they can open the lock in its normal state, and consequently the governor must be acquainted with it. There are a variety of other forms of many-tumbler locks, but none of them involve any novelty in principle, and they are all capable of being dealt with in the same way, and therefore we shall at once pass on to another class of locks, viz., those which shut of themselves, and are called—

Spring or Latch Locks.—These locks we chiefly notice because they require a particular provision to make them in the smallest degree secure, and are, nevertheless, often left without it, by way of saving a shilling or two in their price, and multitudes of street-door robberies are committed in consequence. The former of these two names is

generally used for a lock which shuts of itself on a box or drawer; or articles of that kind, and the latter for street or room-door locks which shut of themselves, and open with a handle on the inside, but only with a key on the outside. In the simplest and cheapest form of these locks there is no pretence of any security except a few fixed wards, which the key has to pass; and, as before explained, that is no security at all against anybody with the smallest dexterity, and with a serious intention of opening the lock. Next to them, or rather below them, pretending to be what they are not, come the locks which lock a certain distance themselves by means of a spring, but can be locked further by the key, and have tumblers, but no fixed wards (which a good tumbler-lock does not require). But though this kind of lock cannot be opened when it is thus double locked, except by the key, or some efficient mode of picking, yet when they are only self-locked the tumblers are of no more use than if they did not exist, and the lock can be opened by any bit of bent wire that will go into the keyhole. It should be remarked, however, that the Bramah lock is just as secure as usual when used for a spring or latch lock, because the key cannot turn at all without pushing in the sliders properly. But in this, as in all latch-locks, it is very unsafe to have a handle which pulls back, as it can easily be reached by a wire put through a hole in the door; the handle should always be made to turn, like a common room-door handle.

There are two ways in which spring-locks with tumblers are made as safe as the same lock with an ordinary bolt. One is to make a click or catch fall into the bolt when it is drawn back, and not to make the tumblers to fall when the bolt is drawn back, in the shutting of the door this catch is pushed back by some knob projecting for the purpose, and then the tumblers fall and hold it fast. Prison locks are made in that way. But this will not do for a latch-lock which is intended to open by a handle on one side of the door. For that purpose the proper plan is that which is now adopted in all good latch and spring locks, not to let the key act directly on the bolt, which has no stump, but on the false bolt which lies on the top of the real one, and has the stump fixed in it. When the real bolt is shut by the spring it carries the false one with it, and that is then locked by the tumblers. But the real bolt can be pushed back by the door shutting, or pulled back by the handle, without moving the false bolt, though it cannot be reached through the keyhole. In buying a lock, the test of this is to see whether the stump moves as you push or pull the bolt back. If it does the lock is good for nothing, unless it is on some other peculiar construction.

Latches and Latch Locks.—The latter of these, so called by Mr. Chubb, is substantially on the principle just now described, and so is Hobbs's and Hart's latch lock, which also has the protector stump, and therefore is as unpickable as their other locks, provided neither the handle nor the bolt can be got at. Chubb's latch (not his latch-lock) consists only of four tumblers, which come out and form the bolt, and fit between a sort of mouth in the striking-plate on the door post, and have all to be lifted to the same height by the key; but that can easily be picked by the tentative method, though it might delay a common street thief for an inconvenient time.

Spring Curtain.—All latch locks for street doors are liable to stick fast through dirt getting between the tumblers, especially in a smoky town. They will keep clean much longer if the keyhole is protected by Sir E. Beckett's self-acting spring curtain, which can be added to any lock which is worth it. It consists only of a small thin steel plate, sliding on the key-pin, and another pin just below the keyhole to guide it, with a slight spring

behind, for which there is room in any latch lock with a sliding locking plate over the bolt. They are not patented, and the cost is quite insignificant, and it is odd they are not more commonly insisted on by purchasers.

Safe Locks with Small Keys.—In all the locks we have yet mentioned the bolt is acted on by the key, even though the key may not touch it, the key must therefore be strong enough to move the bolt besides lifting the tumblers, or whatever is substituted for them, and this makes the key for a large lock too large and heavy to be conveniently carried in the pocket, and a bunch of such keys impossible. To get over this difficulty, most of the makers of iron safes have adopted the plan (we do not know by whom invented) of shooting a large bolt, or a number of bolts, by means of a handle, and then a small lock with a small key locks into one of them, and thus fastens them all. The security then depends upon the impregnability of the small lock against fraudulent picking or forcible eversion. There are certain thieves' instruments by which a force sufficient to tear open the inside of a lock can be inserted through a keyhole of the common size. This, however, is now defeated by cutting out a piece of the back plate, and then sawing it on again with only a few small screws, and so that alone gives way under any bursting pressure, whether from the instrument called the jack-in-the-box, or from gunpowder, which is another of the thieves' methods for cutting the knot which they cannot untie. If the small lock, therefore, cannot be picked, or forced, this mode of locking the bolts of a large door is quite safe, and you have the advantage of a very powerful lock with nothing to carry in your pocket larger than a small desk key.

Sir E. Beckett's Lock.—A lock was invented by Sir Edmund Beckett (formerly Demson) in 1852, but not patented, which combines the advantages of large and strong works with a keyhole so narrow that no instrument strong enough to injure the lock could be got in, nor a reflector to observe the bellies of the tumblers, and the bolt is not only shot by turning the handle, but locked besides, without using any key at all. This lock enjoys the distinction of being the only one of English invention which was pronounced secure against any known method of picking, by Messrs Hobbs and Tomlinson, in the treatise before referred to.

In fig. 20 are shown the tumblers T, turning on a pin at or near the middle of their length, so as to be really

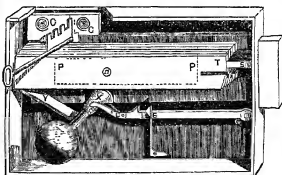


Fig. 20.

balanced, though in small locks this is unnecessary. Between every two adjacent tumblers, and between the bolt and the tumbler next to it, there is a thin steel plate, which occupies the position shown by the dotted lines PP. These plates have one edge lying against the upper side of the lock, so that they cannot turn at all on the tumbler-pin, which goes through them quite loosely. One or two of the plates should be bent a little to make them act as friction springs on the tumblers when the cap of the lock

is on, so that they will stand indifferently in any position. In the figure they are drawn all pressed down, so as to prevent the stump S from entering the gating, and this has been done by the long tail Y of the handle, which, it is easy to see, will raise the left end of the tumblers, and depress the right, after the fan-tail piece X of the handle has shut the bolt. After the tumblers have been raised to the proper height by turning the key half round (where it may be stopped by the plates P, P), the stump can enter the gating, and the bolt can be drawn back by the handle, the tail Y then doing nothing. So far as we have yet gone, the lock would possess no greater security than any other many-tumbled lock, but there is a steel curtain CC, which does not revolve as usual, but slides on two pins set in the back of the lock, and is pressed up against the front plate by two spiral springs, so as to close the keyhole completely, except when it is pressed in. From the back of the curtain there goes a kind of square plug (shown in section at fig. 21), which can be pushed through

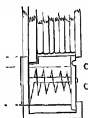


Fig. 21

a hole in the back plate, and has a notch in it just in the plane of the bolt, and the bolt itself has a corner there, in this way, when the curtain is up, the bolt can be drawn back through the notch in the curtain plug, but when the plug is pushed in, ever so little the bolt cannot be drawn back, because its corner cannot pass the curtain plug, and in this position the stump cannot be made to touch the tumblers, except one of them, which is made a little longer than the rest (as shown at T in fig. 20), in order to keep the bolt steady. It is evident then that as soon as the curtain is pushed in, to admit any instrument whatever, the bolt is held fast, and it becomes impossible to put any pressure of the stump upon the tumblers, in other words, the tentative mode of picking is impossible. In small locks the curtain has no plug, but merely works against the edge of a second stump of the bolt, which can only pass when the curtain is up, and it slides on the drill-pin and another pin below it.

The security of the lock is farther increased by the addition (DEG) of what may be called a detector, as it does detect if the bolt has not been shot far enough by the person who locked it, and, what is of more consequence, prevents it from being opened in that state. It turns on a hinge or pin at G, and is held up or down by a jumper-spring at E, as in Chubb's first detector. In fig. 20 it is shown as held down, or out of the way of the bolt, but, as the handle turns back again and draws back the bolt, the pin below X raises the detector a little, and then the spring is ready to throw its tooth into the notch in the bolt as soon as it is shot only about half-way. In that state the bolt cannot be drawn back without turning the handle far enough for the fan-tail X to send the detector down again below the corner of the spring, and by doing that you will also have locked all the tumblers, and so made the lock fast until the key comes to open it. And it is to be observed that the curtain cannot be pushed in until the bolt is fully shot, so that no exploration of the lock can take place while it is open, or even partially open. By adding a spring catch under the curtain, to be freed by one of the tumblers when it is fully locked, it may be arranged, if required, that the curtain could not be pushed in, not only until the bolt is shot, but until the tumblers are locked also.

The following, therefore, are the advantages of this lock. 1 A very large lock, with all its parts strong, only requires a very small key, not weighing above a quarter of an ounce. 2 No key is required to lock it, and you cannot leave the key in the lock (a fruitful source of mischief), and yet it is free from the inconvenience of spring-locks, which sometimes shut themselves when not intended,

and moreover, when large, require large and strong keys to open them. 3 It cannot get out of order from the usual causes of the tumblers sticking together, or tumbler-springs breaking, because there are none, and the tumblers do not touch each other, but the friction-plates between them. 4 The keyhole being always quite closed by the curtain, except while the key is in, the lock is protected from dirt and from the effects of a damp or smoky atmosphere, which injures other locks. 5 The smallness of the keyhole prevents the insertion of any instrument strong enough to force the lock, and also prevents inspection. 6 It is sanctioned by the highest authority to be secure against any known mode of picking. 7 It requires no delivery of construction of high finish in any of the parts, and the moving parts are few—in fact, the whole of them together are fewer than the number of springs alone in the great American lock of Day & Newell. 8 It is free from the innumerable of a patent, the inventor being one of those who agree with the opinion of the jury on philosophical instruments in the exhibition of 1851, and with many of the first engineers and most scientific men, that "patents are a great obstruction to the progress of science," and waste, on the whole, more money than they gain for real inventors.

Changeable Key Locks

Any lock with many tumblers may be changed by taking it off and transposing any two or more of the tumblers, but it will then want a different key, and the process is too troublesome to be resorted to except when there is reason to apprehend that the original key has fallen into bad hands, or had a copy taken of it. A lock which can be locked by a great number of keys, but can only be opened by the one which locked it last, is evidently an immense addition to security. Those keys may either be all distinct, or there may be a great number of different bolts, or stopped parts, fitting to a common handle, or each bit or step may be separate, and all screwed together into the key frame as shown in fig. 22.

Fig. 22

In a lock with a tumbler, each movable to six distinct heights, if you have only a loose bits of the six different heights you may compose $1 \times 2 \times 3 \times 4 \times 5 \times 6$ keys, which for nine tumblers = 362,880. But if you also have six bits for each place in the web, the possible number of different keys is very much greater, viz. 6^6 ; for every possible length of bit in each place may be used with every possible length in every other place. If so is 7 and 8, as they are in the locks we are going to describe next, each lock may have very nearly sixty million different keys, or key-webs capable of fitting into one shank or handle, and the chances are so many against a lock-picker hitting on the right one.

The first changeable key lock known in England was Day & Newell's "Pneumatic" (inspection-defying) lock, which was brought from America by Mr Hobbs at the time of the 1851 Exhibition, and has been largely used since for banks and other safe. It was fully described in the last edition of this work, and in the books above referred to, but in this place we will describe instead a much simpler form of it, since introduced by Mr Hart of the firm of

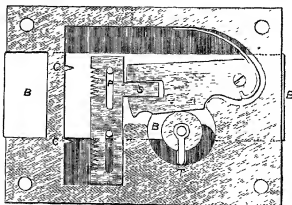


Fig. 23.

Hobbs, Hart, & Co. The principle of all changeable key locks is that instead of a single stump fixed to the bolt, there are as many stumps as tumblers, and each one is the projecting part S of a slider PPS which can ride up and down on two pins PP in the bolt, and will stay at any height where it is left when the bolt B is shot. Fig. 23 shows the lock open and the slider stumps lying in the jaws or gating of the tumblers ready to be raised to

any height. In fig. 24 the bolt has been shot, and the sliders coated forward with it. Just before they leave the tumblers they are received by the two small teeth C, O on the frame of the lock, holding each slider at whatever height it may then be, these teeth go right down to the thin part of the bolt or as deep as the sum of all the tumblers and sliders. In this figure the foremost slider is received at its third notch, and each of those below it at some other notch. The tumblers having fallen behind all the stops, the sliders cannot move until the tumblers are all raised again to the various heights at which they left them, which is possible only by the key that locked the lock. These locks have

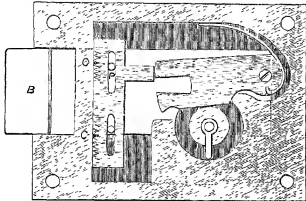


Fig. 24

Hobbs's protector behind the bolt, and the bit which moves the bolt is behind a revolving curtain (the darkest circle) which is kept steady by one of the tumblers resting on its flattened top. The bolts of the tumblers are shortened, to obviate a certain risk by which one of Newell's locks was picked, but which it is not necessary now to explain. So far as we can judge, this lock has more than all the advantages of that, as it is much less complicated and liable to get out of order from any cause except that to which all locks with spring tumblers are liable, viz., from two tumblers getting stuck together by dirt, so that one of them goes too high with its neighbour. Oiling tumblers is accordingly fatal to them, though it is necessary in other parts of a lock.

The keys of these locks are practically made not of distinct bits screwed into a key frame as in fig. 23, which is the plan used in the Day & Newell lock, and makes a heavy thing to carry, but separate wheels are made, each complete in itself, and fitting into a thickish key pipe which need not be carried about. You may leave it near the safe, and lock up therein, or keep somewhere else, all the bits except the one you use for the day, and carry that in your waistcoat pocket. For such a lock as that described you may have as many of the sixty million bits as you like, and may get new ones from time to time. Or you may have separate bits, as in the paratopic lock, but in that case you must take good care of the key whenever the lock is shut.

The risk of tumblers sticking together in a changeable lock, or any other, may be obviated by not using springs but putting thin plates between the tumblers, as in Sir E. Beckett's lock, giving the tumblers tails coming down on the right of the keyhole in figs. 23, 24, and making the revolving curtain act on all the tails just before the key comes out, by means of an intermediate lever, or else by a small handle which might at the same time bring an escutcheon or external curtain over the keyhole.

Yale Lock

This American lock is remarkable for the smallness of its key, which is shown from *a* to *a* in fig. 25, full size, and is a thin flat piece of steel weighing only 1 of an ounce. The narrowness of the keyhole would be an impediment to introducing a picking instrument together with any other intended at the same time to give a twisting pressure to the small barrel *abc*, which has to turn, as in the Bramah lock, in order to move the bolt, which is not shown in these figures. That may be done either as in Bramah locks or by a tongue or bit attached to the end *ab* of the barrel as in several other locks. The barrel is prevented from being turned,

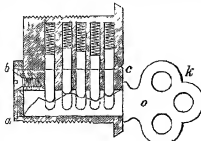


Fig. 25.

The same company have an entirely different kind of lock from all the preceding ones; it consists of a watch in a case enclosed within the safe door, and has a dial with pins marked for every hour, something like a "toll-tale clock." Any number of these pins can be pulled out a little, and the watch will let a weighted lever fall against the bolts of the safe during all those hours, and hold it up during all the other hours, or *vice versa*. For security the case contains two such watches, so that one may do the work if the other happens to fail. Thus no key is used (except the watch key for winding), but the safe can be opened by a hand moving its bolt at such hours as the watch is set for, and at no other.

It should be added that Mr. Hobbs introduced into England in 1851 the American system of manufacturing every part of a lock by machinery, so that all similar locks of a given size are exactly alike, except the keys, and the gating in the tumblers, which is cut when they are fitted by the key, and even those are done by machinery adjustable to secure what may be called an infinite number of variations. The same system has been introduced in the Government gun-manufacturers, and for clocks and watches, and no hand-wink can compete with it. (E B)

LOCKE, JOHN (1632-1704) Some idea of the man and his surroundings is more needed for the interpretation of what Locke has written than in the case of most philosophers. His youth was spent amidst the war of principles of which England was the scene in the middle of the 17th century. In later life he mixed much with the chief actors in the political drama that followed the Restoration. In his advanced years he was the intellectual representative of tendencies which at the Revolution settlement inaugurated the tranquil material progress and tolerant but more prosaic spirit of the 18th century in England. It is instructive to see how the foundations of belief and the constitution of knowledge are investigated by an English gentleman, who was no reclusive medieval monk or pedantic modern professor, but a man of the world, practically conversant with affairs, in tone calm and rational, and now justly regarded as the typical English philosopher.

Locke was born in the county of Somerset, on the 29th of August 1632, six years after the death of Bacon, and three months before the birth of Spinoza. His father was a small landowner and attorney at Pensford, near the northern boundary of the county, to which neighbourhood the family had migrated from Dorsetshire early in the century. The elder Locke, a strict but genial Puritan, by whom the son was carefully educated at home, was engaged in the military service of the popular party when the son was a boy, Bristol being one of the centres of the war. "From the time that I knew anything," Locke wrote in 1660, "I found myself in a storm which has continued to this time." For fourteen years his education was going on at home, in the Puritan family. The house at Beluton, on his father's little estate, in which these years were spent, may still be seen on the side of one of the orchard-land sales of Somerset, half a mile from the market town of Pensford, and 6 miles from Bristol. The actual place of Locke's birth was at Wrington, 10 miles westward in a house which still exists, where his mother chanced to be on a visit.

In 1646 he entered Westminster School, then of course under Puritan control, and at the headquarters of the parliamentary movement. The six following years were mostly spent there. He does not seem to have liked Westminster, and its memories perhaps produced the bias against public schools which afterwards almost disturbed his philosophic impartiality in his *Thoughts on Education*.

In 1652 Locke passed from Westminster to Oxford. He there found himself at Christ Church, in charge of John Owen, the newly appointed Puritan dean, and vice-chancellor of the university. Christ Church was more or less Locke's home for thirty years. For eight years after he entered Oxford was ruled by the Independents, who, through Owen and Goodwin, unlike the Presbyterians, were among the first in England to promulgate the principles of genuine religious liberty. Locke's hereditary sympathy with the Puritans was gradually lessened by what he saw of the intolerance of the Presbyterians and the fanaticism of the Independents. He found, he says characteristically, that "what was called general freedom was general bondage, and that the popular assertors of liberty were the greatest engrossers of it too, and not unfitted called its keepers." The influence of the liberal divines of the Church of England became apparent afterwards in the progress of his mental history.

Oxford had suffered as a seat of learning during the civil war. Under Owen the scholastic studies and disputations were maintained with a formality unsuited to Locke's free inquisitive temper. The reaction against them which he expressed showed thus early a strong disposition to rebel against empty verbal reasonings. He was not, according to his own account of himself to Lady Masham, a very hard student at first. He sought the company of pleasant and witty men, with whom he likewise took great delight in corresponding by letter; and in conversation and in these correspondences he spent much of his time. He took his bachelor's degree in 1656, and that of master in 1658, the latter on the same day with Joseph Glanville, the author of *Serapis Scientificæ*. In December 1660 he was made tutor of Christ Church, and lectured in Greek, rhetoric, and philosophy in the following year.

At Oxford Locke was within reach of distinctive intellectual influences, then of great strength, and particularly fitted to promote self-education in a strong character. The metaphysical works of Descartes had appeared a few years before he entered Christ Church, and the *Human Nature* and *Leviathan* of Hobbes during his undergraduate years. It does not seem that Locke read extensively, but he was soon drawn to Descartes. The first books, he told Lady Masham, which gave him a relish for philosophical things were those of Descartes. He was delighted in reading them, though he very often differed in opinion from the writer, for he found that what he said was very intelligible. After the Restoration he lived amidst the influences which were then drawing Oxford and England into experimental research. Experiments in physics became the fashion after 1660. The Royal Society was that year founded at Oxford. Wallis and Wilkins, and afterwards Boyle and Wren, at Oxford, and Barrow and Newton at Cambridge, helped to make chemistry, meteorology, and mechanics take the place of verbal disputes. We find him, accordingly, at work in chemistry about 1663, and also in the meteorological observations which always interested him.

The restraints of professional life were not well suited to Locke. There is a surmise that he once contemplated taking orders in the Church of England. His religious disposition attracted him to theological studies. His revulsion from the severe dogmatism of Presbyterians and

the unreasoning fanaticism of Independents favoured that connexion with liberal Anglican churchmen which he maintained in later life. Wheate was his favourite preacher, and latterly his closest intimacy was with the Cadworth family. But, though he has a place among the lay theologians of England, his dislike to ecclesiastical impediments to free research, as well as his taste for experimental investigations, led him in the end to turn to medicine when he had to think about a profession. This was soon after the Restoration, and before 1666 he seems to have been practising medicine in Oxford. But, though afterwards known among his friends as "Doctor Locke," he never graduated as a physician. His health was uncertain, for he suffered all his life from chronic consumption and asthma, and besides that an event soon occurred which withdrew him from medical practice. To the end, however, he was fond of the science, and also ready on occasion to give friendly advice.

Locke had early shown an inclination to politics as well as to theology and to medicine. In 1665 he diverged from medical study at Oxford to diplomacy, and was engaged for a few months in this sort of business, as secretary to Sir Walter Vane on his embassy to Cleves. It was soon after his return from Germany in the following year that the incident occurred which determined his career in the direction of politics. Lord Ashley, afterwards first earl of Shaftesbury, the most truly historical figure among the statesmen of Charles II.'s reign, had come to Oxford for health. There Locke was accidentally introduced to him. This meeting was the beginning of a lasting friendship, sustained by a common sympathy with liberty—civil, religious, and philosophical. In 1667 Locke removed from Christ Church to Exeter House, Lord Ashley's London residence, to become his private secretary, and in 1673 secretary of the Board of Trade. Although he retained his studentship at Christ Church, and occasionally visited Oxford, and also his patrimony at Belton, lately inherited from his father, he found a home and shared fortune with the great statesman during the fifteen years which followed his removal to Exeter House.

The manuscripts of Locke which belong to this Oxford period throw welcome light on the growth of his mind in early life. Among them is an essay on the "Roman Commonwealth," which expresses convictions as to religious liberty and the relations of religion to the state which were only strengthened and deepened in the progress of his life. Objections to the sacerdotal conception of Christianity are strongly stated in another paper; short work is made of human claims to infallibility in the interpretation of Scripture in a third; a scheme of utilitarian ethics, wider in its conception than that of Hobbes, is offered in a fourth. But the most significant of those early revelations is an "Essay concerning Toleration," dated in 1666, which anticipates many of the positions maintained nearly thirty years later in his famous *Letters* on that subject.

The Shaftesbury connexion helped to save Locke from those idols of the den to which professional life in every form is exposed. It brought him much in contact with public men, with the springs of political action, and with the details of office. The place he held as confidential adviser of the greatest statesman of his age is indeed the most remarkable feature in his middle life. Exeter House afforded every opportunity for society, and of this Locke, according to his disposition, availed himself. He became one of the intimates among others of the illustrious Sydenham. But though he joined the Royal Society he seldom went to its meetings, for his custom all his life was to encourage small reunions of intimate friends. One of these at Exeter House was the occasion of the enterprise

which has made his name memorable in history, for it was there that "five or six friends" met one evening in his rooms, about 1671, and discussed "principles of morality and religion" which seemed remote from questions about "human understanding." They "found themselves quickly at a stand by the difficulties that arose on every side." Locke suggested a careful examination of the exact limits of man's power to know the universe as the proper way out of their difficulties. The results of the reflexion to which these difficulties thus gave rise, he thought, when he set to work, might be contained on "one sheet of paper." But what was thus "begun by chance was continued by contrasty, written by incoherent parcels, and after long intervals of neglect resumed again as humour and occasions permitted," till at last, at the end of nearly twenty years, it was given to the world as the *Essay on Human Understanding*. This work gave intellectual unity and a purpose to his life as a man of letters and philosophy.

The fall of Shaftesbury in 1675 enabled Locke to escape for four years from the centre of English politics to a retreat in France, where he could unite the study of "human understanding" with attention to health. He spent three years partly at Montpellier and partly in Paris. His journals and commonplace books of this period show the *Essay* in process of construction. The visits to Paris were times of meeting with men of letters and science, among others Gassendi, the well-known Amsterdam physician; Romer, the Danish astronomer; Thoyard, the critic; Thieriot, the traveller; Justel, the jurist; and Bernier, the expatriate of Gassendi. There is no mention of Malebranche, whose *Recherche de la Vérité* had appeared three years before, and who was then at the Oratoire, nor of Arnauld, his illustrious rival at the Sorbonne.

Locke returned to London in 1679. A reaction against the court party had for a time restored Shaftesbury to power. Locke resumed his old confidential relations. A period of much-interrupted leisure followed. It was a time of plots and counterplots, when England seemed on the brink of another civil war. In 1680 and Shaftesbury was committed to the Tower, tried, and acquitted. More insurrectionary plots followed in the summer of 1682, after which, isolated at home, he escaped to Holland, and died at Amsterdam in January 1683. In these two years Locke was much at Oxford or at Belton. The last movements of Shaftesbury did not recommend themselves to the sage caution of his secretary. "The officials of Government kept their eyes on him. 'John Locke lives a very cunning unattainable life here,' Pridemore reported from Oxford in 1682. 'I may confidently affirm,' the dean of Christ Church afterwards wrote to Lord Sunderland, 'there is not any one in the college who has heard him speak a word against, or so much as censuring, the Government; and, although very frequently, both in public and private, discourses have been purposely introduced to the disparagement of his master, the earl of Shaftesbury, he could never be provoked to take any notice, or discover in word or look the least concern; so that I believe there is not in the world such a master of taciturnity and passion.' Some unpublished correspondence with his Somerset friend, Edward Clarke of Chipley, describes his daily life in these troubled years, and refers to intercourse with the Cudworth family, who were intimate with the Clarkes. The commonplace books and letters about the same time allude to toleration in the state and comprehension in the church, and show an indifference to questions on which theological disputers lay stress, hardly consistent with a strict connexion with any organized body of Christians, notwithstanding his gravitation towards the Church of England as the most liberal community.

In his fifty-second year, in the gloomy autumn of 1683,

Locke retired to Holland in voluntary exile. It was then the asylum of eminent persons who were elsewhere denied civil and religious liberty. Descartes and Spinoza had meditated there; it had been the home of Erenus and Orotius; it was now the refuge of Bayle. Holland was Locke's sanctuary for more than five years; but it was hardly a voluntary retreat. His (unpublished) letters from thence represent a man of tender feelings, on whom exile sat heavily. Amsterdam was his first Dutch home. For a time he was in danger of arrest at the instance of the English Government. After anxious months of concealment in the houses of friends, he escaped; he was, however, deprived of his citizenship at Christ Church, and Oxford was finally closed against him by order of the king. But Holland introduced him to new friends. One of these, ever after an intimate correspondent, was Philip van Limborch, the successor of Episcopius as Remonstrant professor of theology, lucid, learned, and tolerant, the friend of Cudworth, Whiclocke, and More. Limborch attached him to Le Clerc, then the youthful representative of letters and philosophy in Limborch's college, who had escaped from Geneva and Calvinism to the milder atmosphere of Holland. The *Bibliothèque Universelle* of Le Clerc, commenced in 1686, soon became the chief organ in Europe of men of letters. Locke was at once united with him in the work, and contributed several articles. It was his first appearance as an author, although he was now more than fifty-four years of age, and afterwards produced so many volumes. This tardiness in authorship is a significant fact in Locke's mental history, in harmony with the tempered wisdom and massive common sense which reign throughout his works. The next fourteen years were those in which the world received the thoughts which observation of affairs and reflexion had so long been forming in his mind. They were taking shape for publication while he was in Holland. The *Essay* was finished there, and a French epitome of it appeared in 1688, in Le Clerc's journal. Locke was then at Rotterdam where he lived for more than a year in the house of a Quaker friend, Benjamin Farley, a wealthy merchant and collector of books. The course of affairs in England at last opened a way for his return to his native country. At Rotterdam he was the confidant of the political exiles, including Burnet and Mordaunt, afterwards the famous earl of Peterborough, as well as of the prince of Orange. William landed in England in November 1688; Locke followed in February 1689, in the same ship with the princess of Orange and Lady Mordaunt.

It was after his return to England that through authorship Locke emerged into European fame. Within a month he had declined the embassy to Brandenburg, and taken instead the modest office of commissioner of appeals with its almost nominal duties. The two years, 1689 and 1690, during which he lived at Dorset Court, in London, was memorable for the publication of his two chief works in social polity, and also of the most popular and widely influential book in modern philosophy, which expresses in a generalized form the principles that lie at the root of all his political and other writings. The first of the three to appear was the defence of religious liberty in the state, in the *Epistola de Tolerantia*, addressed to Limborch. It was published at Gouda in the spring of 1689, and translated into English in autumn by William Popple, a Unitarian merchant in London. The *Two Treatises on Government*, in defence of the sovereignty of the people, followed a month or two after. The *Essay concerning Human Understanding* saw the light in the spring of 1690. He received £30 for the copyright, which was nearly the same as Kant afterwards got for the first edition of his *Kritik der reinen Vernunft*. He had carried the manuscript

from Holland, ready for the press except a few last touches. It was the first book in which his name appeared, for the other two were published anonymously.

Locke's asthma and other ailments had increased in the latter part of 1690. The air of London always aggravated them. The course of public affairs also disappointed him, for the settlement at the Revolution in many ways fell short of his ideal. It was then that the home of his old age, the brightest of all his homes, opened to receive him. This was the manor house of Oates in Essex, pleasantly situated midway between Ongar and Harlow, the country seat of Sir Francis Masham. Lady Masham was the accomplished daughter of Cudworth, and Locke had known her before he went to Holland. In the course of the two years after his return, she told Le Clerc, "by some considerably long visits Mr Locke made trial of the air of this place, which is some 20 miles from London, and he thought that none would be so suitable for him. His company could not but be very desirable for us, and he had all the assurances we could give him of being always welcome; but, to make him easy in living with us, it was necessary he should do so on his own terms, which Sir Francis at last assenting to, he then believed himself at home with us, and resolved, if it pleased God, here to end his days—as he did." It was in the spring of 1691 that this idyllic life at Oates began. There, among the green lanes of rural England, he enjoyed for fourteen years as much domestic peace and literary leisure as was consistent with broken health and sometimes anxious visits to London on public affairs. Oates was in every way his home. In his letters and otherwise we have charming pictures of its inmates and its internal economy, as well as of occasional visits of friends who went there to see him, among others Lord Peterborough and the Lord Shaftesbury who wrote the *Characteristics*, Isaac Newton, William Molyneux, and Anthony Collins.

At Oates he was always busy with his pen. The *Letter on Toleration* had already involved him in controversy. The answer of a certain Jonas Frost of Queen's College, Oxford, had drawn forth in 1690 his *Second Letter on Toleration*. A rejoinder in 1691 was followed by Locke's *Third Letter* in the summer of the following year. And other questions divided his interest with this one. In 1691 those of currency and finance were much in his thoughts; in the year after he addressed a letter to Sir John Somers on the *Consequences of the Lowering of Interest and Raising the Value of Money*. It happened too that when he was in Holland he had written letters to his friend Clarke of Chipley about the education of his children. These letters formed the substance of the little volume that appeared in 1693, entitled *Thoughts on Education*, which still holds its place among the classics in that department. Nor were the "principles of revealed religion" forgotten, which a quarter of a century before were partly the occasion of the *Essay*. The circumstances of the time now made him desire to show how few and simple all the essential points held in common by the religious community of England were, and to bring men if possible to agree to differ as individuals regarding all beyond. The issue was an anonymous essay on the *Reasonableness of Christianity as delivered in the Scriptures*, which appeared in 1695, in which Locke tried to separate the divine essence of Christianity from accidental accretions of dogma, and verbal reasoning of professional theologians, ignorant of the limits within which the conclusions of human beings on such subjects must be confined. This renunciation involved him in controversies that lasted for years. A host of angry polemics assailed the book. A now forgotten John Edwards was conspicuous among them. Locke produced a *Vindication* which added fuel to the fire,

and was followed by a *Second Vindication* in 1697. Notes of opposition to the *Essay* too had been heard almost as soon as it appeared. John Norris, the metaphysical rector of Banerston, an English disciple of Malebranche, criticized it in certain *Curvey Refutations* in 1690. Locke took no notice of this at the time, but his second winter at Oates was partly employed in writing what appeared after his death as an *Examination of Malebranche's Opinion of Seeing all Things in God*, and as *Remarks upon some of Mr Norris's Books*,—tracts which throw important light upon his own theory, or rather want of theory, as to perception through the senses. When he was examining Malebranche he was also preparing the *Essay* for a second edition, and corresponding with his friend William Molyneux at Dublin about amendments in it. This edition, with a chapter added on "Personal Identity," appeared in 1695. It was followed by a third, which was only a reprint, later in the same year. Wynne's well-known abridgment in that year helped to make the book known in Oxford, and Molyneux had years before introduced it in Dublin. In 1695 a return to questions about the currency diverted Locke's attention for a little from metaphysics and theology. Circumstances in that year gave occasion to his tract entitled *Observations on Silver Money* and also to his *Further Considerations on Raising the Value of Money*.

In 1696 Locke was induced to accept a commissionership on the Board of Trade, which made frequent visits to London needful in the four following years, and involved him considerably in the cares of office. Meantime the *Essay on Human Understanding* and the *Reasonableness of Christianity* were both becoming more involved in the world warfare between dogmatists and latitudinarians, trinitarians and unitarians, of which England was the scene in the last decade of the 17th century. The controversy with Edwards was followed by another with Stillingfleet, bishop of Worcester, which takes its place among the memorable philosophical controversies of the modern world. It arose in this way. John Toland, an Irishman, in his *Christianity not Mystical*, had exaggerated some passages in the *Essay*, and then adopted the opinions as his own. In the autumn of 1696, Stillingfleet, who was a learned and argumentative ecclesiastic more than a religious philosopher, in a *Vindication of the Doctrine of the Trinity* wrote some pages on Locke, condemning him especially for eliminating mystery from human knowledge in his account of what is meant by "substance." Locke replied in a *Letter* dated January 1697. Stillingfleet's rejoinder appeared in May, followed by a *Second Letter* from Locke in August, to which the bishop replied in the following year. Locke's elaborate *Third Letter*, in which the ramifications of the controversy are pursued with a tedious expenditure of acute reasoning and polished irony, was delayed till 1699. The death of Stillingfleet in that year brought this famous trial of strength to an end. (The interesting episode of Molyneux's visit to Oates, followed by his death a few days after his return to Dublin, occurred in 1698, when the Stillingfleet controversy was at its height.) Other critics were now entering the lists against the *Essay*. One of the ablest was John Sergeant, a Catholic priest, in his *Solid Philosophy Asserted Against the Fancies of the Idealists*, in 1697. He was followed by Thomas Burnet and Dean Sherlock. Henry Lee, rector of Trichmarsh, produced in 1702 a folio volume of notes on each chapter in the *Essay*, under the title of *Anti-Scepticism*; John Broughton dealt another blow in his *Psychologia* in the following year. About the same time too John Norris returned to the attack, in various passages in his *Theory of the Ideal or Intelligible World*. Locke was defended with vigour by Samuel Bodke, a Dorsetshire

clergyman. The *Essay* was all the while spreading over Europe, impelled by the great name of its author as the chief friend and philosophical defender of civil and religious liberty. The fourth edition (the last while Locke was alive) appeared in 1700. It contained two important new chapters on "Association of Ideas" and "Enthusiasm." What was originally meant for a third chapter was prepared but withheld. It appeared among Locke's posthumous writings, under the now well-known title of *Conduct of the Understanding*, in some respects the most characteristic of his works. The French translation of the *Essay* by Pierre Coste, Locke's amanuensis at Oates, was almost simultaneous with the fourth edition. The Latin version by Burridge of Dublin appeared the year after, reprinted in due time at Amsterdam and at Leipzig.

After 1700 Locke was gathering himself up for the end, in the rural repose of family life at Oates. The commission at the Board of Trade was resigned, and the visits to London ceased. Scriptural studies and religious meditation engaged most of his available strength in the four years that remained. The Gospels had been much searched by him when he worked in theology years before. He now turned to the Epistles of St Paul, and applied the spirit of the *Essay*, and the rules of critical interpretation which apply to other books, to interpret a literature which he still venerated with the submissiveness of the pious Puritans who surrounded his youth. The results of these studies were ready for the printer when he died, and were published about two years afterwards. A few pages on *Miracles*, written in 1702, in connexion with Fleetwood's essay, also appeared posthumously. More adverse criticism was now reported to him, and the *Essay* was formally condemned by the authorities at Oxford. "I take what has been done rather as a recommendation of the book," he wrote to his young friend Anthony Collins, a neighbouring Essex squire, then a frequent visitor at Oates, and afterwards a leader of free thought, "and when you and I next meet we shall be merry on the subject." One attack only moved him. In 1704 his adversary Jonas Proast unexpectedly revived their old controversy. Locke in consequence began a *Fourth Letter on Toleration*. The few pages in the posthumous volume, ending in an unfinished sentence, seem to have exhausted his remaining strength in the weeks before he died. Thus the theme which had employed him at Oxford more than forty years before, and had been his ruling idea throughout the long interval, was still dominant in the last days of his life. All that summer of 1704 he continued to decline, tenderly nursed by Lady Masham and her step-daughter. On the 28th of October he passed away, as he declared, "in perfect charity with all men, and in sincere communion with the whole church of Christ, by whatever names Christ's followers call themselves." The tomb of Locke may be seen on the south side of the parish church of High Laver, in which he often worshipped, near the tombs of the Mashams, and of Damaris, the widow of Oudworth, bearing a Latin inscription prepared by his own hand. At the distance of a mile are the garden and park where the manor house of Oates once stood, surrounded by a green undulating country, in the lanes of which the slender delicate figure, with the refined reflective countenance made familiar to us by Kneller, was so often seen in the last years of the 17th century.

Locke's history, combined with his writings, has made his intellectual and moral features not less familiar. The reasonableness of taking probability for our ultimate guide in all the really important concerns of life was the essence of his philosophy. The desire to see for himself what is really true in the light only of its reasonable evidence, and that others should do the like, was his ruling passion, if

the term can be applied to one so calm and judicial. "I can no more know anything by another man's understanding," he would say, "than I can see by another man's eyes." The knowledge which one man possesses is "a treasure which cannot be lent or made over to another." This repugnance to believe blindly what rested on authority, as distinguished from what was seen to be sustained by self-evident reason or by demonstration or by good probable evidence, runs through his life. He is typically English in his reverence for facts, whether facts of sense or of rational consciousness, in his tendency to turn away from purely abstract speculation and merely verbal reasonings, in his suspicion of mysticism, in his calm reasonableness, and in his ready submission to truth, even when the truth was incapable of being reduced to system, provided only that it served a human purpose. The delight he took in making use of his reason in everything he did, and a wise use of it too, was what his friend Pierre Coste found most prominent in Locke's daily life at Oates. "He went about the most trifling thing always with some good reason. Above all things he loved order, and he had got the way of observing it in everything with wonderful exactness. As he always kept the useful in his eye in all his disquisitions, he esteemed the employments of men only in proportion to the good they were capable of producing, for which cause he had no great value for the critics who waste their lives in composing words and phrases, and in coming to the choice of a various reading in a passage that has after all nothing important in it. He cared yet less for those professed disputants who, being taken up with the desire of coming off with victory, justify themselves behind the ambiguity of a word, to give their adversaries the more trouble. And whenever he had to deal with this sort of folks, if he did not beforehand take a strong resolution of keeping his temper, he quickly fell into a passion, for he was naturally choleric, but his anger never lasted long. If he retained any resentment it was against himself, for having given way to so ridiculous a passion, which, as he used to say, may do a great deal of harm, but never yet did any one the least good." Large, "round-about," even prosaic common sense, with intellectual strength solidly directed by a virtuous purpose, much more than subtle or daring speculation sustained by an idealizing faculty, in which he was deficient, is what we find conspicuous in Locke's conduct, correspondence, and books. A defect in speculative imagination undoubtedly appears when he encounters the vast and complex problem of human knowledge in its organic unity, and when he is obliged to recognize the need for philosophy as an additional inquiry to that within the scope of any one, or all, of the special sciences.

In the inscription on his tomb Locke refers to his printed works as the true representation of what he really was. They are concerned with SOCIAL POLITY, CHRISTIANITY, EDUCATION, and PHILOSOPHY. It may be convenient to arrange them under these four heads, in the order in which they were published, and then to give some account of his opinions under each head.

I. SOCIAL POLITY.—(1) *Apologia de Tolerantia*, 1689 (translated into English in the same year) (2) *Two Treatises on Government*, 1690 (the *Patriarcha* of Filmer, to which the *First Treatise* was a reply, appeared in 1680) (3) *A Second Letter concerning Toleration*, 1690 (4) *Some Considerations on the Consequences of Lowering the Rate of Interest and Raising the Value of Money*, 1691. (5) *A Third Letter for Toleration*, 1692. (6) *Short Observations on a printed paper entitled, "For Encouraging the Coining of Silver Money in England, and after for Keeping it here,"* 1696. (7) *Further Considerations concerning Raising the Value of Money*, 1696 (this was occasioned by a Report containing an "Essay for the Amendment of Silver Coins," published that year by William Lowndes, a secretary for the Treasury; Locke anticipates some later views in political economy). (8) *A Fourth Letter for Toleration*, 1706 (posthumous).

II. CHRISTIANITY.—1. *The Reasonableness of Christianity as delivered in the Scriptures*, 1666. (2) *A Vindication of the Reason-*

abilities of Christianity from Mr. Bouverie's *Reflections*, 1695. (3) *A Second Publication of the Reasonableness of Christianity*, 1697. (4) *A Paraphrase and Notes on the Epistles of St. Paul to the Galatians, First and Second Corinthians, Romans, and Ephesians. To which is prefixed an Essay for the understanding of St. Paul's Epistles by consulting St. Paul himself*, 1705-7 (posthumous).

(5) *Education*, 1693. (6) *Thoughts concerning Education*, 1693. (7) *The Conduct of the Understanding*, 1706 (posthumous). (8) *Some Thoughts concerning Reading and Study for a Gentleman*, 1706 (posthumous). (9) *Instructions for the Conduct of a Young Gentleman*, 1706 (posthumous). (10) *Of Study* (written in France in Locke's journal, and published in L. King's *Life of Locke* in 1830).

(11) *Posthumous*.—(1) *An Essay concerning Human Understanding*, in four books, 1689. (2) *A Letter to the Bishop of Worcester concerning some passages relating to Mr. Locke's Essay of Human Understanding in a late Discourse of his Lordship's in a Publication of the Trinity, 1697*. (3) *Mr. Locke's Reply to the Bishop of Worcester's Answer to his Letter*, 1697. (4) *Mr. Locke's Reply to the Bishop of Worcester's Answer to his Second Letter*, 1699. (5) *A Discourse of Miracles*, 1706 (posthumous). (6) *An Examination of Father Malebranche's opinion of Something else than God*, 1706 (posthumous). (7) *Remarks upon some of Mr. Norris's Books, wherein he asserts Father Malebranche's opinion of Something else than God*, 1720 (posthumous).

The following are Miscellaneous Tracts:—(1) *A New Method of a Common Place Book*, 1686 (this was Locke's first article in the *Bibliothèque de La Clero*, his other contributions to it are uncertain, except the *Epistola de Usu*, in 1688). (2) *The Fundamental Constitutions of Carolina* (prepared when Locke was Lord Shaftesbury's secretary at Exeter House about 1673; remarkable for its recognition of the principle of toleration, and published in 1708, in the posthumous collection). (3) *Notes relating to the Life of Anthony, First Earl of Shaftesbury*, 1706. (4) *Elements of Natural Philosophy*, 1706. (5) *Observations upon the Growth and Culture of Vines and Olives*, 1706. (6) *Rules of a Society which met once a Week, for their improvement in Useful Knowledge, and for the promotion of Truth and Christian Charity*, 1706. (7) *A Letter from a Person of Quality to his Friend in the Country*, published in 1755 (included by Des Maizeaux in his *Collection of Several Pieces of Mr. John Locke*, 1750), and soon afterwards burned by the common hangman by orders from the House of Lords, was disavowed by Locke himself. It may have been dictated by his amanuensis.

There are also various writings of Locke first published in the biographies of Lord Haig and of Mr Fox Bourne.

Locke's numerous letters to Thoynard, Lamborch, Le Clero, Guendouin, Moyleux, Collins, Sir Isaac Newton, the first and the third Lord Shaftesbury, Lord Bolingbroke, the Countess of Clifley, and others, many of them unpublished, are models in their kind. They express the courtesy and humour which were natural to him, and his varied interests in human life. These to Moyleux and Lamborch in particular throw light on the *Essay*, and his works on Toleration and Christianity.

It has been truly said that all Locke's writings, even the *Essay on Human Understanding* itself, were "occasional, and intended directly to counteract the enemies of reason and freedom in his own age." This is obviously true of his works on Social Policy, written in an age when the principles of democracy and toleration were struggling with passive obedience and divine right of kings, and when even "the popular assertions of public liberty were the greatest engrossers of it too." The state with Locke was the issue of free contract, and was not a natural organism. That the people, in the exercise of their sovereignty, have the right to govern themselves in the manner they judge most conducive to their common good, and that the civil government, whatever form it assumes, has no right to interfere with religious beliefs not expressed in actions inconsistent with civil society, is the essence of his political philosophy. He based the ultimate sovereignty of the people on a virtual consent or compact between the people themselves and the government. The precise terms of contract, he allowed, might and should be modified by the sovereign people from time to time, in accommodation to ever changing circumstances. He saw that things in this world were in so constant a flux that no society long remained in the same state, and that "the greatest inconveniences must be the issue of a following custom when reason has left the custom." With an English love of compromise in the working of political affairs, he was always disposed towards liberal ecclesiastical concessions for the sake of religious unity and peace, and recommended obedience to the civil magistrate in all indifferent things in worship and government, not otherwise expressly determined by supernatural revelation.

His attack on Sir Robert Filmer in the *First Treatise on Government* was an anachronism, even when it was published; in the democratic principle argued for in the *Second Treatise*, while in advance of the practice of his age, was he over-reacted by Aquinas and Bodin, as well as by Grotius and Hooker. His philosophical defence of the social rights of religious beliefs was the most original

and important of his contributions to polity, and the most far-reaching in its ultimate assumptions. Locke held a more modest estimate of human resources, natural and supernatural, for forming true judgments in religion, and a less pronounced judgment of the immorality of religious error, than either the Catholic or the Puritan.

The toleration which he spent his life in arguing for meant a revolution from the absolute to a relative point of view in the theory of knowledge. It was a protest against those who in theology "peremptorily require demonstration, and demand certainty where probability only is to be had." The practice of universal toleration without increasing religious differences was the most important application to the circumstance of his own age of the theory about human knowledge which pervaded his *Essay*. This paradox is now a commonplace, and the superabundant argument and irony in the *Lettres on Toleration* fatigue the modern reader.

The change of opinion as more due to Locke himself than to any one else. "The rights of free thought and liberty of conscience had indeed been pleaded for, on various grounds, throughout the century in which he lived. Chillingworth, Jeremy Taylor, Cudworth, Glanville, and other philosophical thinkers in the Church of England urged toleration in the state, in conjunction with a wide comprehension in the church, on grounds which implied intellectual limitation and even uncertainty in religious matters. Puritan Independents and Baptists, like Owen, Goodwin, and Richardson, whose idea of ecclesiastical comprehension was dogmatic and narrow, were ready to accept sectarian vanity within the state, on the ground that it was possible to have many religions in the land, but only their own form within their sects." The existence of separate Christian nationalities, on the other hand, was the only justification of separate religious societies to the latitudinarian churchmen with whom Locke associated; in each nationality they would have a comprehensive church co-extensive with the nation.

Locke went far to unite in a higher principle what was best in the broad Anglican and in the Puritan theories, while he recognized the individual liberty which has ever distinguished the national church of England. (a) In his reasonings for toleration he insists on the fact that all human theologies must consist more of beliefs determined on presumptions of probability than of knowledge founded on facts, either self-evident or demonstrable in the light of reason. A profound sense of the limits of human reason was at the bottom of his arguments for a tolerant comprehension by the state and also by the church. He had no objections to a national establishment of some form of religion, provided it was conducted with tolerance, and was really the nation organized to promote goodness, and not to protect the metaphysical subtleties by which professional theologians spoil the original simplicity of Christianity.

The recall of the national religion to this primitive simplicity, he hoped, would make a nation of accommodation unnecessary, as few would then remain to ask for it. (2) The speculative, and the metaphysical, and the socially harmless, nature of most presented beliefs and forms of worship is another point on which he insists. "No man is hurt because his neighbour is of a different religion from his own, and civil society is hurt because its members are of different religions from one another." The more various our beliefs are, the more probable it becomes that a complete view of truth may by degrees be reached at last by the human race. In the meantime beliefs in religion concern the individual only and not society. To the atheist alone Locke absolutely refuses toleration, on the ground that the soul bonds can have no hold over him, for "God is taking away of God himself all."

If atheism means the denial that reason is the ultimate regulative principle in the universe, then the consistent atheist without doubt "dissolves all," and must reject physical science even, as well as morality, in an absolute ascension, so that he is incapable of citizenship as one who is insane. In Locke's own philosophy, as we shall see, the case of God is equally strong, but not demonstrable, but the distinctive articles of Christianity are founded only on presumptions of probability. He argued too against full toleration to the Church of Rome, at least in the circumstances of the age in which the Toleration Act was passed, on the ground of its subsistence to a foreign sovereign.

(3) The infiniteness of force as a means of bending the light of truth into human minds is a third argument urged by Locke, founded on the psychology of human understanding. Persecution can only transform a man into a hypocrite, belief must be formed by individual discernment of evidence. Apart from evidence, a man cannot command his own understanding, he cannot determine arbitrarily what opinions he is to hold. Thus all Locke's pleas for a universal toleration resolve at last into a philosophical view of the limits and origin of knowledge.

It is the principles which determined Locke's social polity largely determining his way of looking at Christianity. His "institutionalism" was really the result of an extraordinary reverence for truth, and of his perception that in matters of religion knowledge may be sufficient for practice while it falls far short of perfection and demonstration. He insists on referring questions in religion to the reasoning individual, and never loses sight of the essential reasonableness of Christianity as the only ground on which it

can rest. Locke accepted the Scripture as infallible with the reverence of a Puritan, but he did not, like so many Puritans, mean only Scripture as interpreted by himself. Confidence in Biblical infallibility was also combined in Locke with a distrust in the pretensions of "enthusiasm," which predisposed him to regard miracles as a criterion needed for distinguishing reasonable religious convictions from mere "impressions, fancies, and strong senses." Assent in religion as in every thing else he could only justify on the grounds of its evident rationality: "illumination without search, and certainty without proof and without examination," was to him a sign of the absence of the divine spirit. Fanatical confidence that we are right, he says, "is to be judged by the doctrine, and not the doctrine by the miracles." All this sort of argument became commonplace in books about the "evidences" in the 18th century. The *Reasonableness of Christianity* was an attempt to recall religion from verbal reasonings of theological schools, destructive of peace among Christians, to its original simplicity, but it no doubt involved an abatement of its transcendent mystery and ultimate incomprehensibility. The book was probably written to promote a comprehension of the dissenters. All who practically acknowledge the supremacy of Jesus as the Messiah accept all that is essential to the Christianity of Locke, whatever other theological opinions they may individually or collectively add to this only catholic one.

Christian teachers and apologists at the succeeding age, as well as the assailants of Christianity, alike appealed to the *Essay on Human Understanding*, and the catholic tradition of Anglican theology was thus interrupted in the church for more than a hundred years. The confusion, anxiety and earnestness, were more the outcome of the sort of common sense sagacity which through him moulded the prudential theology of England in the 18th century, than of the nobler elements present in More, Cudworth, and other religious philosophers of the preceding age, or afterwards in Latimer and Schlegel.

III. Locke takes his place in the succession of great writers on the theory and art of Education. His educational writings might be regarded either as an immediate introduction to or as an application of the *Essay on Human Understanding*. In his *Thoughts on Education* imagination is stimulated to new activity as weigh against prudential utilitarianism; information and mere learning are subordinated to the formation of character and practical wisdom; the part which habit plays in individuals is always kept in view; the dependence of conscious mind, which it is the purpose of education to improve, upon the health of the corporeal organism is steadily indicated; to make those happy who are undergoing education is a favourite precept; accumulating facts in the memory without using the power to think, and without accompanying the youthful mind to apply reason to the evidence by which individual thoughts must be tested, is always referred to as the cardinal vice in teaching. "Wisdom more than learning is what he requires in the teacher. In the knowledge to be communicated he gives the first place to "that which may direct us to heaven," and the second to "the study of prudence, or discreet conduct and management of ourselves in the several occurrences of our lives," which most assists our present prosperity and the enjoyment of the present life. The infancy of knowable existence in contrast with the narrowness of human understanding and experience is always in his thoughts. This "disproportionateness" is one reason given for due deliberation in the choice of studies, and for declining those which lie out of the way of a really wise man, however much they may have been favoured by custom. Among the things he warns especially against "that mass of words and phrases which have been employed only to instruct and amuse people in the art of disputing, and which will be found perhaps, when looked into, to have little or no meaning, . . . words being of no value nor use, but as they are the signs of things, when they stand for nothing more, or less than clear ideas, for instead of representing the value of those they are joined with, they lessen it and make it nothing." Knowledge of what the opinions of other men have been is another study which Locke depreciates. "Truth needs no recommendation, and error is not mended by it; in our inquiry after knowledge it hinders concerns us to know what other men have thought."

It is an idle art, he says, to make it one's business to study what have been other men's sentiments in matters where reason is only to be judge. Realism and individual rationality are two essential educational principles with Locke. In his *Conduct of the Understanding* the pupil is to be led to the point at which "a full view of all that relates to a question" is to be had, and at

which alone a rational discernment of the truth is possible. The unmediated mass of material, on the contrary, rather than reason at all, or else "put passion in the place of reason," or "for want of large, sound round-about sense" they direct their minds only to one part of the evidence, "converse with one sort of men, read but one sort of books, and will not come in the hearing of but one sort of notions, and so carry out to themselves a little Goshawk in the intellectual world, where light shines, and, as they conclude, day blesses them; but the rest of the vast expanse they give up to night and darkness, and avoid coming near it." It is a tissue on the wisdom needed for the management of the individual mind, so as to that it may overcome the *idola* or common tendencies to error against which Bacon had warned mankind, that requires judgment, bias, or want of a *prætor*, "indifference" to what evidence may require us to conclude, undue regard for authority or love for custom and antiquity, indolence and sceptical despair, are among the states of mind marked by him, as most apt to interfere with the formation of our individual thoughts in harmony with the Universal Thought that is latent in nature. The development of vigorous intellect in each person is the aim of this admirable tract.

IV. The *Essay Concerning Human Understanding* contains Locke's Metaphysical Philosophy. It was the first attempt, on a great scale, and in the Baconian spirit, to show the certainty and inadequacy of human knowledge. This enterprise seemed to Locke to hold out the most reasonable hope of a solution of some sort for the perplexities which encompassed every department of inquiry.

The Introduction to the *Essay* is the keynote to the whole. The ill fortune of mankind in their endeavour to comprehend themselves and their surroundings is there attributed to their disposition to extend their inquiries into matters beyond the reach of our intelligence, letting their thoughts wander into depths where we can have no footing. "Whereas, were the capacities of our understandings well considered, the extent of our knowledge once discovered, and the horizon found which sets the bounds between the enlightened and the dark parts of things, between what is and what is not comprehensible by us, men would perhaps with less acute sequences in the avowed ignorance of this one, and employ their thoughts in more advantage in the search of the other." To inquire into "the original, certainty, and extent of human knowledge, together with the grounds and degrees of belief, opinion, and assent," is Locke's own account of the design of his *Essay*. He expressly excludes from his inquiry "the physical causes of the mind,"—the nature, cause, and extent of the faculties, and the transcendental reasons for our conscious experience being what in his own "plain historical method" he might find it to be. He wanted to be able to make a faithful report, based on what he actually found, as to how far a merely human understanding of the universe could extend, to what extent, and how far it fell short of pure knowledge, and in what cases they can only judge and guess "on grounds of probability. Although his report might show that the knowledge attainable by the individual must be "narrow," and far short of a "universal or perfect comprehension of whatsoever is," it might also convince us that it is "sufficient," because "suited to our individual state." The "light of reason," the "candle of the Lord" that is set up in us, "shines bright enough for all our purposes. If we will disabuse every thing because we cannot certainly know all things, we shall do much as wisely as he who would not see by his legs, but sit still and perish because he had no wings to fly." Locke thus opens his *Essay* in a tone which, with a more homely cheerfulness, reminds one in parts of the sublime conceptions of Pascal, and in others of the wise moderation of Bishop Butler. The outcome is that, if it should turn out on investigation that human understanding cannot solve the metaphysical problem of the universe, we may at least find that at no stage of our individual existence are we the sport of chance or of an evil power,—that there is a way by which we can secure our final wellbeing, even within the inexorable causal connexions, conditioned by space and time, and which their imperfectly calculable issues, by which we are surrounded.

The fourth book alone is concerned directly with the professed design of the *Essay*. It has been suggested by Stewart that Locke may have commenced with this book, especially as it contains few references to preceding parts of the *Essay*, so that "it might have been published separately without being intelligible than it is." The inquiries in the preceding books are of a more abstract and scholastic nature, which probably opened gradually on his mind as he studied his subject more closely. The second and third books both relate to our individual ideas or thoughts. That each person has thoughts, and that without thoughts or consciousness there could be no knowledge for him, is a *Lockian* postulate. That we pre-exist, "will be easily granted," for "every one is conscious of ideas in himself, and men's words and actions will satisfy him that they are in others." Questions about knowledge and its extent therefore presuppose questions about ideas or thoughts. But our most ideas are, as Locke reminds us, "ideas of sense, or of reflection, being nothing but bare appearances in our own minds." Truth

and falsehood belong only to the assertions or denials of the mind. The idea of a centaur has no more falsehood in it, when it appears in our minds, than the name centaur has falsehood in it when it is pronounced by our mouths, or written on paper. Truth and falsehood lie always in affirmations or negations, and the mere thoughts of which as individuals we happen to be conscious are not proper either true or false. They do not become either real knowledge or error "till the mind affirms or denies something of them."

That none of our knowledge is "innate" is the conclusion argued for in the First Book. But the drift of this famous argument has been overlooked by Locke's critics. It has been conceived as if it was a metaphysical disquisition about the existence of transcendental elements in human knowledge, like that at issue in the present day between empiricism and intellectualism. If it were so it would be an example of the fallacy of irrelevant conclusion. For this Locke himself is no doubt verily responsible. It is not easy to determine who or what he had in view in this polemic. Lord Herbert alone is made prominent as the defender of innateness, and Locke was perhaps too little led in the literature of ancient and modern philosophy to do full justice to those who, from Plato downwards, have recognized the intuitions of reason as well as the phenomena of sense in the constitution of knowledge. The positions which he assails would have been disclaimed by the most eminent defenders of the transcendental elements. "Innates," as Lord Shaftesbury says, "is a word Mr. Locke poorly plays on,"—at least if he is to be understood as engaged in an intellectual struggle against Plato or Descartes. "The right word, though less used, is *conscientia*. For what has birth, or the progress of the fœtus, to do in this case?" The real question, as Shaftesbury adds, is not about the time when the supposed innate knowledge entered, but "whether the constitution of man be such that, being adult and grown up, the ideas of (rational) order and administration of a God will not infallibly and necessarily spring up in him." But this Locke himself does not deny. "That there are certain propositions," we find him saying, "which, though the soul from the beginning, or when a man is born, does not know, yet, by assistance from the outward, and the help of some previous cultivation, it may afterwards come certainly to know the truth of, as no more than what I have affirmed in my first book" (see "Epistle to Reader," in second edition). This further appears from the fact that, although the *Essay* opens with an attack on innateness in human nature, yet the self-evident, in the light of educated instincts of much that we know is asserted elsewhere not less strenuously. Much of our knowledge he reports in the fourth book to be reached by purely rational insight and demonstration. What he really argues against in the first book is that any of it should be supposed to have a claim to protection against a free criticism of its reasonableness. He argues there against the innateness of our knowledge of God and of morality; yet in the fourth book he reports, as a result of his search into our rational consciousness, in the "plain historical method," that the evidence of God is a demonstrable rational conclusion, involved in that causal necessity without which there could be no knowledge at all; and he maintains in various places that morality may be found to be as demonstrably necessary as mathematics. The two positions are quite consistent. The demonstrable rational necessity of these and other sorts of knowledge often remains latent, he might say, in the state of reason that is potentially present in all individuals, and therefore cannot be called "innate" knowledge; but, for all that, such truths "carry their own evidence along with them" in every mind that is rationally awake. Even in the first book he appeals to what might be called common reason, which he calls "common sense," and which he thought would of common sense who asked, on the one side, or, on the other, want to give a reason, why 'tis impossible for the same thing to be and not to be. It carries its own light and evidence with it, and needs no other proof, he that understands the terms assents to it for its own sake, or else nothing will ever be able to prevail with him to do it" (bk. i. chap. 24). The idea that Locke here presents to intellectuals of the 17th century expressed their meaning with enough of precision; if they had, Locke's first book would probably have taken a form more consistent with its true intention. It is really to be read as an energetic argumentative protest against anything in human knowledge being supposed to be independent of rational criticism. Locke believed that in attacking innate principles he was really substituting conscious self-evidence and rational demonstration instead of blind repose on authority, and was thus, as he says himself, not "pulling up the foundations of knowledge," but "laying these foundations sure." Truth is to be found in "the constitution of things themselves," that is, by actual rational insight on the part of each individual. But when men heard of "some general propositions that could not be doubted as soon as understood," it was a short and easy way to conclude that such propositions are "innate," and that a personal perception of their truth and self-evidence is unnecessary. This language once received, "it ceased the lazy from the pains of search,

and stopped the inquiry of the doubtful concerning all that was once styled innate." Dogmas became protected against rational criticism. "It was no small advantage to those who affected to be masters and teachers to make thus the principle of principles—that principles must not be questioned." The mere assumption that we are "innate" was enough "to take men off the use of their own reason and judgment, and to put them upon believing and taking upon trust without further examination . . . Nor is it a small power it gives a man over another to have the authority to make a man swallow that for an innate principle which may serve his purpose who teaches them" (bk. i. chap. 4, § 24). Locke's examination of the way in which the rational consciousness of self-evident truths is actually reached refers them to "the bang of things themselves daily considered, and to the application of those faculties that are fitted to receive and judge of them when duly employed." Thus the reasoning which runs through the first book is a return to a more general and therefore more philosophical way, to that defence of individual rational insight against blind dependence on authority which was offered in the *Letters on Toleration*.

The Second Book opens with the suggestion of a general proposition regarding the genesis and constitution of ideas or thoughts, which it does after a laboured endeavour to verify it. This hypothetical proposition is that all human thoughts, even the most complex and abstract, are due to "experience." If so, the significance of all abstract words, and the objective truth of all individual thoughts, must be tested by the elements of which "experience" consists, and cannot in any instance claim protection against this test.

The important point is what "experience" consists of. Locke says that it all comes either from external sources or from the mind itself; and he promises to show that even our most abstract thoughts, which seem to reach to infinity, may be traced to one or other of these constitutents. In the first words, our most "complex ideas" are all made up of "simple ideas," either from without or from the mind; they are due to phenomena of which we are percipient in the five senses, or else due to reflexion upon "the operations of mind." The "reflection" of this position, in the central chapters of the second book, is to the effect that even those thoughts which are "most abstract, how remote soever they may seem from sense, or from any operations of our minds, are yet only such as the understanding fashions to itself by repeating and joining together ideas that it had either from objects of senses, or from its own operations about objects of sense; and that even large and even complex ideas, taken from one or other of the two sources (bk. ii. chap. 12, § 8). For this purpose our thoughts of space, time, infinity, power, substance, personal identity, causality, and several others which "seem most remote from the supposed original," are examined one after another, in the "historical plain method," and their complicated constitution is revealed to be made up of (a) perceptions of things through the five senses, or into (b) perceptions of operations of our own minds.

The source of experience which depends upon the five senses Locke calls *sensation*; the other, through which mind is reflectively aware of its own operations, he calls *reflection*. This last, "though it be not sense, as having nothing to do with external objects," is yet, he says, "very like it, and might properly enough be called internal sense." The suggestion that "sense" might designate both the springs of experience is misleading, when we find in the sequel how much Locke tacitly credits "reflection" with,—in the way of rational tendencies and intellectual obligations; it may be objected, to on grounds like those on which the somewhat analogous employment by Reid and others of the "common sense" for common reason has been condemned. They both mean to say that we may call that "sense" in which reason at once carries the light of its own evidence, and does not even admit of external proof. Reason in its own evidence is then supposed to be what is so popularly assumed to be. The elasticity of Locke's language in explaining his thesis makes the most opposite interpretations of the *Essay* possible, and all we can do is to compare one part with another, and in doubtful cases to give him the benefit of the doubt. His reluctance in the use of words is unfortunate. It was partly caused by a determination to avoid rigid technicalities, and partly by "Sensation" for instance is, in one definition, confined to "impressions or motions made in some part of the body which produce perceptions in the understanding" (bk. ii. 1, § 28); yet, when treated as one of the two springs of experience, it is made equivalent to what philosophers now call *self-perception*, while "reflection" turns out to be another name for *self-consciousness*. Accordingly, although the second book is professedly limited to the examination of our ideas or thoughts only, it by implication makes the (provisional) assumption that the "ideas" of which we are conscious in "sense" are at the same time to be regarded as "qualities" of sensible things which in some sort or other are perceived by us. It is also that the successive "operations" presented in "reflection" are those of an individual mind, presumed to exist somehow independently of them. Locke thus starts as a *common sense* perceptualist, and likewise relieves himself of the difficulty of having at the outset to show how the data abstracted by each sense are united in real

things and persons. In order to make his theory work, he begins by assuming a *Hypothetical duality* beneath phenomena—some phenomena referable to external things, others referable to the conscious self,—and in fact confesses that this dual experience is the ultimate fact, the denial of which would make it impossible to speak about the growth and constitution of our thoughts.

In the early chapters of the second book, the "simple" thoughts into which he promises to resolve all possible "complex" ones are arranged in classes. Some of them, he reports, are constituted "by one sense only," as colours by sight, or heat, cold, and solidity by touch, others "by more senses than one," as space or extension and motion, which are perceptible both by the eyes and by touch, or a third class are got from reflexion only, when "the mind turns its view inward upon itself," and by this means we get our ideas of perception or thinking itself, and also of willing, as well as the "modes of these two," such as remembrance, discerning, reasoning, knowledge, faith, &c.; lastly, there are simple ideas which we have both from sensation or reflexion. For instance, our thoughts of bodily and mental pleasures and pains, as well as thoughts of existence, unity, power, and succession. Such, according to Locke, are the elements of the simplest human thoughts. While the mind is becoming gradually stored with simple ideas like these (which are, however, somehow complex for us, when we "are conscious of them"), we find a growing power to elaborate them for ourselves at pleasure in an almost infinite variety; we are in fact obliged to do this in our tentative endeavours inductively to bring the thoughts of our individual minds into harmony with the actual complexity of thought that is presumed to us in the order of nature. "But it is not in the power of the most exalted wit or enlarged understanding to invent or frame any new simple idea not taken in in one or other of these two ways,—in proof of which Locke would have any one try to fancy any taste which had never affected his palate, or frame the thought of a scent he had never smelt, and when he can do this he is ready to concede that a born blind man has ideas of colours, and a born deaf man notions of sounds."

The contrast and correlation of these two fountains of individual experience is suggested in the eighth chapter of this book, on the "qualities of matter, in which we are introduced to a noteworthy vein of speculation running through the *Essay*. A chapter on "qualities of things" looks like an interpolation in an examination of our individual thoughts; its relevancy appears when we remember Locke's previous hypotheses, according to which simple ideas of matter may also be viewed as qualities of things. Now, our original sense-thoughts are, we find, partly revelations of *external things themselves* in their essential externality or extension, and partly sensations, boundless in their variety, which are somehow raised in us through contact with the things. Locke calls the former primary qualities, the latter secondary qualities of matter, and the others its secondary or derived qualities. The primary, which involve mathematical relations, and might be called quantities rather than qualities, are inseparable from matter as matter, and somehow exactly correspond, he reports, to the thoughts we have of them. On the other hand, there is nothing in the mathematical relations of space-occupied body which in the least resembles our ideas or thoughts of the secondary qualities; they are qualities of bodies at all, rather than sensations in us, only in so far as our different secondary sensations somehow correlate with (unknown) sizes, shapes, and motions of the primary particles, with which they are thus in an established harmony. Therefore, if there were no sentient and intelligent beings in existence, the secondary qualities would cease to exist,—except perhaps as unknown modes of the primary, or, if not, as "something still more obscure." On the other hand, "solidity, extension, figure, and motion, and rest were really in the world as they the moment there were any sensible being to perceive them or not" (bk. ii. chap. 21, § 2). The outcome of what Locke teaches about the mutual relations of matter (*a*) known as occupied-space, and (*b*) known in and through the sensations caused by secondary or relative qualities, is that it is something capable of being expressed at once in terms of mathematical quantity or extension, and also in terms of sense-consciousness. A further step would have led to the conception of the correlative dependence of all the so-called qualities of bodies upon "the bulk, figure, number, situation, and motions of the solid parts of which they consist," and which, as we think of them, whether we think of them as they are perceived. The true conception of an individual body would then be a conception of the actual mathematical relations of the atoms of which it consists, regarded as the established "occasions" of the sensations of colour, resistance, sound, taste, or smell which we refer to it as qualities; and also of the fact that it occasions in the minds of those whose individual bodies consist, which are followed by their operating on sentient beings differently from what they did before, as when the sun melts wax. But Locke only suggests in a hesitating way that the powers of bodies which are manifested in sensible changes may be conditioned by unknown changes in the mathematical relations of their inextensible atoms, or, if not thus dependent upon them, conditioned by

"something yet more remote from our comprehension." For, not knowing what size, figure, and texture of particles are which depend and from which result those qualities which make our complex ideas, for example, of gold, "it is impossible we should know what other qualities result from, or are incompatible with, the same constitution of the insensible parts of gold, and so consequently must always consent with that complex idea we have of it, or else be inconsistent with it."

Some of the most remarkable chapters in the second book are those which relate to the verification of its initial proposition. They carry us towards the metaphysical mystiques which so attract mediæval minds. The hypothesis that our most complex thoughts are all resolvable into "experience" is tested in those chapters by the *modes or modifications, and substantiations, and relations* which, in various degrees of complexity, we find ourselves somehow obliged to make the simple phenomenal thoughts of sense and reflexion undergo. Such, for instance, are the thoughts of finite quantity in space and time and number, in which Locke reports that we find ourselves mentally impelled towards immensity, eternity, and the unmeasurable, that is to say, towards Infinity, which transcends quantity; the complex thought of Substance, towards which he reports that we find ourselves impelled in another of the "operations of our minds," when the simple phenomena of the senses have to be regarded as powers or qualities of "something"; the thought of the identity of individuals, involved in the apparently inconsistent ideas of their constant phenomenal changes, and, above all, the mental tendency we find we somehow have to suppose what we call "Cause" whenever we observe a change. Let us see how Locke deals with these crucial instances.

He dwells much on our uses of Space, Succession, and Number. The first he says begins to appear when we use our senses of sight and touch, the second he finds "suggested" by all the phenomena of sense, but still more by "what passes in our minds"; the third "suggested by every object of our senses and every thought of our minds, by everything that either doth exist or can be imagined." The modifications of which these three sorts of simple ideas are susceptible he reports to be "inexhaustible and truly infinite," extension alone affording a boundless field to the mathematician. In his own nearest practical way, he finds many curious analogies between space and time. Neither is limited by the world of individual things. We can imagine space without bodies, but we cannot perceive or imagine bodies without space. Places and periods are all relative to objects and events, but both space and time are absolute in their nature. Time is finite in all directions, but while time has only one dimension. All things exist in the same present time, while no two things occupy the same space. The parts of time cannot be thought to occur; the parts of space cannot be thought to succeed one another. Whether the thought of unoccupied space is the thought of a substance or of an attribute Locke professes that he cannot tell, at least till they that ask show him "a clear distinct idea of substance."—"But the real mystery which he has to report of these thoughts of space and time is that "something in the mind" hinders us from imagining any limit to either. We find ourselves, when we try, obliged to lose our positive thought of space in the negative thought of immensity, and our positive thought of time in the negative thought of eternity. We have never seen, and we cannot mentally imagine, an object whose extent is boundless. Yet we find when we reflect that there is an "operation of the mind" which somehow forces us to think that space and time have no limits. "I would fan meet with that thinking man that can in his thoughts set any bounds to space more than he can to duration" (§ 21). Thus Locke by implication acknowledges something added by the mind to the originally presented simple ideas of extension and succession, though he explains that what is added is not positively imaginable. When we reflect on our thoughts of immensity and eternity, we find them to be thoughts, yet negations of all imaginable thought; and that whether we proceed by addition or by division. He characteristically accepts the fact; he does not inquire why mind should find itself thus obliged to add without limit, and to divide without limit. He simply reports that immensity and eternity are inevitable negative ideas, and that every endeavour to transform them into positive or imaginable ones only issues in the contradictory attempt to represent as a bounded quantity what is really infinite or beyond quantity. The idea of the infinite, or unmeasurable in extent and in succession, has so far, he finds, "something that is receivable into the simple positive ideas of space and time." For, when we try to think of the infinite in space or duration, we at first usually make some very large idea (imaginable in itself, though by men unmeasurable, or perhaps of millions of miles, or of days, or years, or we multiply millions of millions of times. All that we thus attain in our thoughts is positive (i.e., imaginable in its nature, although not imaginable by a human mind). But at the end of this we are as far from the infinite reality as we were at the beginning, so that what lies beyond the imaginable idea *remains* the infinite *He* "in obscurity and has the indeterminate confusion of a negative idea,"—inseparable and incomprehensible.

Locke, with all his aversion to what is unrepresentable in forms of existence and succession, is too faithful to rational facts to overlook these mysterious elements of our rational experience. His integrity is also illustrated in his acknowledgment of the unimaginable, and in this sense inconceivable, in our thought of Substance. He tries to phenomenalize it, but he finds that it cannot be phenomenalized, and yet that we cannot dispense with it. An unsubstantiated succession of phenomena, without a centre of unity to which they are referable, is unintelligible, we could not have a language consisting only of adjectives. Locke had an obscure apprehension of this intellectual obligation as a fact of rational consciousness. According to his reports, "the operations of the mind" oblige us to suppose something beyond phenomena, to which as qualities phenomena must belong; but he was honestly perplexed by the "confused negative" thought of this "something," which was all that he could reach, and of which he says we "neither have nor can have any positive idea either by sensation or reflection." The word substance thus means "only an uncertain supposition of we know not what" (i. 4, § 18). All attempt to realize it is like the attempt to reduce immensity or eternity, and we are involved in an endless—inevitable yet incomprehensible—regress. If one were to ask what the substance is in which the colours and that taste and smelling "where," and was told that they belong to the solid and extended parts, or primary qualities, of the thing, he must again ask what their substance is, and so on for ever. "It would be in a difficulty like the Indian, who, after saying that the word rested on an elephant, and the elephant on a broad-backed tortoise, could only suppose the tortoise to rest on 'something, I know not what.'" We must fail, in short, when we try earlier to phenomenalize our thought of substance or to dispense with it. He finds that our only positive complex ideas of substances are these in which we imagine an aggregate of attributes; it is only thus that we can rise to any positive thought even of God, in "the power we have of enlarging indefinitely some of the ideas we receive from sensation and reflection" (ii. 28, § 83). Why we must be in this strange mental predicament with regard to our thought of substance, Locke characteristically did not inquire. He reported the fact in his own case, and in the case of others.

He struggled bravely to be faithful to facts in his report of the no unlike mental predicament in which we find ourselves when reflection awakens in us the conviction of our own individuality and continued personal sameness. The paradoxes of expression in which he gets involved in the effort to express personal identity are evidence of this. He makes the thought of our actual individual personality, given in our consciousness of something external to self, and above all in our moral experience of responsible agency, with the negative thought of the transcendental relation of substance, which, we try to phenomenalize, to be the source of an uncertain supposition of we know not what.

But we must pass on to his report about our thoughts of Causality and Power, especially as his theory of real knowledge in the fourth book is very much an application of the principle of causality. The intellectual demand for the cause of an event is what we find we cannot help having, and yet it is a demand for what in the end we cannot grasp in a phenomenal representation. The causal thought in the form of power very much perplexed Locke, in his famous chapter on that idea (21); the perplexity is not so obvious in the sections on "cause and effect." In another chapter (26), where he considers only the circumstances in which this relational thought arises, he does not help having, and yet it is a demand for what in the end we cannot grasp in a phenomenal representation. The causal thought in the form of power very much perplexed Locke, in his famous chapter on that idea (21); the perplexity is not so obvious in the sections on "cause and effect."

Locke traces the thought of "cause and effect" back to our "constant observation" that "qualities and finite substances begin to exist, and receive their existence" from other beings which produce them. Soaring, for instance, flat, in the substance in which we call water, is constantly produced by the application of a certain degree of heat, we somehow come to think of heat as the cause and fluidity as the effect. This is to report what happens in our minds when we observe a particular example of that causal connexion which gives intelligibility to successive phenomena, converging into the concentrated system which we call the universe. Through calculated observations we, in this way, learn that *this* is the cause of *that*, and that *such as this* is the cause of *such as that*. But Locke's words in the 26th chapter do not explain the rational need for this causal expectation. Anything, as far as we can know, is constantly produced by the cause of anything; no finite number of instances can be "observed" sequence—in the strict meaning of the term—"observation"—can guarantee its universality. Elsewhere, indeed, he adds to this meagre account the important statement that "Our clearest idea of power is got through our consciousness of our own voluntary agency, and therefore through reflection" (ch. 21). Really phenomena he there reports to be incapable of presenting originary agency, this being an idea which cannot be phenomenalized in external sense. In changes among bodies we observe no origination, but only phenomenal order—significant and therefore interpretable phenomena. The thought of the "production" of actions is connected with what we are conscious of when we exert volition. Locke here approaches the view of power afterwards taken by

Berkeley, which was the constructive principle of Berkeleyan philosophy. But neither Locke nor Berkeley explains the transformation of our moral consciousness of ourselves, as free or originary, and therefore, to this extent, responsible agents, into the universal rational principle, on which both proceed in explaining our knowledge of the real existence of God and of the sensible world. Locke's language sometimes suggests that the transformation is made through an induction that is either instinctive or produced by custom. Now, not to say that every inductive generalization presupposes causal connexion, the particular fact that this, that, or the other person, through his moral experience, finds *himself* a free cause, does not, consistently with inductive rules, warrant the *general* conclusion that the phenomenal changes of the universe must all be referred to power like our own personal power. That we are somehow obliged to think a cause or phenomenal cause, and ultimately an uncaused or free agent, of every change—that we are obliged to view changes as events or issues from adequate productive causes into which they may be referred—is vaguely accepted in the *Essay* as a fact of rational consciousness; but no explanation is given of its origin, only of the circumstances in which it arises in the individual mind. The suppositive reason also asks why the individual mind is obliged to think back all changes into sufficient causes of which they are the issues, and why each set of antecedent phenomena, into which we thus refund new phenomena, themselves occasion a fresh intellectual demand for a preceding cause, while, after all, the mind is still left dissatisfied until it rests in a truly originary or unconditional cause. And yet if the intellectual need for a phenomenal cause were withdrawn there could be no rationality in, and therefore no reasoning possible about, Nature, for all the physical government of the universe depends upon it; and again, if uncaused or unconditional power were withdrawn there could be no moral responsibility or moral government. This sort of *reductio ad absurdum* of every merely empirical analysis of the causal thought into what is strictly observable was foreign to Locke. His aversion from mysticism may have made him pass slightly over the mystery of an experience that like ours is conditioned by relations of place, which lead to the unimaginable thought of Infinity, of succession, which lead to the unimaginable thought of Eternity, and of change, which lead to the unimaginable thoughts of Substance and Power.

Locke's book about our individual ideas or thoughts leads naturally to his Third Book, which is especially about those of them which are powers and abstract; and more especially regarding the latter. It is here that he describes "abstract ideas;" here also he illustrates the confusion apt to be produced in our thoughts by the imperfections of language.

But we must pass on to the Fourth Book, about knowledge, which we described in the *Essay*. It is, as we perceived, a discernment of relations among our thoughts, a knowledge of their government, and therefore a knowledge of their nature. In his books about our "ideas" he had dealt with "simple apprehensions;" here he is concerned with "judgments" and "reasonings," and largely with judgments and reasonings about matters of fact. At the end of the long and patient research among our mere thoughts or simple apprehensions, he supposes his reader apt to complain that he has been "all this while only building a castle in the air," and to ask what the purpose is of all this stir about our thoughts, or our knowledge either, if we are not thereby carried beyond our own individual thoughts, and must accordingly regard our faculties as the universe. "If it be true that knowledge lies only in the agreement or disagreement of our own ideas, the visions of an enthusiast and the reasonings of a sober man will be equally certain. It is no matter how things themselves are" (iv. 4, § 1). This is the keynote of the fourth book. It does not, however, carry him into an analysis of the nature of knowledge, but he regards as knowledge, as it would carry a transcendentalist of the 19th century, or even an associative philosopher. Transcendental analysis is too remote from human affairs to interest Locke. Hence, moreover, had not yet shown the difficulties which sceptical ingenuity could suggest against those facts of rational consciousness which Locke accepted without analysis.

The sceptic who doubted the very constitution of reason and experience, because it could not be supported by external proof, was less in his view than minds blindly resting on authority or on irrational instincts. Universal scepticism like Hume's he would at any rate probably have regarded as a frivolous amusement, into which no human mind could permanently subside, and therefore unworthy of the serious attention of a wise man. What he wanted was to awaken a conscious conviction of principles apt to be dormant in the individual, but to which he believed a response must be given when reflection was called forth. He was anxious to show how these principles might be developed into a reasoned system of speculative philosophy. "Where we perceive the agreement or disagreement of any of our ideas there is *certain* knowledge; and wherever we are sure these ideas agree with the reality of things, there is *certain* real knowledge" (ch. 4, § 18). He is anxious throughout to show that a great deal of commonly supposed real

knowledge is not entitled to be called "knowledge," and that it is merely presumption more or less probable. Instead of the immediate or the demonstrable insight, which alone is what he intends by knowledge, it is only "assent," "opinion," "probability."

Locke's report about human knowledge and the narrow extent of it is contained in the first thirteen chapters of the fourth book. The remainder of the book is concerned for the most part with what his found when he examined instances of "assent" or reasonable presumption, so liable to error, but on which human life really turns, as he and Butler are fond of reminding all transcendentalists. He takes for granted that "all the knowledge we have or are capable of" must be discernment of one or other of four sorts of agreement or disagreement among our thoughts themselves, or between our individual thoughts and the reality that is independent of them. All that can be conceivably known must be either (a) relations of identity and difference in what we are conscious of, that, for instance, "blue is not yellow"; or (b) that thought being mathematically related to that, as, for instance, that "two triangles upon equal bases between two parallels must be equal"; or (c) that one quality does or does not coexist with another in the same substance, as that "iron is susceptible of magnetical impressions"; or (d) that a thought has a real objective existence, independent of our individual mind, as that "God exists," or the "earth exists." What would now be called merely analytical knowledge exemplifies the first sort, mathematical Locke would add moral knowledge represents the second; physical and natural science, if this can become knowledge proper at all, would come under the third head, metaphysical knowledge forms the fourth. The third and several following chapters of this concluding book of the *Essay* are really an inquiry, under these four heads, how far knowledge is possible for man in mathematics, and in morality; about nature of natural phenomena in relations of coexistence and succession; and about the hyperphenomenal reality of our own existence, the existence of God, and the existence of matter.

Locke found a difference among the examples of what "knowledge" is that was offered in his natural experience. In some instances the known reality was at once evident, as when he judged that a circle was not a triangle, or three more than two and equal to one and two. In other cases the known relation was perceived only through the medium of something else, as in a mathematical conclusion, in which each step is taken by a rational intuition. The former is rational knowledge, the latter is rationally demonstrated knowledge. In strictness all knowledge or rational certainty, he would have it, is in one or other of these two kinds. There is, however, a third sort of certainty which rather puzzled him. He found that "our perceptions of the particular existence of finite beings without doubt, and the highest probability, although they are not examples of rational necessity. There is nothing contradictory to reason in the supposition that our sense-perceptions are illusory, although we are, in fact, incapable of doubting their reality. We find ourselves 'inwardly conscious of a different sort of perception,' when we look on the sun by day and only imagine the sun at night. This, which is Locke's third sort of knowledge, might be called sense-perception. This difficulty that a "sense-perception" only of the present moment, divorced from the past and the future, can be other than "blind," or irrational, does not occur to him.

Locke next inquired to what extent a human knowledge—or the way either of intuitive or demonstrative rationality, or of sense perception—is possible in regard to each of the four (already mentioned) sorts of knowable relation in which must be contained all knowledge we can be supposed capable of. Of our knowledge must of course be confined within our "ideas"; for it is self-evident that we cannot have knowledge of a thing if consciousness is dormant. But there is only one of the four sorts of knowable relation in regard to which our knowledge is coextensive with our thoughts. The only knowable relation which he finds to be coextensive with his thoughts is that of "identity and diversity"; he cannot be conscious of all without distinguishing, and every distinction implies negation. The second sort of knowable relation—purely rational constatement among our thoughts—is intuitively and also demonstrably discernible in thoughts about quantities, in forms of space, time, and number; it is through this channel that the mathematical sciences are constructed. Morality too, Locke thinks, as well as quantity, is capable of being thus rationalized. "Where there is no property there is no injustice," he offers as an example of a proposition "as certain as any demonstration in Euclid." Only we are more apt to be biased, and thus to have reason withdrawn from us, in dealing with problems of morality than in dealing with those of mathematics. Mankind might in consequence, in questions of morals, "with Egyptian darkness expect Egyptian bondage, were not the candle of the Lord set up by himself in their minds" (ch. 4, § 20). It is not easy to say whether the mathematical sciences which Locke finds thus demonstrable would be, as understood by him, sciences of what Kantists call analytical judgments founded on arbitrary definitions, or sciences consisting of synthetical judgments *a priori*.

In turning from mathematical and moral relations to those of

coexistence and succession among phenomena,—Locke's third sort of knowable relation,—he finds the light of pure reason disappear, although the relations in question are those in which "the greatest and most important part of what we desire to know" consists. Of relations of this third kind, with which all the physical and natural sciences are concerned, he repeats that "our knowledge is very short, if indeed we have any at all," and are not wholly thrown on presumptions of greater or less probability, or even left in ignorance. According to the philosophy of this *Essay* "there can be no sciences of bodies." All physical and natural sciences depend on a knowledge of the relations between the secondary qualities and other powers of bodies on the one hand, and the primary or mathematical qualities of their atoms on the other, or else "on something yet more remote from our comprehension." Now, as a rational insight of these relations, either instantaneous or through demonstration, is beyond our reach, we must be satisfied with inductive presumptions, which the completest "verification" leaves, after all, only presumptions that more facts might prove to be unwarranted. Our inductive generalizations about particular things must always involve an element of possible error, or at least inadequacy, and therefore of probability only. The presumption is "sufficient for all other things, except Arbitrariness of connexion, and not rational necessity, require over the whole realm of physical government, with its relations of constant coexistence and succession; we only presume, as reasonably as we can, what its actually established laws are, and we can only presume that these laws are sustained in a steady and uniform government." The presumption is "sufficient for all other things, except Arbitrariness of connexion, and not rational necessity, require over the whole realm of physical government, with its relations of constant coexistence and succession; we only presume, as reasonably as we can, what its actually established laws are, and we can only presume that these laws are sustained in a steady and uniform government." The presumption is "sufficient for all other things, except Arbitrariness of connexion, and not rational necessity, require over the whole realm of physical government, with its relations of constant coexistence and succession; we only presume, as reasonably as we can, what its actually established laws are, and we can only presume that these laws are sustained in a steady and uniform government."

The amount of our knowledge under Locke's fourth category of knowable relations—those of real metaphysical or metaphenomenal existence—is reduced, in his report, to—(a) rational perception of our own individual existence as conscious persons, (b) the demonstrative rationality of the existence of God or Supreme Mind, and (c) sense-perception of the existence of particular objects—as long as, but only as long as, they are actually present in sense. That each individual person exists is manifested to himself in memory, and no certainty beyond that of each passing thought while it passes can be greater than this. "If I doubt that I exist, says Locke, after Descartes, 'that very doubt makes me perceive my own existence, and will not suffer me to doubt of that' (iv. § 8). The eternal existence of God or Supreme Reason is with Locke only another way of expressing the principle of causality and sufficient reason in its universality as manifested by our conviction that our own personal existence had a beginning. Each individual person knows that he now exists, and is convinced that he once had a beginning; with not less intuitive certainty of reason he knows that nothing can no more produce any new being than that it can be equal to it, or be right angles to it. The final conclusion is that there must be eternally "a most powerful and most knowing Being, in which, as the origin of all, must be contained all the perfections that can ever after exist," and out of which can come only what it has in itself, so that, as the adequate cause, it must involve matter. There is thus a rational assurance for Eternal Reason, or what we call God. He cautiously adds elsewhere, "Though I call the thinking faculty in me 'mind,' yet I cannot, because that name, equal it in any thing to that infinite and incomprehensible Being which, for want of right and distinct conceptions, is called 'mind' also, or the eternal mind."

Turning from the metaphysics of religion to the metaphysics of matter, nearly—but perhaps not quite—all that one can affirm or deny about things external to us is, according to Locke, not knowledge but only presumptive truth. We have on the whole as much knowledge of the real existence of anything other than our individual existence, that of Universal Reason, and that of particular objects of sense—while, but only while, they are present to our senses. "When I see an external object at a distance, a man for instance, I cannot but be satisfied of his existence while I am looking at him," (Locke might have said, "while he has a sense of me") "it is only his *visible* qualities that are perceived; for his other qualities are as little 'actual present sensations' as if he was out of the range of the senses altogether." But when the man leaves me alone, I cannot be certain that he still exists. There is no necessary connexion between his existence and my sense (when he was present to my sense of sight) and his existence now (when he is absent from all my senses); by a thousand ways he may have ceased to be. I have not that certainty of his continued existence which we call knowledge; though the great likelihood of it puts it past doubt. But this is but probability and not knowledge" (chap. II, § 9). Either a rationally intensive or a rationally demonstrative science of Nature is thus, according to Locke, impossible. A conception of the co-existences and successions of phenomena which form the external world being essentially the natural expression of the Universal Mind, we are therefore capable of being reasoned about by our individual minds, in our gradual scientific progress towards agreement between the objective thought in nature and our subjective thoughts, was too speculative and mystical for Locke. He prefers to urge the matter-of-fact consideration that all our interpretations

of nature can be only presumptive probabilities—not purely rational certainties. For into the vast regions of reality—beyond our immediate sense-perceptions, memory, and the demonstrably necessary causal connection with Universal Mind—no other presumed probability, grounded on faith, or else it is within that veil which equates what is behind it from reasonable belief as well as from knowledge. And he even fails to explain how anything at all above the world of sense can be “known” in a sense-perception that is restricted to the transitory “actual present sensation” of each moment. No past events and no future events can be known in the strict meaning of “knowledge.” It is unreasonable to demand a knowledge of nature that exceeds present and present-momentary experiences. For the rest, we can only gradually convert beliefs into certainties that are absolute for all practical purposes. Such is the outcome of the *Essay*.

We might expect to learn from Locke something as to the rationality of the probable presumptions by which, as supplementary to our limited knowledge of real existence, we pass beyond the narrow sphere within which that knowledge is confined, according to his report of it, and possess ourselves so far of the unperceived past, distant, and future, in our experimental reasoning. He does little to satisfy us here. The concluding chapters of the fourth book contain valuable advice for human beings, whose lives are passed in a world of probabilities and presumptions, for avoiding the consequent risks of error or misinterpretation in their reasonings about what they see,—with or without the help of syllogism, the function of which, is an organ of discovery, he criticizes in the seventeenth chapter. Nothing is done to connect “probable” interpretations of the contingent phenomena of existence with the rational relations involved in the knowable part of the constitution, with which the preceding chapters were occupied.

This subject was resumed by Hume, very much at the point where Locke left it. With a still bolder view of the possible extent of human knowledge than Locke's, Hume proposed as a subject “worthy of curiosity,” to inquire what is “the nature of that evidence which assures us of any real existence and matter of fact, beyond the present testimony of our senses and the records of our memory,” remarking that “his part of philosophy has been little cultivated—because the ancients and the moderns.” The result of the inquiry was his announcement that Custom and the associative tendencies are a sufficient practical explanation of the formation of our experience. All beyond each present transitory “impression” is connected with it, through “ideas,” by means of Custom and Association. Hume's solvent, in the form either of individual or of inherited associative tendency, has since been made the philosophical explanation of all human experience in the Empirical Philosophy to which his *Inquiry* conducted. As for Locke, the “association of ideas”—either in the individual or as inherited—was introduced in the first edition of the *Essay*. The short chapter on the subject—now found at the end of the second book—was introduced in the second edition, not as in any way philosophically explanatory either of the thoughts or of the knowledge and probable beliefs of men, but as the chief source of human prejudices—as a cause of human errors against which men, dependent largely on probable presumptions, need in an especial manner to be warned. This useful chapter was an afterthought added, regarding a tendency which Locke saw was apt to spoil the “quality” of our individual thoughts,—apt, if one may put it so, to make them inconsistent with the Universal Thought latent in nature, by which our personal thoughts about what the laws in nature are must be tested.

On the other hand, an analysis like Kant's of what is abstractly implied in knowledge is even more foreign to the design of Locke, and to the tone of his philosophy, than the attempts of 18th and 19th century associationists and evolutionists to account for knowledge as if it were a fact of physical science. To show, in the case of any self-evident conception or judgment, that without it knowledge could not exist at all, would be to show what Locke took for granted, for for all the purposes he had in view. His aim was to determine to what extent experience, presumed to be rationally constructed, could come within the individual consciousness of man. On the one hand, to analyse in the abstract the rational constitution of knowledge, into which he found that man is able only very partially to subdue the universe, or, on the other hand, to seek for the physical causes of its (partial) realization in the human individual, were neither of them inquiries properly included in his enterprise.

Locke's function was to present to the philosophical mind of the modern world, in his own “historical plain method,” the largest assortment ever made by any individual of the actual facts of sense consciousness and rational consciousness in man. The further investigation of these facts, in Germany on the Transcendental Method, in England and France on the Empirical Method, as well as by Butler and Reid, in Locke's own Common Sense Method—all under the stimulus of Hume's sceptical analysis—has employed philosophy since the *Essay on Human Understanding* collected materials for speculation.

Literature—The *Essay on the Understanding*, which was thus the philosophy of Locke's own life, and also of the century which followed, has passed through more editions than any similar book of ancient or modern times. Before the middle of the 18th century it had reached a sixteenth, and it has now passed through some forty editions, besides being translated into Latin, French, Dutch, German, and modern Greek, in various versions. There are also several abridgements, in which the attempt is made to convert some of its immovable repetitions. A considerable philosophical library might be formed out of the editions and commentaries which are left given in the two hundred and ninety years. In addition to those which appeared when Locke was alive, some of which are mentioned above, among the most important are Leibnitz's *Remarques sur l'Entendement Humain*—written about 1700 and published in 1766, in which each chapter of the *Essay* of Locke is examined in a corresponding chapter. Comte's *Revue Scientifique* Systeme de Locke, in his *Revue de la Philosophie au XVIIIe Siècle*—written about 1780 and published in Professor Gauthier's Introduction to the *Philosophical Works of Locke*, 1874. The letters on Education, on Education, on Education, and on Education, which have also gone through many editions, and have been translated into different languages. The first critical edition of Locke's *Works* was in 1714, in three folio volumes. The new edition is that by Bishop Leys, in four quavos, 1777. The one most commonly known is in ten volumes, 1812. The *Essay*, as well as the other treatises, would require revision and critical annotation.

The *Stages of Life* (*Stages of Life*, 1703) has been the basis of the memoirs of Locke printed in the successive editions of his *Works*, and contained in the biographical dictionaries. In 1880 a *Life of Locke* in two volumes, was published by his descendant Lord King. This adds a good deal to what was previously known, as Lord King was able to draw from the mass of correspondence, journals, and accompanying books of Locke in his possession in the same year Dr Thomas Foster published some interesting letters from Locke to Benjamin Furley. The most copious account of the details of Locke's life is contained in the two volumes by Mr Fox published in 1895, which are full of interesting and faithful research in the Shaftesbury Papers, Locke MSS in the British Museum, the Public Record Office, the Leibnitz, Clarendon, Ashmole, and Bodleian Libraries, and in the Remains of the History of Shaftesbury (O. P.).

LOCKHART, JOHN GIBSON (1794–1854), was born in the manse of Cambusnethan in Lanarkshire, where his father, Dr Lockhart, was minister. His mother was daughter of the Rev. John Gibson, minister of St. Catherine's, Edinburgh. In 1796 his father was transferred to Glasgow, where John Lockhart was reared and educated. He derived his rare abilities from his mother, and his first regular teaching from the High School of Glasgow. He appears to have been from the first distinguished as a clever, but by no means industrious boy. Like most clever boys he read everything that came in his way; and what he had once devoured he never forgot, for his memory was so retentive that, in after life, like Macaulay and Sir George Lewis, he seldom found it necessary to verify a passage for quotation. No livelier boy than John Lockhart ever lived; in or out of school his sense of fun and humour, expressed in joke, sarcasm, and pencil caricatures, was irresistible. At the same time, however merry and mischievous, he was a proud and reserved boy; and this was the side he mostly turned to the outer world as a man. The struggle between a very affectionate nature and a determination not to show his feelings, or perhaps an incapacity to give way to them, cost him dear. A younger brother and sister were carried off within a few days of each other. John appeared to bear the loss like a stoic, but he fell seriously ill, and had to be removed finally from the High School. On his recovery, though still under twelve years of age, he was entered at college, where he sketched the professor for the amusement of his companions, as he had sketched the masters before. When examination time came, he astonished all by a display of erudition, especially in Greek authors, of the acquisition of which he had given no signs; a Small exhibition, just vacant at Oxford, was accordingly offered to him and accepted.

Lockhart was not turned fourteen when he was entered at Balliol College, but he soon asserted his character and his powers. His fun and satire made him, on one popular and formidable, while beyond the regular studies of the place he acquired a great store of extra knowledge. He read French, Italian, German, and Spanish, was curious in classical and British antiquities, and well versed in heraldic and genealogical lore. Lockhart went up to the schools in the Easter term of 1813—not nineteen years of age—and, notwithstanding the most audacious employment of part of his time in caricaturing the examiners, he came out first in classics. The name of Henry Hart Milman, a subsequent friend through life, stood next his. For mathematics he never had the least inclination.

He now quitted Oxford, and before settling to the study of Scottish law, for which his father had designed him, he indulged a long cherished wish to visit Germany. His knowledge of German had introduced him to the great band of poets and scholars who had suddenly exalted the fame of German literature. Lockhart had no means to undertake the journey; but here his reputation came to his aid. A proposal to translate Frederick Schlegel's *Lectures on the Study of History* was accepted by Mr Blackwood, and the price of the labour paid before a line was written. Lockhart always spoke of this as a most generous act on "Ebony's" part, and his friendship with the liberal publisher lasted through life. He meanwhile paid his visit to Germany, was introduced to Goethe at Weimar, traversed France and the Netherlands, made careful observations on pictures and architecture, and returned to Edinburgh to study law by the time he was twenty-one. In 1816 he was called to the bar. But he had no friends among writers and attorneys, his brilliant powers of conversation did not comprise that of public speaking, and few, if any, briefs came in. His habits of observation, however, turned the time to a use afterwards exemplified in *Peter's Letters*.

Edinburgh was then the stronghold of the Whig party. The *Edinburgh Review* was their organ, and it was not till 1817 that the Scotch Tories found a national channel of assertion and defence—namely, in *Blackwood's Magazine*. This periodical held its way dully enough with its first numbers, when suddenly an outburst of wit and ridicule directed against the hitherto unchallenged writers of the Whig party, surpassing them in cleverness and equalling them in personalities, electrified the Edinburgh world. Wilson (Christopher North), Hogg (the Ettrick Shepherd), and Lockhart had joined the staff, and retaliation for long pent-up wrongs began. Lockhart's pen contributed scholarly papers on various subjects, including hearty criticism and eulogium on Coleridge, Wordsworth, and other victims of a *Review* which could find only scant praise even for Walter Scott. His translations also of the Spanish ballads appeared for the greater part in *Blackwood*. But his pen was more often dipped in caustic, dealing out attacks and recriminations which led to regrettable consequences. Meanwhile the gifted and handsome young man, for Lockhart's head was cast in the highest type of brilliant manly beauty, had attracted the notice of Walter Scott. They met first in 1818. The acquaintance soon ripened into friendship, and that friendship led to the union between Lockhart and Scott's eldest daughter, Sophia, in April 1820. For more than five years after his marriage Lockhart tasted the best form of domestic happiness. Winters spent in Edinburgh and summers at a cottage fitted up for them at pretty Chiefswood, near Abbotsford, gave the young couple the constant enjoyment of friendship, society, and even worldly distinction, added to the blessing of a perfect home. At Chiefswood Lockhart's two eldest children, John Hugh and Charlotte, were born; Walter, later, at Brighton.

Between 1818, when he joined the *Blackwood* staff, and 1825 Lockhart's pen was indefatigably at work. As early as 1819 *Peter's Letters to his Kinsfolk* appeared. Luke Goldsmith's *Chimes of the World*, these profess to give the impressions of a stranger in a new country. Dr Peter Morris, a Welsh physician, passes some time in Scotland, especially in Edinburgh, and describes the men and manners very freely in his relations at home. His descriptions of the chief notabilities of the day have a certain historical, almost antiquarian interest, though now the least interesting part of the work. What we enjoy most is the reflexion of a young and ardent mind dealing out opinions and estimates far beyond its years, the cor-

rectness of which time has singularly verified. The amount of reading to which crops out in every page is amazing; a perpetual play of allusions, quotations, and happy nicknames—for which Lockhart to his last days was famous—is given with a raciness of tone of which the reader might tire, but for the simple, vigorous English in which it is clad. A chapter on dandies is a *chef d'œuvre* in its way. That a work describing the appearance and idiosyncrasies of many living individuals should give offence was a matter of course. His description of the northern universities was not likely to please, while for the unsparing ridicule and ruthless quizzing heaped on the General Assembly—"men," he is supposed to have said, "of like passions with ourselves, but worse manners"—it would be strange indeed if the author had escaped with impunity.

Valerius, a Roman Story, followed next (1821). As *Valerius* was intended to illustrate the manners and customs of Rome in the time of Trajan, so *Reginald Dalton*, published in 1823, aimed at exhibiting the life of an undergraduate at Oxford as he had known it. Lockhart's strength did not lie in novel writing, and to those who read *Reginald Dalton* now, the digressions of the author are far more interesting than the adventures of the hero. But a plot of simpler construction and intense passion showed Lockhart's strength to greater advantage. *Adam Blair* (1822) is a tale of temptation, fall, and repentance, each fearful in its way, told with tremendous power, and as far removed from all that is morbid and false in sentiment as the author was himself. It gave great offence to the Scottish Church, for the erring man is a minister, and the scene is laid in a Scottish manse.

In 1826, on the death of Mr Gifford, the editorship of the *Quarterly Review* was offered to Lockhart, and accepted. He was singularly free in position, however far from idia. He was next heir to Milton Lockhart, the property of his unmarried half-brother, who eventually survived him; the legal profession to which he had been destined was virtually abandoned, and time had shown him that the party strife which prevailed in Edinburgh was demoralising to both sides. This last conviction did the most to reconcile him to the separation from all Scottish surroundings. His friends gave him a farewell dinner, when, labouring with strong feelings, and with his habitual dislike or incapacity to express them, he said, on returning thanks, "You all know that I am no speaker; had I been, there would have been no occasion for this parting."

The conduct of a great periodical like the *Quarterly Review* is the touchstone of a man's capacity, knowledge, and temper. Looking back to an editorship which lasted twenty-eight years, it must be admitted that Lockhart maintained a high position in all these respects. He contributed largely to the *Review* himself, his biographical articles being especially admirable. He also found time, being a very glutton in work, for many a paper in *Blackwood*; he wrote what remains the most charming of the biographies of Burns; and he undertook the superintendence of the series called *Murray's Family Library*, which he opened in 1829 with a *Life of Napoleon*. But his chief work was the *Life of Walter Scott*, a task at once of love and duty. Lockhart knew the great and good man as no one else did, and felt that, whatever the mistakes in judgment, no life from first to last could better afford complete revelation. There have not been wanting those in Scotland who have taxed him with ungenerous exposure of his subject, but to most healthy minds the impression conveyed by the biography was, and is, one of the most opposite kind—namely, that Lockhart has almost defiled Scott. The labour incurred was in so far one of love, inasmuch as the writer reaped

no part of its considerable proceeds, but resigned them absolutely for the benefit of Scott's creditors.

Lockhart's life in London was a long succession of constant work, of dignified social success, and of heavy bereavements. His eldest boy, the suffering "Hugh Littlejohn" of the *Tales of a Grandfather*, died in 1831. Sir Walter died in 1832, Anne Scott, the second daughter, who had come to live with the Lockharts in London, in 1833; Mrs Lockhart in 1837. The love for his children was for long the one bright element in his life. But the death in 1852, and, sadder still, the previous life, of his surviving son Walter, a fine youth, who had entered the army under unfortunate auspices, broke down all that remained of health and spirit in the father.

Failing health compelled Lockhart to resign the editorship of the *Quarterly Review* in 1853. He spent the next winter in Rome, but returned to England with no restoration of vital power. He was conveyed to Abbotsford, where, under the tender care of his daughter Mrs Hope Scott, and obeyed by the prattle of his granddaughter, now the possessor of Abbotsford, he lingered till his death, November 25, 1854. He was buried in Dryburgh Abbey, at the feet of Walter Scott. (E. E.)

LOCKPORT, capital of Niagara county, New York, about 21 miles east of Niagara Falls, at the point where the New York Central Railroad crosses the Erie canal. It takes its name from the locks (ten in number) by which the canal is lowered 66 feet from the level of Lake Erie to that of the Genesee river, and its prosperity as a manufacturing centre is due to the water-power. The surrounding country is a rich agricultural district, and in the vicinity are extensive limestones and sandstone quarries. Flour-mills are prominent among the industrial establishments, there are also numerous saw-mills, cotton and woollen factories, foundries, &c. Lockport was made a city in 1835. The population in 1870 was 12,426; in 1880, 13,522. The buildings in the business part of the city are generally heated by steam on the Holly distributing system, which originated in Lockport, as did the celebrated Holly water-works system.

LOCLE, Le, a large town-like village of Switzerland, in the canton of Neuchâtel, 10 miles W.N.W. from Neuchâtel. Along with La Chaux de Fonds, 5 miles north-east, it is the seat of the most extensive watch-making industry in the world; and it also carries on the domestic manufacture of lace. The valley in which Le Locle is situated used to be subject to inundation, but in 1802-6 a tunnel was constructed by which the surplus waters of the Bied discharge into the Doubs. About a mile to the west of the town the stream plunges into a deep chasm, and on the almost vertical face of the rock are what are usually called the subterranean mills of Cal des Roches, situated one above the other, to turn the water-power to account. The population of the commune was 10,464 in 1880.

LOCRI, a people of Greece who are found in two different districts, on the Ægean coast opposite Eubœa and on the Corinthian Gulf between Phœcis and Ætolia. The former are divided into the northern Locri Epizephyrîi, so called from Mount Cnemis, and the southern Locri Opuntii, whose chief town was Opus; but the name Opuntii is applied to the whole district by Thucydides, Herodotus, &c. Homer knows no distinction of tribes among the Locri. They were considered by Aristotle to be a Lelegian tribe; but they became Hellenized at an early time, and rank in Homer along with the other Greek tribes before Troy. Their national hero is Ajax Oileus, who often appears on coins. The Locri Ozolæ on the Corinthian Gulf were a rude and barbarous race who make no appearance in Greek history till the Peloponnesian War. It is said that they separated from the eastern Locri four genera-

tions before the Trojan war, but Homer does not mention them. The most probable view is that the Locri were once a single race spread from sea to sea, that subsequent immigrations forced them into two separate districts, and that the eastern Locri advanced with the growth of civilization, while the remote Ozolæ remained ignorant and barbarous.

A colony of Locrians, probably Opuntians, though Strabo expressly calls them Ozolæ, settled at the south-west extremity of Italy about the end of the 8th century B.C. They are often called Locri Epizephyrîi from the promontory Zephyrion 15 miles south of the city. The earliest and most famous event recorded in the history of the Italian Locri is the legislation of Zaleucus about the middle of the 8th century B.C. The Locri boasted that Zaleucus was the first of the Greeks to promulgate a written code of laws. A body of laws under his name existed in the city throughout the historical period, but the name of Zaleucus is almost as much surrounded with legend as that of Lycurgus. The Locrians are said to have defeated the people of Croton in a great battle at the Sagras, perhaps some time in the 6th century B.C., and in this flourishing period they founded colonies along the south coast of the peninsula. Their nearest neighbour was Rhegium, and the continual wars that raged between the two cities often drew other states into their quarrels. They sent ships to aid Sparta in the Lacedæmonian war. They were allied with the elder Dionysus of Syracuse, who gave them great accessions of territory (389-88 B.C.); the younger Dionysius ruled them as tyrant (365 B.C.). They admitted a Roman garrison before the expedition of Pyrrhus, but sided against the Romans with him and with Hannibal (216 B.C.). The town was finally captured by Scipio (205 B.C.) From this time we hear little of Locri. It seems still to have existed in the 6th century A.D., but in the Middle Ages it had disappeared entirely. The site and remains have been described by the Duc de Luynes (*Ann. Inst. Arch.*, n.). It possessed a famous temple of Proserpine. The town is celebrated by Pindar, *Ol. x.* and xi.

LOCUS, in Greek τόπος, a geometrical term, the invention of the notion of which is attributed to Plato. It occurs in such statements as these:—the locus of the points which are at the same distances from a fixed point, or of a point which moves so as to be always at the same distance from a fixed point, is a circle; conversely a circle is the locus of the points at the same distance from a fixed point, or of a point moving so as to be always at the same distance from a fixed point; and so in general a curve of any given kind is the locus of the points which satisfy, or of a point moving so as always to satisfy, a given condition. The theory of loci is thus identical with that of curves; and it is in fact in this very point of view that a curve is considered in the article CURVE; see that article, and also GEOMETRY (ANALYTICAL). It is only necessary to add that the notion of a locus is useful as regards determinate problems or theorems. Thus, to find the centre of the circle circumscribed about a given triangle ABC, we see that the circumscribed circle must pass through the two vertices A, B, and the locus of the centres of the circles which pass through these two points is the straight line at right angles to the side AB at its mid-point; similarly the circumscribed circle must pass through A, C, and the locus of the centres of the circles through these two points is the line at right angles to the side AC at its mid-point; thus we get the ordinary construction, and also the theorem that the lines at right angles to the sides, at their mid-points respectively, meet in a point. The notion of a locus applies, of course, not only to plane but also to solid geometry. Here the locus of the points satisfying a

single (or onefold) condition is a surface; the locusts of the points satisfying two conditions (or a twofold condition) is a curve in space, which is in general a twisted curve or curve of double curvature.

LOCUST. In its general acceptation this term is strictly applicable only to certain insects of the order *Orthoptera*, family *Acruidae* (see **INSECTS**), and it is advisable to reiterate that according to modern classification the family *Locustidae* is now viewed in a sense that does not admit of what are popularly termed "locusts" being included therein. We universally associate with the term the idea of a very destructive insect; therefore many orthopteran species that cannot be considered true locusts have had the term applied to them; in North America it has even embraced certain *Hemiptera-Homoptera*, belonging to the *Cicadidae*, and in some parts of England cockchafers are so designated. In a more narrow definition of the term we are wont to associate with the destructive propensities the attribute of migration, and it therefore becomes necessary that a true locust should be a migratory species of the family *Acruidae*. Moreover, the term has yet a slightly different significance as viewed from the Old or New World. In Europe by a locust is meant an insect of large size, the smaller allied species being ordinarily known as "grasshoppers," hence the notorious "Rocky Mountain locust" of North America is to Eastern ideas rather a grasshopper than a locust.

In Europe, and a greater part of the Old World, the best known migratory locust is that which is scientifically termed *Pachytelus migratorius*, to which is attached an allied (but apparently distinct) species known as *P. cinerascens*. Another locust found in Europe and neighbouring districts is *Caloptenus italicus*, and still another, *Acridium peregrinum*, has once or twice occurred in Europe (even in England in 1869), though it can only be considered a straggler, its home (even in a migratory sense) being more properly Africa and Asia. These practically include all the locusts of the Old World, though a migratory species of South Africa known as *Pachytelus pardalinus* (presumed to be distinct from *P. migratorius*) should be mentioned. The Rocky Mountain locust of North America is *Caloptenus spretus*, and in that continent there occurs an *Acridium* (*A. americanum*) so closely allied to *A. peregrinum* as to be scarcely distinct therefrom, though there it does not manifest migratory tendencies. In the West Indies and Central America the absolutely true *A. peregrinum* is also reported to occur.

As to general biology, a few words will suffice. The females excavate holes in the earth in which the eggs are deposited regularly arranged in a long cylindrical mass enveloped in a glutinous secretion. The young larvae hatch, and immediately commence their destructive career. As these insects are "hemimetabolic" (see **INSECTS**), there is no quiescent stage, they go on increasing rapidly in size, and as they approach the perfect state the rudiments of the wings begin to appear. Naturally in this stage they are incapable of flight, but their locomotive powers are nevertheless otherwise extensive, and their capacity for mischief very considerable, for their voracity is great. Once winged and perfect these powers become infinitely more disastrous, redoubled by the development of the migratory instinct. The laws regulating this instinct are not yet perfectly understood. Food and temperature have a great deal to do with it, and there is a tendency for the flights to take a particular direction, varied by the physical circumstances of the breeding districts. So likewise it is certain that each species has its area of constant location in which it always exists, and its area of extraordinary migration to the extremes of which it only occasionally extends. Perhaps the most feasible of the suggestions as to the causes

of the migratory impulse is that locusts naturally breed in dry sandy districts in which food is scarce, and are thus impelled to wander in order to procure the necessities of life; but against this it has been argued that swarms bred in a highly productive district in which they have temporarily settled will seek the barren home of their ancestors. Another ingenious suggestion is that migration is intimately connected with a dry condition of the atmosphere, urging them to move on until compelled to stop for food or procreative purposes. The distance particular swarms may travel depends upon a variety of circumstances, such as the strength of impulse, the quantity of food, and many other causes. Certain it is that 1000 miles may, in particular cases, be taken as a moderate estimate; probably it is often very much less, certainly sometimes very much more. As a rule the progress is only gradual, and this adds vastly to the devastating effects, which may be likened to those caused by a foreign army laying black-mail upon the inhabitants of an invaded country through which it is marching. When an extensive swarm temporarily settles in a district, all vegetation rapidly disappears, and then hunger urges them on another stage. Such is their voracity that it has been tolerably well ascertained that the large Old World species, although undoubtedly phytophagous, are often compelled by hunger to attack at least dry animal substances, and even cannibalism has been asserted as an outcome of the failure of all other kinds of food. The length of a single flight must depend upon circumstances. From certain individual peculiarities in the examples of *Acridium peregrinum* that were taken in England in 1869, it has been asserted that they must of necessity have come direct by sea from the west coast of Africa, and what is probably the same species has been seen in the Atlantic at least 1200 miles from land, in swarms completely covering the ship, and obscuring the air; thus, although it is no doubt usual for the swarms to rest during the night, it undoubtedly happens in certain cases that flight must be sustained for several days and nights together. The height at which swarms fly, when their horizontal course is not liable to be altered by mountains, has been very variously estimated at from 40 to 200 feet, or even in a particular case to 500 feet. A "dropping from the clouds" is a common expression used by observers when describing the apparition of a swarm. The extent of swarms, and the number of individuals in a swarm, are matters that must of necessity be purely speculative. That the sun may sometimes be utterly obscured, and the noise made by the rustling of the wings be deafening, is confirmed by a multitude of observers. We prefer to decline the attempt to grapple with so vast a subject,—not unnaturally so when one observer says of a particular swarm that, when driven out to sea and drowned, the dead bodies washed up formed a bank 50 miles long and 3 or 4 feet high.

No special periodicity appears to have governed these flights (which, it is necessary to state, happily do not occur to an alarming extent every year), still an American writer (Mr Thomas) makes the interesting remark that the interim between the years of superlatively extraordinary appearance is both in Europe and America "very nearly a multiple of 11."

In Europe the best known and ordinarily most destructive species is *Pachytelus migratorius* (fig. 1), and it is to it that the numerous records of devastations in Europe mainly refer, but it is probably not less destructive in many parts of Africa and Asia. Eastern Europe, and especially the plains of southern Russia, appear to be more especially liable to its attacks. That the east slopes of Central Asia are the home of this insect appears probable; still much on this point is enveloped in uncertainty. In any case the area of permanent distribution, according to Koppen (who published an elaborate memoir on the subject in 1871), is enormous, and that of occasional distribution is still greater. The former area extends from the parallel of 40° N. in Portugal, rising to 48° in France and Switzerland, and

passing into Russia at 55°, thence continuing across the tundra of Siberia, north of China to Japan, thence south to the Fijian Islands, to New Zealand, and North Australia, thence again to Mauritius and over all Africa to Madagasc. But Koppén remarks that the southern distribution is uncertain and obscure. Taking exceptional distillation, it is well known that it occasionally appears in the British Isles, and has in them apparently been noticed as far north as Edinburgh, so also does it occasionally appear in Scandinavia, and it has probably been seen up to 63° N in Finland. Looking at this vast area, it is easy to conceive that an element of uncertainty must always exist with regard to the exact determination of the species, and in Europe especially is this the case, because (as before stated) there exists an apparently distinct species, known as *P. caucasicus*, which Koppén does not take into

“locust.” In the Argentine Republic a (possibly) distinct species (*A. yuracaca*) is the migratory locust.

Culopterus dilatus (fig. 3) is a smaller insect, with a less extended area of migration, and, though from this cause its invasions are not so notable, still the destruction occasioned in the districts to which

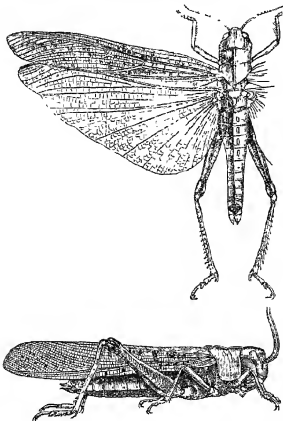


FIG. 1.—*Pachytelus migratorius*. This and the other figures are all natural size.

account. This latter species is certainly the most common of the “locusts” occasionally found in the British Isles, and De Selys-Longchamps is of opinion that it breeds regularly in Belgium, whereas the true *P. migratorius* is only accidental in that country. In the case of this, as of all other locusts, it is impossible within the limits of this article to chronicle even the years of greatest abundance. That they are probably as destructive now as formerly appears within the bounds of belief. At any rate we read that only a year or two ago a detachment of Russian soldiers in Timocomania was held prisoners by the insects forty-eight hours, until the villagers killed them and carried them away for manure, locusts often being as difficult as if the men had been on ice.

Acyrtus peregrinus (fig. 2) can scarcely be considered even an accidental visitor to Europe, yet it has been seen in the south of Spain, and, most extraordinarily, in many examples spread over a large part of England in the year 1869. It is a larger insect than *P. migratorius*. No serious attempt to define the range of this species has yet been made, but there is every reason to believe that it is the most destructive locust throughout Africa and India and other parts of tropical Asia, and its ravages are not one whit less important than are those of *P. migratorius*. Presumably it is the species that, on more than one occasion, has been noticed in a vast swarm in the Atlantic, very far from land, and presumably also it occurs in the West Indies and some parts of Central America. But it has been already remarked that *A. americanus* of North America, although so closely allied as to be scarcely distinguishable, is said not to be migratory, and is therefore scarcely a true

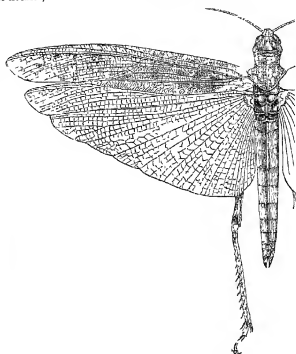


FIG. 2.—*Acyrtus peregrinus*.

it hunted is often scarce less than that of its more terrible ally. It is essentially a species of the Mediterranean district, and especially of the European side of that sea, yet it is also found in North Africa, and appears to extend far into southern Russia.

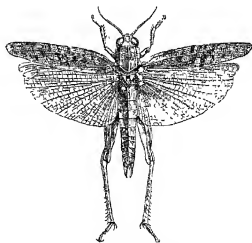


FIG. 3.—*Culopterus dilatus*.

Culopterus apratus (fig. 4) is the “Rocky Mountain locust” or “hateful grasshopper” of the North American continent. Though a comparatively small insect, not so large as some of the grasshoppers of English fields, its destructiveness has procured for it within the last twenty years a notoriety scarcely equalled by that of any other. It is only recently that the persistent migration of American settlers westward extended into the home of this creature. Travellers and prospectors in these regions had previously spoken of enormous swarms of a destructive grasshopper as existing there, and no doubt these occasionally extended into regions already civilized, but the species was not recognized as distinct from some of its non-migratory congeners to which it is so closely allied as to require a practised entomological eye to separate it therefrom. As time drew on, the various “State entomologists” made it their special duty to report on the insect, and at length, in 1877, the matter had become so serious that Congress appointed a United

States Entomological Commission to investigate the subject, and report upon the best (if any) means of controlling the evil effects of the pest. The result, so far as published, consists of two enormous volumes, teeming with information, and taking up the whole subject of locusts both in America and the Old World. *C. spissus* has its home or permanent nest in the sand plains of the central region east of the Rocky Mountains, extending slightly into the southern portion of British North America, outside the

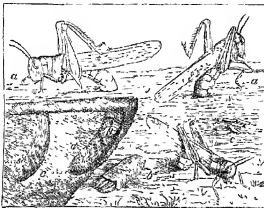


FIG. 4.—Rocky Mountain Locust (*Chortopterus spissus*). a, a, female in different positions, ovipositing; b, egg-pod extracted from ground, with the end broken open; c, a few eggs lying loose on the ground; d, a locust with the egg-pod partially removed; e, an egg-mass already in place, and one being placed; f, shows where such a mass has been covered up. (After Haly.)

is a wide fringe to which the term sub-permanent is applied, and this is again bounded by the limits of only occasional distribution, the whole occupying a large portion of the North American continent, but it is not known to have crossed the Rocky Mountains westward, or to have extended into the eastern States.

As to remedial or preventive measures tending to check the ravages of locusts, little unfortunately can be said, but anything that will apply to one species may be used with practically all. One point is certain, direct remedies must always be of small avail. Something can be done (as is now done in Cyprus) by offering a lure for all the egg-tubes collected, which is certainly the most direct manner of attacking them. Some little can be done by destroying the young larvae while yet in an unwinged condition, and by digging trenches in the line of march into which they can fall and be drowned or otherwise put an end to. Unfortunately little can be done with the winged hordes having the ingenuity instinct upon them, starvation, the outcome of their own work, probably here does much. It has been shown that with all migratory locusts the breeding places, or true homes, are comparatively barren districts (mostly elevated plateaus), hence the progress of civilization and colonization, with its concomitant necessity for converting those hitherto barren plains into areas of fertility, may (and probably will) gradually lessen the evil.

Locusts, like all other animals, have their natural enemies. Many birds greedily devour them, and it has many times been remarked that migratory swarms of the insects were closely followed by myriads of birds. Predatory insects of other orders also attack them, especially when they are in the unwinged condition. Moreover, like all other insects, they have still more deadly insect foes as parasites. Some attack the fully developed winged insect. But the greater part adopt the more cautious method of attacking the eggs.

To such belong certain beetles, chiefly of the family *Cynipidae*, and especially certain two-winged flies of the family *Bombilidae*. These latter, both in the Old and New World, must prevent vast quantities of eggs from producing larvae. Popular ignorance on this subject is yet great, and within a few months before this article was written it was exemplified in a remarkable manner by a suggestion from the Government officials of Cyprus that a certain parasite known to be destructive to the eggs in Asia Minor might be introduced into the island, a suggestion immediately followed by the discovery that what is probably the same parasite already existed there.

A flight of locusts would appear not to be always an unmitigated evil, even to man. The large Old World species form articles of food with certain semi-civilized and savage races, by whom they are considered as delicacies, or as part of ordinary diet, according to the race and the method of preparation.

LITERATURE.—Kirby and Spence, *Introduction to Entomology*, 7th ed., London, 1883. Koppin, "Die tropische Vögelwelt der Wendenhessische," in *Geograph. Mittheilungen*, 18th 1871. Fennel, "The Locusts of the East," in *Report of the United States Entomological Commission on the Rocky Mountain Locust*, by Riley, Packard, Thomas, and others, 2 vols., Washington, 1878-80.

(R. McL.)

LOCUST-TREE, *Ceratonia Siliqua*, L., the carob-tree, of the tribe *Cassieae* of the order *Leguminosae*, is the sole species, widely diffused spontaneously and by cultivation from Spain to the eastern Mediterranean regions, and from Egypt to Bornou in Central Africa (Hogg, Hooker's *Journal of Bot.*, 113), and imported to Hindustan (Graham, p. 254). It differs from all leguminous plants by the dilated disk to the calyx. It has no petals, and the flowers are polygamous or dioecious. The legume is compressed, often curved, indurated, and succulent, but with sweet pulpy divisions between the seeds, which, as in other genera of the *Cassieae*, are albuminous. The pods are eaten by men and animals, and in Sicily a spirit and a syrup are made from them. These husks being often used for swine are called swine's bread, and are probably referred to in the parable of the Prodigal Son. It is also called St John's bread, from a misunderstanding of Matt. iii. 4. The carob-tree was regarded by Spengel as the tree with which Moses sweetened the bitter waters of Marah (Exod. xv. 25), as the *Alcarab*, according to Avicenna (p. 205), has the property of sweetening salt and bitter waters. Gerard (*Herb.*, p. 1241) cultivated it in 1597; it having been introduced in 1570 (London's *Art.*, ii. 660). For various names, extent of distribution, historical references, &c., see Pickering's *Chron. Hist. of Fl.*, p. 141.

LODEVE, capital of an arrondissement of the department of Hérault, France, lies at an elevation of 674 feet, under a range of hills rising to 2790 feet, in a small valley where the Soulouff joins the Lez, a tributary of the Hérault, 34 miles east-north-east from Montpellier. A bridge over the Lez connects the town with the faubourg of Carnes on the left bank of the river, and two bridges over the Soulouff lead to the extensive ruins of the Château de Montbaur. There is railway communication with Agde by a line following the Hérault valley. The old cathedral of St Fulcran, founded by him in 920, was rebuilt in the 14th century and restored in the 16th; the cloister, dating from the 15th century, is ornate in style. In the picturesque environs of the town stands the well-preserved monastery of St Michel de Crammont, dating from the 12th century, it is now used as farm buildings. In the neighbourhood are three fine dolmens. Lodève is one of the most important industrial centres of the south of France, upwards of 7000 workmen being employed in the manufacture of woollens for army clothing, the aggregate horse-power of the factories is 1500. Wool is imported in large quantities from the neighbouring provinces, and from Morocco; the exports are cloth to Italy and the Levant, wine, brandy, chemicals, and wood. The population in 1876 was 10,528.

Latera existed prior to the invasion of the Romans, who for some time called it *Torvis Novus*. The inhabitants were converted to Christianity by St Flou, first bishop of the city, about 328. After passing successively into the hands of the Visigoths, the Franks, the Ostrogoths, the Arabs, and the Calabrians, it became in the 9th century a separate comitatus, and afterwards the domain of the bishops of Lodève. During the religious wars it suffered much, especially in 1578, when it was sacked. It ceased to be an episcopal see in 1789.

LODGE, THOMAS (c. 1556-1625), dramatist, novelist, pamphleteer, poet,—but not player,—was born about the year 1556 at West Ham, and was possibly the son of a namesake, shortly afterwards lord mayor of London. He was educated at Trinity College, Oxford, and then entered as a student at Lincoln's Inn, where, as in the other Inns of Court, a love of letters, and a crop of debts and difficulties, alike grew as matras of course. Thus already as a young man he preferred the looser ways of life and the lighter aspects of literature. When the pensive Stephen Gosson had (in 1579) published his *Schools of Abuse*, Lodge took up the glove in his *Defence of Poetry, Music, and Stage-*

plays (1679 or 1680), which shows some of the moderation as well as of the learning befitting a scholar and a gentleman. The publication was, however, prohibited, besides being answered by Gosson in his *Plays Confuted in Five Actions*, as by a man sure of his ground if not of his cause. Having fleshed his pen, Lodge displayed a strong inclination for continuing its use. In 1584 he published his *Atarum Against Unversers*, a pamphlet to which he no doubt gave the benefit of his personal experience, and in which he mentions the fate of his previous literary venture. Soon after this his years of wandering seem to have begun. It is clear that their primary cause lay in the straits to which he had been reduced, or had reduced himself; that he ever took so bold a leap into disreputableness as to become an actor is improbable in itself, and the assertion which has been made to that effect has been shown to rest on something less satisfactory than conjecture. Lodge joined Captain Clarke in his raid upon Terceira and the Canaries, and seems, in 1591, to have made another similar voyage with Cavendish. During the former expedition, he, to beguile the tedium of his voyage, composed his prose tale of *Rosaguide, Euphans' Golden Leguise*, which, published in 1590, afterwards suggested the story of *As You Like It*. The novel, which in its turn owes some, though no very considerable, debt to the *Tale of Gamelyn*, is a pleasing example of the Euphuistic manner, but proves how slight an advance an individual author of secondary rank is able to effect in a branch of composition of which the genius of his age has not taken hold. In the year before (1589) Lodge had already given to the world a volume of poems, including the delectable *Scyllas Metamorphosis*. One would gladly resign this and much else of Lodge's engorged verse, together with some of his perfumed prose, for the lost *Sailor's Kalender*, in which he must after some fashion have told of his sea adventures. During the last decade of the century he produced a *farrago* of literary products — a *Juvenal*, if not a very "Young Juvenal" at least in the readiness of his wit and in the robustness of his moral indignation. In conjunction with Greene he produced, in a popular vein, the odd but far from feeble play of *A Looking Glasse for London and England*. Probably about the same time he wrote his *Tragedy of the Wounds of Civil War* lately set forth in the *True Tragedies of Marius and Sylla* (published 1594), a good second-rate piece in the fashion of its age, and deficient neither in rhetorical nor in comic vigour. His *Life and Death of William Longbeard* (1593), and his *History of Robin the Devil*, are among his contemporary non-dramatic works, to which should be added *Phillis* (1593), a collection of lyrical pieces, and a *Fig for Momus* (on the strength of which he has been rather loosely termed the earliest English satirist). In his later years, — possibly about 1596, when he published his *Wife Metrie*, which is dated from Low Leyton, and the prose *Prosopopeia* (if, as seems probable, it was his), in which he repents him of his "lewd lines" of other days, — he was engaged in the practice of madrigals, for which he said to have qualified himself by a degree at Avignon. His works henceforth have a sober cast, comprising a translation of Josephus (1602) and another of Seneca (1614), besides a *Treatise of the Plague* (1603), and a popular manual, still in manuscript, on *Domestic Medicine*. He was abroad on urgent private affairs of one kind or another in 1616, from which time to his death from the plague, in 1625, nothing further concerning him remains to be noted. His life is one of those which attract the curiosity of the literary student, who knows that it is precisely in the mental and moral phases and experiences of able and active men devoid of original genius, such as he, that much of the history of an age of literature is to be read.

Lodge's works have not yet been completely reprinted, though the satisfaction of this want may no longer be far distant. His *Rosaguide* is accessible in Hazlitt's *Shakespeare's Library* (vol. ii.) and elsewhere. Its relation to Shakespeare's comedy is exhaustively discussed in an essay by Delius in the *Jahrbuch of the German Shakespeare Society* (1871). Other works of his are scattered through the publications of the old Shakespeare, the Huntarian, and recently other Societies; lists of them will be found in the edition of *Glaucus and Silla*, &c., printed at the Chiswick Press in 1836, in Hazlitt, and elsewhere. The question, *Was Thomas Lodge an Actor?* has been set at rest by Dr. C. M. Ingham in his pamphlet bearing that title (1869), of which the main conclusion is embodied in this notice. (A. W. W.)

LODI, a city of Italy, in the province of Milan, lies on the right bank of the Adda, in 45° 18' N. lat. and 9° 30' E. long. The site of the city is an eminence rising very gradually from the Lombard plain, and the surrounding country is one of the richest dairy districts in Italy. A rather plain and unquaintly cathedral (1158) with a huge lateral tower, the church dell' Incurazione erected by Bramante in 1476, the Palazzo Modagnani with a fine gateway in the style of Bramante, the episcopal palace dating from 1202, and the great hospital with its cloistered quadrangle, are the most noteworthy buildings. Besides an extensive trade in cheese (Lodi making more Parmesan than Parma itself) and other dairy produce, there are manufactures of linen, silk, majolica, and chemicals. The population of the city in 1871 was 16,537.

The ancient Lusa Pompeia lay about 5 miles west of the present city, and the site is still occupied by a considerable village, Lodi Vecchio. In the 11th century, according to Landulphus Junior, Lodi was second to Milan among the cities of northern Italy. A dispute with the archbishop of Milan about the investiture of the bishop of Lodi (1094) provoked the beginning of a bitter and protracted feud between the two cities. In 1111 the Milanese laid the whole place in ruins and forbade their rivals to restore what they had destroyed, and in 1168, when in spite of this prohibition a fairly flourishing settlement had again been formed, they repeated their work in a more thorough manner. The Lodienses, who had settled on Colle Eghezzone; and their village, the Borgo d'Isella, soon grew up under the patronage of Frederick Barbarossa into a new city of Lodi. At first subservient to the emperor, Lodi was before long compelled to enter the Lombard League, and in 1188 it formed alliance offensive and defensive with Milan. The strife between the Somaschi or aristocratic party and the Overgianschi or democratic party was so severe that the city broke into two distinct communes. The Overgianschi, expelled in 1226, were restored by Frederick II. who took the city after three months' siege. During the rest of the Guelph and Ghibelline struggle, and down to the beginning of the 16th century, the annals of Lodi are crowded with stirring events, connected for the most part with the general troubles of the country. In the main it was dependent on Milan. The duke of Brunswick captured it in 1626 in the interests of Spain; and it was occupied by the French (1701), by the Austrians (1706), by the king of Sardinia (1738), by the Austrians (1758), by the Spaniards (1745), and again by the Austrians (1786). On 10th May 1796 was fought the battle of Lodi between the Austrians and Napoleon, which made the latter master of Lombardy.

LODZ (Lode), a town of Russian Poland, in the province of Piotrkow, lies 40 miles by rail to the north of the chief town of the province, on a branch railway of the line between Warsaw and Vienna. Only a small hamlet with 800 inhabitants in 1821, when its woollen manufactures were first introduced by Germans, it is now the second town of Poland, both by population and by the importance of its cotton-mills, the annual production of which amounts to a value of about £150,000, that is, five-sixths of the whole production of cottons in Poland. This, as well as the other less important industries of the place (woollen cloth manufacture, dyeing, and so on), is chiefly in the hands of Germans, and thus the German language predominates in the town. Although its population in 1873 amounted to 60,500, Lodz still maintains its village character, consisting of one broad street 7 miles long, on which are situated alike the factories, the houses of the merchants, and the dwellings of the working men.

LOFOTEN AND VESTERAALEN, a "fogdæti" or bailiwick in the "amt" of Nordland, Norway, consists of a large

and picturesque group of islands lying north-east and south-west off the north-west coast of Norway, between $67^{\circ}30'$ and $69^{\circ}20'$ N. lat., and between 13° and $16^{\circ}35'$ E. long. The extreme length of the group from Andenes, at the north of Andø, to Røst, is about 150 English miles, the aggregate area amounts to about 1560 square miles, supporting a permanent population of about 20,000. It is separated from the mainland by the Vestfjord, Tjeldsund, and Vægsfjord, and is itself divided into two sections by the Raftsund between Hinder and Ost-Vaagø, to the west and south of the Raftsund lie the Lofoten Islands proper, of which the most important are Ost-Vaagø, Gimsø, Vest-Vaagø, Flakstadø, Moskenesø, Mosken, Værø, and Røst, east and north of the Raftsund are the islands of Vesterålen, the chief being Hinder, Ulvø, Langø, Skogø, and Andø. The islands, which are all of granite or metamorphic gneiss, are precipitous and lofty; the highest peaks are in the Lofoten group, Vaagøkalen on Ost-Vaagø rising directly from the sea to a height of 5090 feet. The channels which separate them are narrow and tortuous, and generally of great depth; they are remarkable for the strength of their tidal currents, particularly the Raftsund mentioned above, and the once famous Malström or Moskenström between Moskenes and Mosken. Though situated wholly within the Arctic Circle, the Lofoten and Vesterålen group enjoys a climate that cannot be called rigorous when compared with that of the rest of Norway. The isothermal line which marks a mean January temperature of 32° F. runs south from the Lofotens, passing a little to the east of Bergen onwards to Gothenburg and Copenhagen. The prevailing winds are those from the south and west, the mean temperature for the year is $38^{\circ}5$ F. and the annual rainfall is 43.94 inches. In summer the hills have only patches of snow, the snow limit being about 3000 feet. The natural pasture produced in favourable localities permits the rearing of cattle to some extent; but the growth of cereals (chiefly barley, which here matures in ninety days) is insignificant. A few potatoes are planted. The islands yield no wood. The great and characteristic industry of the district, and an important source of the national wealth, is the cod fishery which is carried on along the east coast of the Lofotens in the Vestfjord from January to April. It employs about 18,000 men from all parts of Norway; the annual take of cod amounts to an average of twenty millions, worth on the spot about £250,000. The fish, which is dried during early summer, is exported principally to Spain (where it is known as bacalao), but also to Holland, Sweden, and Belgium. Other industries arising out of the fishery are the manufacture of cod-liver oil and of artificial manure. The summer cod fisheries and the lobster fishery are also valuable. The herring is frequently taken in large quantities off the west coasts of Vesterålen, but is a somewhat capricious visitant. The balliwick contains no towns properly so called, but Kabelvaag on Ost-Vaagø and Svolvær on a few rocky islets off that island are considerable centres of trade and (in the fishing season) of population; Lødingen also, at the head of the Vestfjord on Hinder, is much frequented as a port of call. Regular means of communication are afforded by the steamers which trade between Hamburg or Christiania and Hammerfest, and also by local vessels; less accessible spots can be visited by means of boats, in the management of which the natives are adepts. There are some roads on Hinder, Langø, and Andø. The largest island in the group, and indeed in Norway, is Hinder, with an area of 864 square miles. The south-eastern portion of it belongs to the amt of Tromsø. In the island of Andø there is a bed of coal at the mouth of Ramsa which is likely to prove ultimately of some practical value.

LOG. The ordinary log for ascertaining the speed of a ship consists of four parts, viz., the log-glass, log-line, log-reel, and log-skip. The word log may have been derived from the fact that a piece of wood was thrown overboard, to lie as a log in a fixed position, motionless; now the same name is applied to many contrivances and ingenious inventions for indicating directly, or for registering, the ship's progress through the water.

Though such information now appears to be so essential, nay, imperatively necessary to the safe conduct of a ship, it is a fact that no such simple means as the log and line was devised before the 17th century, or the subject even thought of theoretically before 1570. At least nothing can be found in ancient writings, or even in the works professedly treating upon navigation, till after 1620, while, on the contrary, various passages occur from which we may fairly infer that there was nothing better at the command of the mariner than a rough unassisted estimate. The work of Martín Cortes (Sevilla, 1556), after giving much valuable information for that day, including a description and use of the cross-staff, astrolabe, &c., a table of the sun's declination, with much else, makes no other reference to the ship's motion through the water than this—the pilot must estimate the distance, making allowance for the effects of winds and currents, every day, and as the estimation "is imperfect, especially in a long voyage and long time, it is convenient that he should rectify his position by the corresponding position of the heavens." Mr. J. Tapp, who published a translation and improved edition of Martín Cortes fifty-three years after (1609), made no alteration in that part of the work.

In 1578 William Bourne published *Inventions and Devices*. There are one hundred and thirteen subjects treated of, many of them highly interesting, as they contain the crude germ of useful inventions. The twenty-first device is a close approach to Massey's self-registering log, which was found so useful two hundred and sixty years later. The credit of the device is ascribed to Humphry Cole; the probable date is 1570. The proposal was to have a "little small close boat" with a wheel, and an astrolabe, to turn clock-work in the little boat, with dials and pointers to indicate respectively fathoms, leagues, scores of leagues, and hundreds of leagues. If a small screw rotator had been used instead of a wheel, this might have been a great success. It was only a suggestion, perhaps untried; and in common with so many and written about that time the author allows only 5000 feet to a mile. Edward Wright's *Certain Errors in Navigation detected and corrected* (1610) gives much new and useful information, but the nearest allusion to the ship's speed is in the part translated from the Spanish of Rodrigo Samorano, under the head of finding the ship's place on the chart, called the "point of imagination." "This point doth presuppose the knowledge of two things: to wit, the rhumb by which we have sailed, and that is known by the compass, and the leagues which we have run; and this hath no certainty, but is a little more or less than a good mariner according to his imagination supposeth that he hath sailed; whereof the said point took its name." In 1624 an edition of Gunter by Edward Weever, after much valuable geometric information, proposes at chap. vi, in a long rambling manner, that an account should be kept of the ship's way. "The way that a ship maketh may be known to an old seaman by experience, by others it may be found," as he recommends, with the log-line or by known marks on the ship's side, bearing the proportion to a league or mile, that a certain number of seconds do to an hour. So far good; but he reckons a mile as 5886 feet (214 to a little), and states that seamen count in paces of 5 feet each, and 1000 to a mile, i.e., only 5000 feet. He also proposes to

divide the degrees into one hundred parts, each to be called "centesimas." The whole subject is treated as a new thing. It is stated by Purchas (1633) that Christopher Columbus (1493) deceived his crew with respect to the distance sailed from home, and that "even the pilots did not know how far they had gone" as they glided so smoothly with a continuous fair wind. Had any kind of log been here, the ship's speed would have been publicly known. Mr. Burnaby (*United Geography*, p. 534) states that "no ancient writer has preserved any account of the mode in which ancient navigators computed distance." Following such an authority and the quotations above, we may safely agree with the statement of Purchas that it was first used in 1607. Also we know that it did not become general till many years after. In one of our best works on navigation, printed in 1813, the log is inaccurately described.

If we are surprised that so many centuries passed, and that long voyages were made, after the discovery of the compass, without any means of measuring the distance sailed, we may be almost as much so at the diversity of opinion which prevailed among seamen with regard to the length of the log-line and the length of a mile. At the present day the pumple upon which this log is arranged is easily understood. The mean degree of the meridian (see vol. x. p. 198) is assumed to be 60.09 statute miles, which gives 6080 feet to the mean nautical mile,—an estimate sufficiently accurate for navigating upon any part of the sphere. The distance upon the log line being marked by pieces of line placed between the strands and carrying the requisite number of knots, this has given the name of knot to the nautical mile. The line is marked to knots and half knots (a single knot only), the intermediate fractions are estimated. Two measurements are now in common use, that in the British navy is 17 feet 3 inches of line for each knot made per hour, which corresponds with a twenty-eight second glass,—thus (28 x 6080) = 3600 = 47,238 feet; in the merchant service a knot is 50 feet 7 inches, which is the correct proportion to a mile with the half minute glass. When a ship is going more than five or six knots, a short glass is used, fourteen or fifteen seconds, then the indications by the line are doubled. The shorter measure was probably chosen in consequence of the custom in vogue till about 1833 of making the run on the log-board, or book, in knots and fathoms (or sea furlongs), the fractions are now invariably entered as tenths. The whole length of line is 60 to 80 fathoms, according to the speed anticipated, 10 to 20 fathoms of which is allowed as stay line, that the log-ship may be in a fair position, before the rag of bunting called the turn mark passes the hand. The line should be stretched and well wet before it is measured, and should be remeasured every day at sea. The inner end of the line is made fast to a light reel upon which it is wound.

The "log-ship" (fig. 1) is a piece of wood about $\frac{1}{2}$ inch thick and the fourth part of a circle, having a radius of 5 or 6 inches, weighted with lead round the curve in order to keep it upright in the water, but not to sink it. Two holes are bored, about $1\frac{1}{2}$ inches from the lower angles, through one a short piece of line is passed and knotted; the other end of the line has a bone or hard peg spliced to it, which is inserted in the other hole, thus forming a span by which it is attached to the log-line, and hangs square.

When the log is used, a man holds the reel over his head, the officer places the peg in the log-ship, and throws it well clear of the wake, then allows it to run the "stray

line" off without assistance, steadying it just before the turn mark comes to hand, as the mark passes he calls to his assistant with the glass to "turn." As the sand runs out freely till the word "stop" is expected, then bring the line into a state of tension similar to what it was in when the turn mark passed. At the word "stop" nip the line instantly, count the nearest knots, and estimate the tenths. When the line is stopped the strain should cause the peg to draw from the log-ship, and it can easily be hauled in. In ships of war it is hoisted every hour. The value of the operation depends, of course, entirely upon the care bestowed.

Ground-Log.—In large rivers, such as the Rio de la Plata, where a strong current runs, and shoals are found out of the sight of land, a lead of four or five pounds weight is used instead of the log-ship; the lead rests on the bottom, the line and sand-glass being used in a manner similar to that above described. This is called the ground-log, and indicates the speed at which the ship is passing over the ground, irrespective of currents or tides. It will show also the lateral effect of current as it is hauled in, this is the only log which can do so.

The sand-glasses are very primitive contrivances for measuring the requisite number of seconds; they are much affected by damp and change of temperature, and no reliance can be placed on their accuracy. In 1868 a timepiece sounding a gong at the required intervals was devised by the late Admiral Sir Walter Raleigh, and was tried on board some of Her Majesty's ships, but failed after a short time from damp or other causes. The writer of this article was then attempting to produce a log-gong, but abandoned it on being told that they could be obtained below his estimated cost.

Scow Log.—In 1725 Henry de Saumarez described a machine which was to supersede the ordinary log. This was on the principle of the scaw, having vanes which caused it to revolve and communicate a rotary motion to a piece of rope, this most probably went inboard to clockwork, hence the failure. Mr. Saumarez made many experiments about 1751, he found the results very irregular, especially at high velocities, just as the writer of this article did with one of Massey's flies and a line or rope attached to a spar, supported by large friction rollers inboard, both experiments were done failures on account of the friction. In 1778 two scaw logs were tried on board H. M. ship "Rachess" during a short voyage to the Polar Sea; each was made to communicate motion to a counter inboard. In 1792 Mr. Gower took out a patent for a scaw log. None of these experiments were sufficiently successful to gain the confidence of seamen.

We see that the principle was not new in 1834 when Mr. Massey patented a scaw log, which has been generally adopted that it deserves special notice and description. Though Massey took out other patents, and others have followed with modifications, the principle of all is the same, and likely to remain in use with the "common log" for many years to come. Massey fitted his log to the stern of a few vessels, a vertical spindle conveying the rotations of the fly to a register in the cabin above, but it did not answer.

The log of 1836 which came into general use is represented in fig. 2. It consists of two parts united by 2 or 3 feet of rope. The "fly" consists of a hollow copper cylinder about 9 or 10 inches long with four fins or blades placed at a given angle, causing it to rotate once in a certain distance. The rope is attached to the fly and to a spindle which freely revolves in a brass box, an endless screw acting upon a system of wheel-work records the fractions of a mile on one dial, turns upon a second, and runs up to one hundred on the third, on the same principle with the index of a gas meter.

The last patent was for the "frictionless log" shown in fig. 3, which is similar to the former except that, by dispensing with the piece of rope and part of the heavy box, it is much more compact and less liable to foul,—an accident to which all logs when towed after a ship are very liable. Walker's harpoon log is very similar



Fig. 1.



Fig. 2.



Fig. 3.

to the list of Massey's, but has a plate at the back in the shape of a luncheon to prevent the upper part from revolving. This log is now supplied to Her Majesty's ships. The fins or blades which cause the rotation in each of the logs above described are flat pieces of brass (not portions of a screw) soldered to a cylinder, which is hollow in order to diminish the tendency to sink when going slowly, but if the log be left overboard when the ship stops, the tow-line will allow it to sink about 100 feet, the pressure of water will then fill it, and there is no means provided for getting the water out. Screw logs will also at low speeds hang obliquely and be useless. Mr. Fidler tried a log with paddles protruding from a brass box instead of using a screw, but the plan was not adopted. However accurate the registering logs may be, an ordinary log cannot be dispensed with, unless the ship be on one course during the whole twenty-four hours, at her speed be uniform; even then the old log and line should not be neglected. Both Massey and Walker are now trying logs the rotations of which are towed, while the dials for registering are on the ship's stern.

Pressure Log.—In 1840 the Rev R. L. Baiton patented a log (fig. 4), indicating the speed of the ship by means of the pressure of water due to the velocity acting upon a tube about 2 of an inch diameter in the close, closed at the end, protruding some 8 inches below the ship's bottom, with an aperture of about an 8 of an inch in diameter in the front end, near the closed end. A vane was used to turn the aperture in the direction of the ship's progress (course and heave combined). At the upper end of the tube a small pointer indicated the amount of heave. To take into account the effect which change of draught would produce, another pipe was used having the aperture in a vertical direction (4120) with regard to the ship's progress, so that the water was neither forced in nor drawn out. The two pipes communicated with air-vessels, which were allowed to be about half full of water. thence two flexible tubes conveyed the pressure to the ends of an inverted syphon partly filled with mercury, one leg of which forms a glass index tube, a glass scale being placed behind it, graduated upon the principle that the pressure will increase according to the square of the velocity. As the specific gravity of mercury is so great, the scale even up to 16 knots is brought within a convenient compass, and it can be hung in gimbals (as a barometer) in any part of the ship. This velocity indicator in more recent fittings has been abandoned. The water of this article first saw it in one of the Jersey packets, when she was steaming about 13 knots, it appeared to be very sensitive, and he was strongly impressed in its favour. For details respecting this log see paper by Vaughan Pendered, before the Society of Engineers, December 6, 1869.

The motions or disturbances imparted to the water by the body of the ship passing through it at high velocity must vitiate in a great degree all attempts to measure the speed by instruments placed near the hull of the ship, and under varying circumstances of draught, speed, and foulness of bottom. For the results of experiments and opinions on this point, see the *Whitaker's Rep.*, p. 235, and Mr. R. Edmund Froude, see *Brit. Assoc. Rep.*, 1874, p. 236, and 1879, p. 210.

Electric Log.—In the chronological order in which we have taken various descriptions of logs, the last deserving notice is Kelway's "electric log," the only such log known to the public. Its chief feature is the making and breaking of an electric circuit by means of a screw passing in the water and an electric battery connected with the step motion indicator. One of the difficulties

to be overcome was that of securing a chamber wherein to form the electric contacts, which should remain watertight under the pressure due to its depth below the surface of the sea, particularly in the event of the ship stopping and suffering it to sink when being towed with 50 fathoms of line. Mr. Kelway now believes that he has overcome that difficulty, and his log has been tried on board several of Her Majesty's ships at Portsmouth, with satisfactory results, a screw similar to Massey's being towed, while in electric connexion with a dial on board.

What is considered by Mr. Kelway to be an improved application of the principle is now (1882) on view in the International Exhibition at the Crystal Palace. It is intended that a hole should be cut in the ship's bottom, by preference in the engine-room, large enough to allow a short cylinder (fig. 5) containing the screw to pass down below the ship's bottom. The cylinder is open in a fore-and-aft line and attached to a cage II, which is drawn up or lowered by means of a large screw C working through a stuffing box F. The iron box D containing the cage is 4 feet in height, made in three parts, the lower part (high enough to receive a sluice valve C) is to be bolted to the ship's bottom, and must, with the rest of the box, be nearly as strong, the central part is secured to the valve box and covered by a lid E, this being space enough above the sluice valve to set the cage and screw.

To place the log, let the sluice valve C be lightly closed; open two small taps to let the water out of the box and to prove that the valve is acting. Open the lid, run the lowering screw through the cage, place it, secure the lid, open the sluice valve, and lower the rotation to the desired standard. The index of the rotation is a portion of a true screw. An endless screw on the spindle of the rotation communicates the revolutions to a vertical spindle M, which moves a train of wheels in a watertight box N, the last of these wheels revolves once in a mile, and on the same spindle is a wheel having eight ratchet teeth, which by moving a lever complete an electric circuit, which passes by the wire O to a dial placed in any part of the ship, sounding a bell and causing one hand of the dial to make a stop and mark an eighth, one revolution indicates a mile, and other dials only the register up to 100 miles. This form of electric log has, however, the disadvantage pointed out as affecting the electric current, or any log placed under the hull of a ship.

The electric towing log (by Kelway) promises to show continuously on board the ship what she is doing, while keeping a record of what has been done. A rating table would be at the dial, in any part of the ship, or several dials could be worked by the same electric current. It will be exposed to the danger of fouling seaweed, &c., as other towing logs are.

The logs now generally used are Massey's, Walker's, and a few of Baiton's, generally in conjunction with the old log-ships and line. (H. A. M.)

LOGAN, JOHN (1748-88), a Scottish poet of some reputation, was born in 1748, and was son of George Logan, a farmer at Soutra, in East Lothian. Being destined for the church, he was in 1762 sent to study at the university of Edinburgh. After finishing his course, Logan was in 1768-69 tutor at Ulbster to the well-known Sir John Sinclair, and in 1770 he edited some of the poems of his college friend MICHAEL BRUCE (*q.v.*). This publication was for the benefit of Bruce's parents, who were in humble circumstances. In order to make up a volume he inserted some poems of his own, with some from other sources, and in his preface he stated that these could be easily distinguished without any names being attached. Of the seventeen pieces in the volume five were by Bruce, two by Bruce and Logan, eight by Logan, one by Sir James Foulis, and of one the authorship is unknown. One of the poems by Logan was "The Ode to the Cuckoo."

In 1770 Logan was licensed as a preacher by the presbytery of Edinburgh, and in 1771 was presented to the charge of South Leith, but was not inducted till 1773. In 1779 he delivered a course of lectures on the philosophy of history in St. Mary's Church, Edinburgh. An analysis of these lectures was published in 1781 under the title of *Elements of the Philosophy of History*, and was followed by one of the lectures *On the Manners and Government of Asia*, 1781.

Logan was an active member of the committee of the General Assembly of the Church of Scotland appointed in 1775 to revise the "Translations and Paraphrases" drawn up in 1745 for use in private families, and to adapt them for public worship. The committee described its

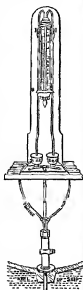


Fig. 4

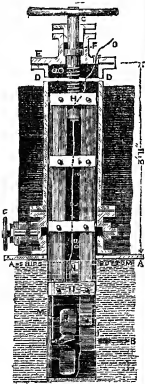


Fig. 5

labours in 1781, and their collection of paraphrases is still in use. Eleven of them are the composition of Logan, and others were revised or altered by him. In the same year he published his poems in a volume which attracted so much attention that a second edition was issued in 1782. It also included the "Ode to the Cuckoo," with which Edmund Burke was so pleased that when in Edinburgh he sought out Logan and complimented him as the author of the finest ode in the English language.

In 1783 he published a tragedy called *Ruxamede*, which met with little success. In 1786 he resigned his charge at South Leith, retaining part of his stipend. He then went to London, where he devoted himself to literature. He was engaged on the management of the *English Review*, and in 1788 published a pamphlet on the charges against Warren Hastings. He died in December 1788.

A work on ancient history, published that year under the name of Dr. Rathenold, rector of an academy at Uabridge, is believed to have been the lectures written by Logan. His sermons were published in 1790-91, in two volumes, and have been several times reprinted. His poems were collected and published in 1812, with a memoir understood to be by the Rev. R. Douglas of Galashiels.

About forty years after Logan's death what may be called the Bruce-Logan controversy arose by the publication in 1884 of a life of Michael Bruce, prefixed to an edition of his poems by the Rev. Dr. MacKilvie. In this work there is claimed for Bruce the authorship of sixteen of the pieces in the volume issued by Logan in 1770. Logan was at the same time charged with having returned some of Bruce's MSS. entrusted to him, which he used in the revision of the paraphrases. These statements have been reiterated with much abuse of Logan in a memoir of Bruce prefixed to an edition of his works published in 1895, by the Rev. Dr. Gosset. In this edition the paraphrases written by Logan are inserted as having been written by Bruce. The evidence, however, brought against Logan in these biographies of Bruce, being nearly altogether of a hearsay character, is not of much value, and it may be said that Logan was not blamed during his life for any such literary delinquencies. If anything can be brought against him with justice, it is his publishing as his own, with very few alterations, the second Pamphlet, which is the composition of Dr. Doddridge.

Within the last few years the various pieces in the volume of Bruce's poems issued by Logan in 1770 have been subjected to careful criticism, and the statements made from personal knowledge by the Rev. Dr. Robertson of Dalmeny, the college friend of Bruce and Logan, who was often referred to on the subject, must be held to be substantially correct. These will be found in a brochure by Dr. David Laing, *Ode to the Cuckoo* (Edinburgh 1770), with remarks on its authorship, in a letter to J. C. Sharpe, LL.D., 1878. See also a paper by J. Small in the *Brit. and For. Rev.* Nov., 1877, and especially two papers by the Rev. R. Small, *ibid.*, 1878.

LOGANSPOUT, capital of Cass county, Indiana, U.S., is situated at the confluence of the Wabash and the El rivers, and on the Wabash and Erie canal, 75 miles north-west of Indianapolis. It is an important railway junction, and the trading-centre of an extensive agricultural district—dealing in grain, pork, and timber (poplar and black walnut). The Pittsburgh, Cincinnati, and St. Louis railroad maintains at this point large carriage-works, occupying 25 acres, and employing 600 men. The population was 11,198 in 1880.

LOGARITHMS The definition of a logarithm is as follows:—if a, x, m are any three quantities satisfying the equation $a^x = m$, then a is called the base, and x is said to be the logarithm of m to the base a . This relation between a, x, m , may be expressed also by the equation $x = \log_a m$.

Properties.—The principal properties of logarithms are given by the equations

$$\log_a (mn) = \log_a m + \log_a n, \quad \log_a \frac{m}{n} = \log_a m - \log_a n,$$

$$\log_a m^r = r \log_a m, \quad \log_a \sqrt[r]{m} = \frac{1}{r} \log_a m,$$

which may be readily deduced from the definition of a logarithm. It follows from these equations that the logarithm of the product of any number of quantities is equal to the sum of the logarithms of the quantities, that the logarithm of the quotient of two quantities is equal

to the logarithm of the numerator diminished by the logarithm of the denominator, that the logarithm of the r th power of a quantity is equal to r times the logarithm of the quantity, and that the logarithm of the r th root of a quantity is equal to $\frac{1}{r}$ th of the logarithm of the quantity.

Logarithms were originally invented for the sake of abbreviating arithmetical calculations, as by their means the operations of multiplication and division may be replaced by those of addition and subtraction, and the operations of raising to powers and extraction of roots by those of multiplication and division. For the purpose of thus simplifying the operations of arithmetic, the base is taken equal to 10, and use is made of tables of logarithms in which the values of x , the logarithm, corresponding to values of m , the number, are tabulated. The logarithm is also a function of frequent occurrence in analysis, being regarded as a known and recognized function like $\sin x$ or $\tan x$; but in mathematical investigations the base generally employed is not 10, but a certain quantity usually denoted by the letter e , of value 2.71828 18284 . . .

Thus in arithmetical calculations if the base is not expressed it is understood to be 10, so that $\log m$ denotes $\log_{10} m$, but in analytical formulae it is understood to be e .

The logarithms to base 10 of the first twelve numbers to 7 places of decimals are

$\log 1 = 0.0000000$	$\log 5 = 0.6989700$	$\log 9 = 0.9542425$
$\log 2 = 0.3010800$	$\log 6 = 0.7781513$	$\log 10 = 1.0000000$
$\log 3 = 0.4771213$	$\log 7 = 0.8450980$	$\log 11 = 1.0413927$
$\log 4 = 0.6020600$	$\log 8 = 0.9030900$	$\log 12 = 1.0791812$

The meaning of these results is that

$$1 = 10^0, \quad 2 = 10^{0.3010800}, \quad 3 = 10^{0.4771213}, \quad \dots$$

$$10 = 10^1, \quad 11 = 10^{1.0413927}, \quad 12 = 10^{1.0791812}, \quad \dots$$

The integral part of a logarithm is called the index or characteristic, and the fractional part the mantissa. When the base is 10, the logarithms of all numbers in which the digits are the same, no matter where the decimal point may be, have the same mantissa; thus, for example,

$$\log 25618 = 0.4084604, \quad \log 25618 = 1.4084604,$$

$$\log 2561800 = 6.4084604, \text{ \&c.}$$

In the case of fractional numbers (δ), numbers in which the integral part is 0) the mantissa is still kept positive, so that, for example,

$$\log 25618 = \bar{1}.4084604, \quad \log .0025618 = \bar{5}.4084604, \text{ \&c.}$$

the minus sign being usually written over the characteristic, and not before it, to indicate that the characteristic only and not the whole expression is negative; thus

$$\bar{1}.4084604 \text{ stands for } -1 + .4084604.$$

The fact that when the base is 10 the mantissa of the logarithm is independent of the position of the decimal point in the number affords the chief reason for the choice of 10 as base. The explanation of this property of the base 10 is evident, for a change in the position of the decimal points amounts to multiplication or division by some power of 10, and this corresponds to the addition or subtraction of some integer in the case of the logarithm, the mantissa therefore remaining intact. It should be mentioned that in most tables of trigonometrical functions, the number 10 is added to all the logarithms in the table in order to avoid the use of negative characteristics, so that the characteristic 9 denotes in reality 1, 8 denotes 2, 10 denotes 0, &c. Logarithms thus increased are frequently referred to for the sake of distinction as *tabular logarithms*, so that the tabular logarithm—the true logarithm + 10.

In tables of logarithms of numbers to base 10 the mantissa only is in general tabulated, as the characteristic of the logarithm of a number can always be written down at sight, this rule being that, if the number is greater than

unity, the characteristic is less by unity than the number of digits in the integral portion of ix , and that if the number is less than unity the characteristic is negative, and is greater by unity than the number of cyphers between the decimal point and the first significant figure.

It follows very simply from the definition of a logarithm that

$$\log_a b \times \log_b a = 1, \quad \log_a m = \log_a m \times \frac{1}{\log_a b}.$$

The second of these relations is an important one, as it shows that from a table of logarithms to base a , the corresponding table of logarithms to base b may be deduced by multiplying all the logarithms in the former by the constant multiplier $\frac{1}{\log_a b}$, which is called the *modulus* of the system whose base is b with respect to the system whose base is a .

The two systems of logarithms for which extensive tables have been calculated are the Napierian, or hyperbolic, or natural system, of which the base is e , and the Briggsian, or decimal, or common system, of which the base is 10, and we see that the logarithms in the latter system may be deduced from those in the former by multiplication by the constant multiplier $\frac{1}{\log_e 10}$, which is called the modulus of the common system of logarithms. The numerical value of this modulus is 0.43429 44819 03251 83765 11389 ..., and the value of its reciprocal, $\log_{10} e$, 10 (by multiplication by which Briggsian logarithms may be converted into Napierian logarithms) is 2.30258 50929 94045 68401 79914 ...

The quantity denoted by e is the series,

$$1 + \frac{1}{1} + \frac{1}{2} + \frac{1}{2 \cdot 2} + \frac{1}{3 \cdot 2 \cdot 2} + \frac{1}{4 \cdot 2 \cdot 2 \cdot 2} + \dots$$

the numerical value of which is,

$$2.71828 18284 59045 23536 02874 \dots$$

The mathematical function $\log x$, or $\log_e x$, is one of the small group of transcendental functions, consisting only of the circular functions (direct and inverse) $\sin x$, $\cos x$, $\&c.$, arc $\sin x$, arc $\cos x$, $\&c.$, e^x , and $\log x$, which are universally treated in analysis as known functions. It is the inverse of the exponential function e^x , the theory of which may be regarded as including that of the circular functions, since

$$\sin x = \frac{1}{2i} (e^{ix} - e^{-ix}), \quad \cos x = \frac{1}{2} (e^{ix} + e^{-ix}).$$

There is no series for $\log x$ proceeding either by ascending or descending powers of x , but there is an expansion for $\log(1+x)$, viz. —

$$\log(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \&c.;$$

the series, however, is convergent for real values of x only when x lies between +1 and -1. Other formulae which are deducible from this equation are given in the portion of this article relating to the calculation of logarithms.

We have also the fundamental formulae—

$$(i.) \text{ Limit of } \frac{x^h - 1}{h}, \text{ when } h \text{ is indefinitely diminished,} = \log x;$$

$$(ii) \int \frac{dx}{x} = \log x + \text{const.}$$

Either of these results might be regarded as the definition of $\log x$; they may be readily connected with one another, for we have in general

$$\int \frac{dx}{x} = \frac{x^{a+1}}{a+1} + \text{const.};$$

but if $a = -1$, this formula no longer gives a result. Putting, however, $a = -1 + h$, where h is indefinitely small, we have

$$\int \frac{dx}{x} = \frac{x^{a+1}}{h} + \text{const.} = \frac{x^h - 1}{h} + \text{const.} = \log x + \text{const. by (i).}$$

The result (ii) establishes a relation, which is of historical interest, between the logarithmic function and the quadrature of the hyperbola, for, by considering the equation of the hyperbola in the form $xy = \text{const.}$, we see at once that the area included between the arc of a hyperbola, its nearest asymptote, and two ordinates drawn parallel to the other asymptote from points on the first

asymptote distant a and b from their point of intersection is proportional to $\log \frac{b}{a}$.

The function $\log x$ is not a *uniform* function, that is to say, if x denotes a complex variable of the form $a+ib$, and if complex quantities are represented in the usual manner by points in a plane, then it does not follow that if x describes a closed curve $\log x$ also describes a closed curve; in fact we have

$$\log(a+ib) = \log \sqrt{(a^2+b^2)} + i(a+2\pi n),$$

where a is a determinate angle, and n denotes any integer. Thus, even when the argument is real, $\log x$ has an infinite number of values, for, putting $b=0$ and taking a positive, in which case $a=0$, we obtain for $\log a$ the infinite system of values $\log a + 2\pi ni$. It follows from this property of the function that we cannot have for $\log x$ a series which shall be convergent for all values of x , as is the case with $\sin x$, $\cos x$, and e^x , as such a series could only represent a uniform function, and in fact the equation

$$\log(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \&c.,$$

is true only when the analytical modulus of x is less than unity.

The notation $\log x$ is generally employed in English works, but Continental writers usually denote the function by $\lg x$ or \lg_e .

History.—The invention of logarithms has been accorded to John Napier, baron of Merchiston, in Scotland, with a unanimity which is rare with regard to important scientific discoveries. The first announcement was made in Napier's *Mirifici logarithmorum canonis descriptio* (Edinburgh, 1614), which contains an account of the nature of logarithms, and a table giving natural sines and their logarithms for every minute of the quadrant to seven or eight figures. These logarithms are not what now be called Napierian or hyperbolic logarithms (i.e. logarithms to the base e), though closely connected with them, the relation between the two being

$$e = 10^L \log_e 10, \text{ or } L = 10^L \log_e 10, 10^L = 10^L,$$

where L denotes the logarithm to base e and L denotes Napier's logarithm. The relation between N (a sine) and L its Napierian logarithm is therefore

$$N = 10^N \frac{1}{10^L},$$

and the logarithms decrease as the sines increase. Napier died in 1617, and his posthumous work *Mirifici logarithmorum canonis constructio*, explaining the mode of construction of the table, appeared in 1619, edited by his son.

Henry Briggs, then professor of geometry at Gresham College, London, and afterwards Savilian professor of geometry at Oxford, admired the *Canon mirificus* so much that he resolved to visit Napier. In a letter to Usher he writes, "Napier, lord of Merchiston, hath set my head and hands at work with his new and admirable logarithms. I hope to see him this summer, if it please God; for I never saw a book which pleased me better, and made me more wonder." Briggs accordingly visited Napier in 1616, and stayed with him a whole month. He brought with him some calculations he had made, and suggested to Napier the advantages that would result from the choice of 10 as a base, having explained them previously in his lectures at Gresham College, and written to Napier on the subject. Napier said that he had already thought of the change, and pointed out a slight improvement, viz. that the characteristics of numbers greater than unity should be positive and not negative, as suggested by Briggs. In 1616 Briggs again visited Napier and showed him the work he had accomplished, and, he says, he would gladly have paid him a third visit in 1617 had Napier's life been spared.

Briggs's *Logarithmorum canonis prima* was published, probably privately, in 1617, after Napier's death, as in the short preface he states that why his logarithms are different from those introduced by Napier "aperandum, ejus librum posthummum abunde nobis propediem satisfieturum." The *liber posthummus* was the *Canonis constructio* already mentioned. This work of Briggs's, which contains the

first published table of decimal or common logarithms, is only a small octavo tract of sixteen pages, and gives the logarithms of numbers from unity to 1000 to 14 places of decimals. There is no author's name, place, or date. The date of publication is, however, fixed as 1617 by a letter from Sir Henry Bourchier to Ussher, dated December 6, 1617, containing the passage—"Our kind friend, Mr Briggs, hath lately published a supplement to the most excellent tables of logarithms, which I presume he has sent to you." Briggs's tract of 1617 is extremely rare, and has generally been ignored or incorrectly described. Hutton erroneously states that it contains the logarithms to 8 places, and his account has been followed by most writers. There is a copy in the British Museum.

Briggs continued to labour assiduously at the calculation of logarithms, and in 1624 published his *Arithmetica logarithmica*, a folio work containing the logarithms of the numbers from 1 to 20,000, and from 90,000 to 100,000 (and in some copies to 101,000) to 14 places of decimals. The table occupies 300 pages, and there is an introduction of 88 pages relating to the mode of calculation of the tables, and the applications of logarithms.

There was thus left a gap between 20,000 and 90,000, which was filled up by Adrian Vlacq, who published at Gouda, in Holland, in 1628, a table containing the logarithms of the numbers from unity to 100,000 to 10 places of decimals. Having calculated 70,000 logarithms and copied only 30,000, Vlacq would have been quite entitled to have called his a new work. He designates it, however, only a second edition of Briggs's *Arithmetica logarithmica*, the title running *Arithmetica logarithmica sive logarithmorum chiliadas centum, . . . Editio secunda aucta per Adrianum Vlacq, Goudanum*. This table of Vlacq's was published, with an English explanation prefixed, at London in 1631 under the title *Logarithmicki Arithmetike . . . London, printed by George Miller, 1631*. There are also copies with a French title page and introduction (Gouda, 1629).

Briggs had himself been engaged in filling up the gap, and in a letter to Pell, written after the publication of Vlacq's work, and dated October 25, 1628, he says:—

"My desire was to have these chiliades that are wanting betwixt 20 and 90 calculated and printed, and I had done them all almost by my self, and by some friends whom my rules had sufficiently informed, and by agreement the business was conveniently parted amongst us; but I am eased of that charge and care by one Adrian Vlacq, an Hollander, who hath done all the whole hundred chiliades and printed them in Latin, Dutche, and French, 1000 books in these 8 languages, and hath sold them almost all. But he hath cutt off 4 of my figures throughout; and hath left out my dedication, and to the reader, and two chapters the 12 and 13, in the rest he hath not varied from me at all."

The original calculation of the logarithms of numbers from unity to 101,000 was thus performed by Briggs and Vlacq between 1615 and 1628. Vlacq's table is that from which all the hundreds of tables of logarithms that have subsequently appeared have been derived. It contains of course many errors, which have gradually been discovered and corrected in the course of the two hundred and fifty years that have elapsed, but no fresh calculation has been published. The only exception is Mr Sang's table (1871), part of which was the result of an original calculation.

The first calculation or publication of Briggian or common logarithms of trigonometrical functions was made in 1620 by Gunter, who was Briggs's colleague as professor of astronomy in Gresham College. The title of Gunter's book, which is very scarce, is *Canon triangulorum*, and it contains logarithmic sines and tangents for every minute of the quadrant to 7 places of decimals.

The next publication was due to Vlacq, who appended to his logarithms of numbers in the *Arithmetica logarithmica*

of 1638 a table giving log sines, tangents, and secants for every minute of the quadrant to 10 places; these were obtained by calculating the logarithms of the natural sines, &c., given in the *Theaurus Mathematicus* of Pitiscus (1613).

During the last years of his life Briggs devoted himself to the calculation of logarithmic sines, &c., and at the time of his death in 1631 he had all but completed a logarithmic canon to every hundredth of a degree. This work was published by Vlacq at his own expense at Gouda in 1633, under the title *Trigonometria Britannica*. It contains log sines (to 14 places) and tangents (to 10 places), besides natural sines, tangents, and secants, at intervals of a hundredth of a degree. In the same year Vlacq published at Gouda his *Trigonometria artificialis*, giving log sines and tangents to every 10 seconds of the quadrant to 10 places. This work also contains the logarithms of the numbers from unity to 20,000 taken from the *Arithmetica logarithmica* of 1628. Briggs appreciated clearly the advantages of a centesimal division of the quadrant, and by dividing the degree into hundredth parts instead of into minutes, made a step towards a reformation in this respect, and but for the appearance of Vlacq's work the decimal division of the degree might have become recognized, as is now the case with the corresponding division of the second. The calculation of the logarithms not only of numbers but also of the trigonometrical functions is therefore due to Briggs and Vlacq; and the results contained in their four fundamental works—*Arithmetica logarithmica* (Briggs), 1624; *Arithmetica logarithmica* (Vlacq), 1628; *Trigonometria Britannica* (Briggs), 1633; *Trigonometria artificialis* (Vlacq), 1633—have never been superseded by any subsequent calculations.

A translation of Napier's *Descriptio* was made by Edward Wright, whose name is well known in connexion with the history of navigation, and after his death published by his son at London in 1616 under the title *A Description of the admirable Table of Logarithmes* (12mo); the edition was revised by Napier himself. Both the *Descriptio* (1614) and the *Constructio* (1619) were reprinted at Lyons in 1620 by Bartholomew Vincent, who thus was the first to publish logarithms on the Continent.

Napier calculated no logarithms of numbers, and, as already stated, the logarithms invented by him were not to base e . The first logarithms to the base e were published by John Speidell in his *New Logarithmes* (London, 1619), which contains hyperbolic log sines, tangents, and secants for every minute of the quadrant to 5 places of decimals.

In 1624 Benjamin Ursinus published at Cologne a canon of logarithms exactly similar to Napier's in the *Descriptio* of 1614, only much enlarged. The interval of the arguments is 10', and the results are given to 8 places; in Napier's canon the interval is 1', and the number of places is 7. The logarithms are strictly Napierian, and the arrangement is identical with that in the canon of 1614. This is the largest Napierian canon that has ever been published.

Kepler took the greatest interest in the invention of logarithms, and in 1624 he published at Marburg a table of Napierian logarithms of sines, with certain additional columns to facilitate special calculations.

The first publication of Briggian logarithms on the Continent is due to Wingate, who published at Paris in 1635 his *Arithmétique logarithmique*, containing seven-figure logarithms of numbers up to 1000, and log sines and tangents from Gunter's *Canon* (1620). In the following year, 1636, Denis Hamion published at Paris a *Traité des Logarithmes*, containing Briggs's logarithms of numbers up to 20,001 to 10 places, and Gunter's log sines and tangents to 7 places for every minute. In the same year De Decker also published at Gouda a work entitled *Nieuwe Tekonst, inhoudende de Logarithmi voor de Gheallen beginnende van*

1 to 10,000, which contained logarithms of numbers up to 10,000 to 10 places, taken from Briggs's *Arithmetica* of 1624, and Gunter's log sines and tangents to 7 places for every minute. Vlacq rendered assistance in the publication of this work, and the privilege is made out to him.

The preceding paragraph contains a brief account of the main facts relating to the invention of logarithms. In describing the contents of the works referred to the language and notation of the present day have been adopted, so that for example a table to radius 10,000,000 is described as a table to 7 places, and so on. Also, although logarithms have been spoken of as to the base e , &c., it is to be noticed that neither Napier nor Briggs, nor any of their successors till long afterwards, had any idea of connecting logarithms with exponents.

The invention of logarithms and the calculation of the earlier tables form a very striking episode in the history of exact science, and, with the exception of the *Principia* of Newton, there is no mathematical work published in the country which has produced such important consequences, or to which so much interest attaches as to Napier's *Description*. The calculation of tables of the natural trigonometrical functions may be said to have formed the work of the last half of the 16th century, and the great canon of natural sines for every 10 seconds to 15 places which had been calculated by Rheticus was published by Pitiscus only in 1613, the year before that in which the *Description* appeared. In the construction of the natural trigonometrical tables England had taken no part, and it is remarkable that the discovery of the principles and the formation of the tables that were to revolutionize or supersede all the methods of calculation then in use should have been so rapidly effected and developed in a country in which so little attention had been previously devoted to such questions.

The only possible rival to Napier in the invention of logarithms is Justus Byrgius, who about the same time constructed a rude kind of logarithmic or rather anti-logarithmic table; but there is every reason to believe that Napier's system was conceived and perfected before that of Byrgius; and in date of publication Napier has the advantage by six years. The title of the work of Byrgius is *Arithmetische und geometrische Progress-Tabulen*; in his table he has log 1 = 0 and log 10 = 230270022. The only contemporary reference to Byrgius is contained in the sentence of Kepler, "Apices logarithici Justo Byrgio multis annis ante editionem Neperianam viam preceperunt ad hos ipseiusmodi logarithmos," which occurs in the "Præcepta" prefixed to the *Tabulae Rudolphinae* (1627); the apices are the signs ":", used to denote the orders of sexagesimal fractions. The system of Byrgius is greatly inferior to that of Napier, and it is to the latter alone that the world is indebted for the knowledge of logarithms. The claims of Byrgius are discussed in Kistner's *Geschichte der Mathematik*, vol. ii. p. 375, and vol. iii. p. 14; Montucla's *Histoire des Mathématiques*, vol. ii. p. 10; Delambre's *Histoire de l'Astronomie moderne*, vol. i. p. 560; De Morgan's article on "Tables" in the *English Cyclopædia*; and Mr Mark Napier's *Memoirs of John Napier of Merchiston* (1834).

An account of the facts connected with the early history of logarithms is given by Hutton in his *History of Logarithms*, prefixed to all the early editions of his logarithmic tables, and also printed in vol. i. pp. 306-340 of his *Tracts* (1812); but unfortunately Hutton has interpreted all Briggs's statements with regard to the invention of decimal logarithms in a manner clearly contrary to their true meaning, and unfair to Napier. This has naturally produced retaliation, and Mr Mark Napier has not only successfully refuted Hutton, but has fallen into the opposite extreme of attempting to reduce Briggs to the level of a mere com-

puter. It seems strange that the relations of Napier and Briggs with regard to the invention of decimal logarithms should have formed matter for controversy. The statements of both agree in all particulars, and the warmest friendship subsisted between them. Napier at his death left his manuscripts to Briggs, and all the writings of the latter show the greatest reverence for him. The words that occur on the title page of the *Logarithmical arithmetike* of 1631 are "These numbers were first invented by the most excellent John Neper, Baron of Merchiston; and the same were transformed, and the foundation and use of them illustrated with his approbation by Henry Briggs." No doubt the invention of decimal logarithms occurred both to Napier and to Briggs independently; but the latter not only first announced the advantage of the change, but actually undertook and completed tables of the new logarithms. For more detailed information relating to Napier, Briggs, and Vlacq, and the invention of logarithms, the reader is referred to the life of Briggs in Ward's *Lives of the Professors of Gresham College*, London, 1740, Thomas Smith's *Vita quorundam eruditissimorum et illustrium virorum* (Vita Henrici Briggsii), London, 1707; Mr Mark Napier's *Memoirs of John Napier* already referred to, and the same author's *Naperi libri qui superant* (1839); Hutton's *History*; De Morgan's article already referred to; Delambre's *Histoire de l'Astronomie Moderne*; the report on mathematical tables in the *Report of the British Association* for 1873; and the *Philosophical Magazine* for October and December 1872 and May 1873. It may be remarked that the date usually assigned to Briggs's first visit to Napier is 1616 and not 1615 as stated above, the reason being that Napier was generally supposed to have died in 1618; but it was shown by Mr Mark Napier that the true date is 1617.

For a description of existing logarithmic tables, and the purposes for which they were constructed, the reader is referred to the article TABLES (MATHEMATICAL). In what follows only the most important events in the history of logarithms, subsequent to the facts connected with their invention and the original calculations, will be noticed.

Nathaniel Roe's *Tabulae logarithmicæ* (1638) was the first complete seven-figure table that was published. It contains seven-figure logarithms of numbers from 1 to 100,000, with characteristics appended from the mantissa, and was formed from Vlacq's table (1628) by leaving out the last three figures. All the figures of the number are given at the heads of the columns, except the last two, which run down the extreme columns—1 to 50 on the left hand side, and 50 to 100 on the right hand side. The first four figures of the logarithms are printed at the tops of the columns. There is thus an advance half way towards the strangely now universal eight-figure tables. The final step was made by John Newton in his *Trigonometria Britannica* (1668), a work which is also noticeable as being the only extensive eight-figure table that has ever been published; it contains logarithms of sines, &c., as well as logarithms of numbers.

In 1705 appeared the original edition of Sherwin's tables, the first of the series of ordinary seven-figure tables of logarithms of numbers and trigonometrical functions such as are in general use now. The work went through several editions during the last century, and was at length superseded in 1786 by Hutton's tables, which have continued in successive editions to maintain their position up to the present time.

In 1717 Abraham Sharp published in his *Geometry Improved* the Briggsian logarithms of numbers from 1 to 100, and of primes from 100 to 1100, to 61 places; these were copied into the later editions of Sherwin and other works.

In 1743 a seven-figure table was published in quarto form by Gardiner, which is celebrated on account of its accuracy, and of the elegance of the printing. A French edition, which closely resembles the original, was published at Avignon in 1770.

In 1758 appeared at Paris the first edition of Gallot's tables, which correspond to those of Hutton in England. These tables, which form perhaps the most complete and practically useful collection of logarithms for the general computer that has been published, have passed through many editions, and are still in use.

In 1764 Vega published his *Thesaurus logarithmorum completus*, a folio volume containing a reprint of the logarithms of numbers

from Vlacq's *Arithmetica logarithmica* of 1628, and *Trigonometria arithmetica* of 1633. The logarithms of numbers are arranged as in an ordinary seven-figure table. In addition to the logarithms reprinted from the *Trigonometria*, etc., there are given logarithms for every second of the first two degrees, which were the result of an original calculation. Vega devoted great attention to the detection and correction of the errors in Vlacq's work of 1628. He also published in 1797, in 3 vols. 8vo., a collection of logarithmic and trigonometrical tables which has passed through many editions, a very useful one volume stereotype edition having been published in 1840 by Hulise. The tables in this work may be regarded as so complete and supplementary to those of Callet.

It we consider only the logarithms of numbers, the main line of descent from the original calculation of Briggs and Vlacq is Roe, John Newton, Sherwin, Gardiner, there also then two branches, viz., Hutton founded on Sherwin and Callet on Gardiner, and the editions of Vega form a separate offshoot from the original tables. Among the most useful and accessible of modern ordinary seven-figure tables of logarithms of numbers and trigonometrical functions may be mentioned those of Riemeier, Schron, and Bruhns. For logarithms of numbers only perhaps Babbage's table is the most convenient.

In 1811 Mr Sang published a seven-figure table of logarithms of numbers extending from 20,000 to 200,000; and the logarithms of the numbers between 100,000 and 200,000 were calculated *de novo* by Mr Sang as if logarithms had never been computed before. In tables extending from 10,000 to 100,000 the differences near the beginning of the table are large, and they are so numerous that the proportional parts must either be very crowded, or some of them have to be omitted, and to diminish this inconvenience many tables extend to 108,000. By beginning the table at 20,000 instead of at 10,000, the differences are halved in magnitude, while the number of them in a page is quartered. In this table multiple of the differences, instead of in proportional parts, are given.

As regards the logarithms of trigonometrical functions, the next great advance on the *Trigonometria arithmetica* took place more than a century and a half afterwards, when Michael Taylor published in 1792 his seven-decimal table of log sines and tangents to every second of the quadrant. It was calculated by interpolation from the *Trigonometria* to 10 places and then contracted to 7. On account of the great size of this table, and for other reasons, it never came into very general use. Bagny's *Nouvelles tables des sinusques* (1829), which also contains log sines and tangents to every second, being smaller. In this table was a serious defect to be pointed out. The only other logarithmic canon to every second that has been published forms the second volume of Shorthead's *Logarithmic Tables* (1849). It contains also proportional parts, and is the most complete and accessible table of logarithms for every second. Shorthead's tables originally appeared in 1844 in one volume, during the author's absence in India; but, not being satisfied with them in some respects, he made various alterations, and published a second edition in two volumes in 1849. There have been subsequent editions of the volumes containing the trigonometrical canon. The work is an important one, and the pages are clear, although the number of figures on each is very great.

On the proposition of Carnot, Prier, and Brunet, the French Government decided in 1784 that new tables of sines, tangents, &c., and their logarithms, should be calculated in relation to the centesimal divisions of the quadrant. Frany was charged with the direction of the work, and was expressly required "Non seulement à composer des tables qui ne laissent rien à désirer quant à l'exactitude, mais à en faire le monument de calcul le plus vaste et le plus important qui ait jamais été exécuté on même genre."

These engaged on the work were divided into three sections: the first consisted of one or six mathematicians, including Legendre, who were engaged in the purely analytical work, or the calculation of the fundamental numbers; the second section consisted of seven or eight calculators possessing some mathematical knowledge; and the third comprised seventy or eighty ordinary computers. The work, which was performed in the greatest haste, and independently by two divisions of computers, occupied two years. As a consequence of the double calculation, there are two manuscripts in existence, one of which is deposited at the Observatory, and the other in the library of the Institute, at Paris. Each of the two manuscripts consists of seventeen large folio volumes, the contents being as follows:

Logarithms of numbers up to 100,000	.....	8 vols.
Natural sines .....	.....	1 "
Logarithms of the ratios of areas to areas from 0° 00' 00" to 0° 59' 00", and log sines throughout the quadrant	.....	1 "
Logarithms of the ratios of arcs to tangents from 0° 00' 00" to 0° 59' 00", and log tangents throughout the quadrant	.....	4 "

The trigonometrical results are given for every hundred-thousandth of the quadrant (10" centesimal or 8" 24' sexagesimal). The tables were all calculated to 14 places, with the intention that only 12 should be published, but the twelfth figure is not to be relied upon. The tables have never been published, and are

generally known as the *Tables du Cadastre*; or, in England, as the great French manuscript tables.

A very full account of the *Tables du Cadastre*, with an explanation of the methods of calculation, formulas employed, &c., has been published by M. Lefort in vol. iv. of the *Annales de l'Observatoire de Paris*. The printing of the table of natural sines was once begun, and M. Lefort states that he has seen six copies, all incomplete, although including the last page. Babbage computed his table with the *Tables du Cadastre*, and M. Lefort has given in his paper just referred to most important lists of errors in Vlacq's and Bagny's logarithms of numbers which were obtained by comparing the manuscript tables with those contained in the *Arithmetica logarithmica* of 1624 and of 1638. These are almost the only uses that have been made of the French tables, the calculation of which involved so great an expenditure of time and money.

It may be mentioned here that the late Mr John Thomson of Greenock made an independent calculation of the logarithms of numbers up to 120,000 to 12 places, and that the manuscript of the table was presented in 1874 to the Royal Astronomical Society by his master. The table has been used to verify the sines which M. Lefort found in Vlacq and Briggs by means of the *Tables du Cadastre*. An account of Mr Thomson's table, and of this and other comparisons between it and the printed tables, is to be found in the *Monthly Notices of the Society*, vol. xxvii pp. 447-76 (1874).

Although the *Tables du Cadastre* have never been published, other tables have appeared in which the quadrant is divided centesimally, the most important of these being Robert and Lidel's *Nouvelles tables trigonométriques* (1799), and Borda and Delambre's *Tables trigonométriques décimales* (1800-1). The former work contains natural and log sines, cosines, tangents, and cotangents to 7 places, up to 3° (centesimal) at intervals of 10" (centesimal), and thence to 60° at intervals of 1'. The latter gives log sines, cosines, tangents, and cosecants for centesimal arguments, viz., from 0° to 10° at intervals of 10", and from 10° to 60° at intervals of 10", to 11 places, and also, in another table, log sines, cosines, tangents, cotangents, secants, and cosecants from 0° to 3° at intervals of 10", and thence to 60° at intervals of 1' to 7 places. After the work was printed it was revised by Delambre with the *Tables du Cadastre*, and a number of last-figure errors which are given in the preface were thus detected. Callet's tables already referred to contain in a convenient form logarithms of trigonometrical functions for centesimal arguments.

Two tables of logarithms of numbers which have been recently published may be noticed, as they involve points of novelty. The first of these is Puot's *Tables de logarithmes* (St Petersburg, 1871). The tables are intended to give in a small space (56 pages) all the results that can be obtained from a complete ten-figure table by means of the following principle:—only the logarithms of the numbers from 1,000,000 to 1,911,000 are given. The logarithms of numbers being brought within the range of this table by multiplication by a factor, the logarithm of which factor is to be subtracted from the logarithm in the table. A list of the most convenient factors and their logarithms is given in a separate table. The principle of multiplying by a factor which is subsequently cancelled by subtracting its logarithm, is one that is frequently employed in the calculation of logarithms, but the peculiarity of the present work is that it forms part of the process of using the table. The other tables, which occupy only ten pages, were published in a tract entitled *Tables de logarithmes à 12 décimales, jusqu'à 434 millions* by MM. Namur and Mansion at Brussels in 1876. The fact that the differences of the logarithms of numbers near to 434294 (these being the first figures of the modulus of the Bignian logarithms) commenced with the figure 100, so that the interpolations in this part of the table are very easily and accurately performed, was ingeniously made use of. The only other extensive tables of numbers near to 434294, and other numbers are brought within the range of the table by multiplication by one or two factors which are indicated.

In the ordinary tables of logarithms the natural numbers are all integers, while the logarithms tabulated are incommensurable. In an antilogarithmic table, the logarithms are exact quantities such as 0.0001, 0.0002, &c., and the numbers are incommensurable. The earliest and largest table of this kind that has been constructed is Dodson's *Antilogarithmic canon* (1748), which gives the numbers to 11 places, corresponding to the logarithms from 0.0001 to .9999 at intervals of 0.0001. The only other extensive tables of the same kind that have been published occur in Shorthead's *Logarithmic tables* already referred to, and in Filipowicz's *Table of antilogarithms* (1849). Both are similar to Dodson's tables, from which they were derived, but they only give numbers to 10 places.

The most elaborate table of hyperbolic logarithms that exists is due to Wylfahm, a Dutch mathematician. It has been given in the logarithms of all numbers up to 3200, and of primes, and also of a great many composite numbers from 2200 to 10,000, to 48 decimal places. The table appeared in Schulze's *Neue und erweiterte Sammlung logarithmischer Tafeln* (1778), and was reprinted in Vega's *Thesaurus* (1794), already referred to. Six

logarithms omitted in Schulze's work, and which Wolfiam had been prevented from computing by a serious illness, were published subsequently, and the table as given by Vega is complete. The largest hyperbolic table as regards range was published by Zacharias Dase at Vienna in 1860 under the title *Tafel der natürlichen Logarithmen der Zahlen*. It gives hyperbolic logarithms of numbers from 10000 to 106000 at intervals of 1 to 7 places, with differences and proportional parts, arranged like an ordinary seven-figure table of Briggsian logarithms. The table appeared in the thirty-fourth part (new series, vol. xiv) of the *Annals of the Vienna Observatory* (1861), but separate copies were issued.

Hyperbolic arithmetics are simple exponentials, i.e., the hyperbolic antilogarithm of x is e^x . A seven-figure table of e^x and its Briggsian logarithm from $x = 0.1$ to $x = 10$ at intervals of 0.1 is given in Hulse's edition of Vega's *Sammlung*, and in other collections of tables; but by far the most complete table that has been published occurs in Gudermann's *Theorie der potestativ-als cyklisch-hyperbolischen Functionen*, Berlin, 1833. This work consists of reprinted papers from Crelle's *Journal*, and one of the tables contains the Briggsian logarithms of the hyperbolic sine, cosine, and tangent of x from $x = 2$ to $x = 5$ at intervals of 0.01 to 9 places, and from $x = 5$ to $x = 12$ at intervals of 0.01 to 10 places. Since the hyperbolic sine and cosine of x are respectively $\frac{1}{2}(e^x - e^{-x})$ and $\frac{1}{2}(e^x + e^{-x})$, the values of e^x and e^{-x} may be deduced from the results given in the table by simple addition and subtraction.

Logistic numbers is the old name for what would now be called ratios or fractions. Thus a table of $\log \frac{a}{x}$, where x is the argument and a a constant, is called a table of logistic or proportional logarithms, and since $\log \frac{a}{x} = \log a - \log x$ it is clear that the tabular results differ from those given in an ordinary table of logarithms only by the subtraction of a constant and a change of sign. The first table of this kind appeared in Kepler's *Chilias logarithmorum* (1624) already referred to. The object of a table of $\log \frac{a}{x}$ is to facilitate the working out of proportions in which the third term is a constant quantity a . In most collections of tables of logarithms, and especially those intended for use in connexion with navigation, there occurs a small table of logistic logarithms in which $a = 3600$ ($= 1^\circ \times 12$), the table giving $\log 3600 - \log x$, and x being expressed in minutes and seconds. It is also common to find tables in which $a = 108000$ ($= 8^\circ \times 3^\circ$), and x is expressed in degrees (or hours), minutes, and seconds. Such tables are generally given to 4 or 5 places. The usual practice in books seems to be to call logarithmic logs when a is 3600, and proportional when a has any other value.

Gaussian logarithms are intended to facilitate the finding of the logarithms of the sum and difference of two numbers whose logarithms are known, the numbers themselves being unknown, and on this account they are frequently called addition and subtraction logarithms. The object of the table is in fact to give $\log(a \pm b)$ by only one entry when $\log a$ and $\log b$ are given. The utility of such logarithms was first pointed out by Leonelli in a book entitled *Supplement logarithmicum*, printed at Bordeaux in the year XI. (1802-3); this work being very scarce, a reprint of it was published by M. J. Houel in 1876. Leonelli calculated a table to 14 places, but only a specimen of it which appeared in the *Supplement* was printed. The first table that was actually published is due to Gauss, and was printed in *Zach's Monatshefte Correspondenz*, vol. xxv, p. 498 (1813). Corresponding to the argument A it gives, to 5 places, B and C , where

$$A = \log x, \quad B = \log \left(1 + \frac{1}{x} \right), \quad C = \log(1+x).$$

so that $C = A + B$.

We have identically

$$\log(a+b) = \log a + \log \left(1 + \frac{b}{a} \right) = \log a + B \text{ (for argument } \log \frac{a}{b} \text{),}$$

and, in using the table, the rule is to take $\log a$ to be the larger of the two logarithms, and to enter the table with $\log a - \log b$ for argument; we then have $\log(a+b) = \log a + B$, or, if we please, $= \log b + C$. The formulae for the difference is $\log(a-b) = \log b + A$ (argument sought in column C) if $\log a - \log b$ is greater than 86108 and $= \log b - A$ (argument sought in column B) if $\log a - \log b$ is less than 86108.

The principal tables of Gaussian logarithms are (1) *Matheseos, Tafel zur begyneren Berechnung* (Altona, 1818), giving B and C for argument A to 7 places—this table is not a convenient one; (2) *Peter Gray, Tables and Formulae* (London, 1849), and *Addendum* (1870), giving full tables of B and $\log(1-x)$ for argument A to 6 places; (3) *Zach, Tafeln der Addition- und Subtraction-Logarithmen* (Leipzig, 1849), giving 7-place values of B for argument A , and 7-place values of C for argument B . These tables appeared originally in Hulse's edition of Vega's *Sammlung* (1849); (4)

Wittstein, *Logarithmus de Gauss* (Hanover, 1866), giving values of B for argument A to 7 places. This is a large table, and the arrangement is similar to that of an ordinary seven-figure table of logarithms.

In 1829 Widenbach published at Copenhagen a small table of modified Gaussian logarithms giving $\log \frac{x+1}{x-1}$ ($= D$) corresponding

to A as argument. A and D are thus reciprocal, the relation between them being in fact $10^{A+D} = 10^A + 10^D + 1$, so that either A or D may be regarded as the argument.

Gaussian logarithms are chiefly useful in the calculations connected with the solution of triangles in such a form as $\cot \frac{1}{2}C = \frac{a+b}{a-b} \tan \frac{1}{2}(A-B)$, and in the calculation of life contingencies $a - b$.

Calculation of Logarithms.—The name logarithm is derived from the words $\lambda \gamma \alpha \nu$ $\delta \rho \alpha \mu \acute{o} \varsigma$, the number of the ratios, and the way of regarding a logarithm which justifies the name may be explained as follows. Suppose that the ratio of 10, or any other particular number, to 1 is compounded of a very great number of equal ratios, as for example 1,000,000, then it can be shown that the ratio of 2 to 1 is very nearly equal to a ratio compounded of 301,030 of these small ratios, or *ratiunculae*, that the ratio of 3 to 1 is very nearly equal to a ratio compounded of 477,121 of them, and so on. The small ratios, or *ratiunculae*, is in fact that of the millionth root of 10 to 1, and if we denote it by the ratio of a to 1, then the ratio of 2 to 1 will be nearly the same as that of $a^{301,030}$ to 1, and so on; or, in other words, if a denotes the millionth root of 10, then 2 will be nearly equal to $a^{301,030}$, 3 will be nearly equal to $a^{477,121}$, and so on.

Napier's original work, the *Descriptio canonis* of 1614, contained, not logarithms of numbers, but logarithms of sines, and the relations between the sines and the logarithms were explained by the motions of points in lines, in a manner not unlike that afterwards employed by Newton in the method of fluxions. An account of the processes by which Napier constructed his table is given in the *Constructio canonis* of 1619. These methods apply, however, specially to Napier's own kind of logarithms, and are different from those actually used by Briggs in the construction of the tables in the *Arithmetica logarithmica*, although some of the latter are the same in principle as the processes described in an appendix to the *Constructio*. It may be observed that in the *Constructio* logarithms are called artificial, and this seems to have been the name first employed by Napier, but which he subsequently replaced by logarithms. It is to be presumed that he would have made the change of name also in the *Constructio*, had he lived to publish it himself.

The processes used by Briggs are explained by him in the preface to the *Arithmetica logarithmica* (1624). His method of finding the logarithms of the small primes, which consists in taking a great number of continued geometric means between unity and the given primes, may be described as follows. He first formed the table of numbers and their logarithms:

Number.	Logarithm.
10	1
3.162277 . . .	0.5
1.778279 . . .	0.25
1.333821 . . .	0.125
1.154781 . . .	0.0625

each quantity in the left hand column being the square root of the one above it, and each quantity in the right hand column being the half of the one above it. To construct this table Briggs, using about thirty places of decimals, extracted the square root of 10 fifty-four times, and then found that the logarithm of 1.0000000000000000 12781 91493 20382 85 was 0.0000000000000000 06951 1112 81267 82702, and that for numbers of this form ($\frac{1}{2^n}$), for numbers beginning with 1 followed by fifteen ciphers, and

then by seventeen or a less number of significant figures) the logarithms were proportional to these significant figures. He then by means of a simple proportion deduced that $\log(1.00000\ 00000\ 00000\ 1) = 0.00000\ 00000\ 00000\ 04342\ 94481\ 90325\ 1804$, so that, a quantity 1.00000 00000 00000 x (where x consists of not more than seven figures) having been obtained by repeated extraction of the square root of a given number, the logarithm of 1.00000 00000 00000 x could then be found by multiplying x by .00000 00000 00000 04342

To find the logarithm of 2, Briggs raised it to the tenth power, viz., 1024, and extracted the square root of 1.024 forty-seven times, the result being 1.00000 00000 00000 16851 60570 53946 77. Multiplying the significant figures by 4343 . . . he obtained the logarithm of this quantity, viz., 0.00000 00000 00000 07318 55936 90633 9336, which multiplied by 247 gave 0.01639 99566 39811 95265 277444, the logarithm of 1024, true to 17 or 18 places. Adding the characteristic 3, and dividing by 10, he found (since 2 is the tenth root of 1024) $\log 2 = .30102\ 99566\ 63981\ 195$. Briggs calculated in a similar manner $\log 3$, and thence deduced $\log 5$.

It will be observed that in the first process the value of the modulus is in fact calculated from the formula

$$\frac{h}{10^4 - 1} = \frac{1}{\log_{10} 10}.$$

the value of h being $\frac{1}{247}$, and in the second process $\log_{10} 2$ is in effect calculated from the formula

$$\log_{10} 2 = \left(\frac{10}{2^{10} - 1} \right) \times \frac{1}{\log_{10} 10} \times 2^9.$$

Briggs also gave methods of forming the mean proportionals or square roots by differences; and the general method of constructing logarithmic tables by means of differences is due to him.

The following calculation of $\log 5$ is given as an example of the application of the method of mean proportionals. The process consists in taking the geometric mean of numbers above and below 5, the object being to at length arrive at 5.000000. To every geometric mean in the column of numbers there corresponds the arithmetical mean in the column of logarithms. The numbers are denoted by $A, B, C, &c.$, in order to indicate their mode of formation.

	Numbers	Logarithms.
$A =$	1.000000	0.0000000
$B =$	10.000000	1.0000000
$C = \sqrt{AB}$	3.162277	0.5000000
$D = \sqrt{BC}$	5.623413	0.7500000
$E = \sqrt{CD}$	4.315964	0.6360000
$F = \sqrt{DE}$	4.385474	0.6437600
$G = \sqrt{EF}$	4.382981	0.7187600
$H = \sqrt{FG}$	4.5043065	0.7081260
$I = \sqrt{GH}$	4.458609	0.6983125
$K = \sqrt{HI}$	4.502865	0.6902187
$L = \sqrt{IK}$	4.486418	0.6872666
$M = \sqrt{KL}$	4.491627	0.6982421
$N = \sqrt{LM}$	4.497342	0.6987304
$O = \sqrt{KN}$	4.500062	0.6989745
$P = \sqrt{NO}$	4.499847	0.6988525
$Q = \sqrt{OP}$	4.499950	0.6989315
$R = \sqrt{OQ}$	4.4999701	0.6989440
$S = \sqrt{OR}$	4.4999873	0.6989592
$T = \sqrt{OS}$	4.4999963	0.6989668
$V = \sqrt{OT}$	4.5000008	0.6989707
$W = \sqrt{TV}$	4.4999984	0.6989687
$X = \sqrt{WV}$	4.4999997	0.6989697
$Y = \sqrt{VX}$	4.5000003	0.6989703
$Z = \sqrt{XY}$	4.5000000	0.6989700

Great attention was devoted to the methods of calculating logarithms during the 17th and 18th centuries. The earlier methods proposed were, like those of Briggs, purely arithmetical, and for a long time logarithms were regarded from the point of view indicated by their name, that is to say,

as depending on the theory of compounded ratios. The introduction of infinite series into mathematics effected a great change in the modes of calculation and the treatment of the subject. Besides Napier and Briggs, special reference should be made to Kepler (*Chilias*, 1634) and Mercator (*Logarithmotechnica*, 1668), whose methods were arithmetical, and to Newton, Gregory, Halley, and Cotes, who employed series. A full and valuable account of these methods is given in Hutton's "Construction of Logarithms," which occurs in the introduction to the early editions of his *Mathematical Tables*, and also forms tract 21 of his *Mathematical Tracts* (vol. i., 1812). Many of the early works on logarithms were reprinted in the *Scriptores logarithmici* of Baron Masereus (6 vols. 4to, 1791-1807).

In the following account only those formulae and methods will be referred to which would now be used in the calculation of logarithms.

Since

$$\log_e(1+x) = x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + &c.,$$

we have, by changing the sign of x ,

$$\log_e(1-x) = -x - \frac{1}{2}x^2 - \frac{1}{3}x^3 - \frac{1}{4}x^4 - &c.,$$

whence

$$\log_e \frac{1+x}{1-x} = 2(x + \frac{1}{3}x^3 + \frac{1}{5}x^5 + &c.),$$

and, therefore, replacing x by $\frac{p-q}{p+q}$,

$$\log_e \frac{p}{q} = 2 \left\{ \frac{p-q}{p+q} + \frac{1}{3} \left(\frac{p-q}{p+q} \right)^3 + \frac{1}{5} \left(\frac{p-q}{p+q} \right)^5 + &c. \right\},$$

in which the series is always convergent, so that the formula affords a method of deducing the logarithm of one number from that of another.

As particular cases we have, by putting $q=1$,

$$\log_e p = 2 \left\{ \frac{p-1}{p+1} + \frac{1}{3} \left(\frac{p-1}{p+1} \right)^3 + \frac{1}{5} \left(\frac{p-1}{p+1} \right)^5 + &c. \right\},$$

and by putting $q=p+1$,

$$\log_e(p+1) - \log_e p = 2 \left\{ \frac{1}{2p+1} + \frac{1}{3} \left(\frac{1}{2p+1} \right)^3 + \frac{1}{5} \left(\frac{1}{2p+1} \right)^5 + &c. \right\};$$

the former of these equations gives a convergent series for $\log_e p$, and the latter a very convergent series by means of which the logarithm of any number may be deduced from the logarithm of the preceding number.

From the formula for $\log_e \frac{p}{q}$ we may deduce the following very convergent series for $\log_e 2$, $\log_e 3$, and $\log_e 5$, viz. —

$$\log_e 2 = 2(7P + 5Q + 8R),$$

$$\log_e 3 = 2(11P + 8Q + 5R),$$

$$\log_e 5 = 2(16P + 12Q + 7R),$$

where

$$P = \frac{1}{81} + \frac{1}{3} \cdot \frac{1}{(81)^3} + \frac{1}{5} \cdot \frac{1}{(81)^5} + &c.,$$

$$Q = \frac{1}{49} + \frac{1}{3} \cdot \frac{1}{(49)^3} + \frac{1}{5} \cdot \frac{1}{(49)^5} + &c.,$$

$$R = \frac{1}{161} + \frac{1}{3} \cdot \frac{1}{(161)^3} + \frac{1}{5} \cdot \frac{1}{(161)^5} + &c.$$

The following still more convenient formulae for the calculation of $\log_e 2$, $\log_e 3$, and $\log_e 5$ are given by Professor J. O. Adams in the *Proceedings of the Royal Society*, vol. xxvii (1878), p. 61. If

$$a = \log \frac{10}{9} = -\log \left(1 - \frac{1}{10} \right), \quad b = \log \frac{25}{24} = -\log \left(1 - \frac{1}{100} \right),$$

$$c = \log \frac{81}{80} = \log \left(1 + \frac{1}{80} \right), \quad d = \log \frac{50}{49} = -\log \left(1 - \frac{1}{100} \right),$$

$$e = \log \frac{128}{125} = -\log \left(1 + \frac{3}{1000} \right),$$

then

$$\log_e 2 = 7a - 2b + 8c, \quad \log_e 3 = 11a - 3b + 5c, \quad \log_e 5 = 16a - 4b + 7c,$$

and

$$\log_e 7 = \frac{1}{2}(80a - 10b + 17c - d) \text{ or } 12a - 4b + 5c + e,$$

and we have the equation of condition,

$$a - 2b + 8c - d + 5e = 0.$$

By means of these formulae Professor Adams has calculated the values of $\log_e 2$, $\log_e 3$, $\log_e 5$, and $\log_e 7$ to 260 places of decimals,

and he has deduced the value of $\log 10$ and its reciprocal M , the modulus of the Briggsian system of logarithms. The value of the modulus found by Professor Adams is

M =	.43429	44819	93921	82765	11299
	18916	80508	03261	97905	80366
	05691	14458	76816	58646	49208
	87077	47292	24949	33843	17488
	18706	10674	47663	08713	84167
	92871	58963	04656	92320	94992
	81926	55521	27086	56867	08326
	03870	86095	49266	53831	13860
	77384	90514	26443	43865	76864
	05890	86186	56148	21594	87658
	43643	43878	17947	48649	05098
	56858	05			

The values of the other logarithms are given in the paper referred to.

If the logarithm are Briggsian all the series in the preceding formulae must be multiplied by M , the modulus; thus, for example,

$$\log_{10}(1+z) = M(x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \dots),$$

and so on.

As has been stated, Abraham Sharp's table contains 61-decimal Briggsian logarithms of primes up to 1100, so that the logarithms of all composite numbers whose greatest prime factor does not exceed this number may be found by simple addition, and Wolfman's table gives 48-decimal hyperbolic logarithms of primes up to 10,000. By means of these tables and of a factor table we may very readily obtain the Briggsian logarithm of a number to 61 or a less number of places or of its hyperbolic logarithm to 48 or a less number of places in the following manner. Suppose the hyperbolic logarithm of the prime number 48,867 required. Multiplying by 60, we have $60 \times 48,867 = 2,932,020$, and on looking in Burckhardt's *Table des densités* for a number next to this which shall have no prime factor greater than 10,000, it appears that

$$2,932,020 = 23 \times 47 \times 2029;$$

thus

$$48,867 = \frac{1}{23} (23 \times 47 \times 2029),$$

and therefore

$$\log 48,867 = \log 23 + \log 47 + \log 2029 - \log 50$$

$$+ \frac{1}{23,198,849} - \frac{1}{2} \left(\frac{1}{23,198,849} \right)^2 + \frac{1}{3} \left(\frac{1}{23,198,849} \right)^3 - \dots$$

The first term of the series in the second line

$$= 0.00000 04659 28795 07819 6286;$$

dividing this by $2 \times 5,108,849$ we obtain

$$= 0.00000 00000 00108 98325 8457,$$

and the third term is

$$= 0.00000 00000 00000 00008 1590,$$

so that the series =

$$= 0.00000 04659 28691 13997 4419;$$

whence, taking out the logarithms from Wolfman's table,

$$\log 48,867 = 10.68891 76079 60668 10191 3661.$$

The principle of the method is to multiply the given prime (supposed to consist of 4, 5, 6 or 8 figures) by such a factor that the product may be a number within the range of the factor table, and such that, when it is increased by 1 or 2, the prime factors may all be within the range of the logarithm tables. The logarithm is then obtained by use of the formula

$$\log(x+d) = \log x + \frac{d}{x} - \frac{1}{2} \frac{d^2}{x^2} + \frac{1}{3} \frac{d^3}{x^3} - \dots,$$

in which of course the object is to render $\frac{d}{x}$ as small as possible.

If the logarithm required is Briggsian, the value of the series is to be multiplied by M .

If the number is incommensurable or consists of more than seven figures, we can take the first seven figures of it (or multiply and divide the result by any factor, and take the first seven figures of the result) and proceed as before. An application to the hyperbolic logarithm of π is given by Burckhardt in the introduction to his *Table des densités* for the second million.

The best general method of calculating logarithms consists, in its simplest form, in resolving the number whose logarithm is required into factors of the form $1 \pm \frac{1}{n}$, where n is one of the nine digits, and making use of subsidiary tables of logarithms of factors of this form. For example, suppose the logarithm of 848689 required to twelve places. Divided by 10^5 and by 5 the number becomes 1.087678 , and resolving this number into factors of the form $1 \pm \frac{1}{n}$ we find that

$$848689 = 10^5 \times 5(1 - \frac{1}{10})(1 - \frac{1}{40})(1 - \frac{1}{16})(1 - \frac{1}{16})(1 - \frac{1}{16}) \\ \times (1 - \frac{1}{16})(1 - \frac{1}{17})(1 - \frac{1}{17})(1 - \frac{1}{17})(1 - \frac{1}{17})$$

where $1 - \frac{1}{16}$ denotes $1 - .0625$, $1 - \frac{1}{17}$ denotes $1 - .000588$, &c., and so

on. All that is required therefore in order to obtain the logarithm of any number is a table of logarithms, to the required number of places, of $\frac{1}{n}$, $\frac{1}{2n}$, $\frac{1}{3n}$, $\frac{1}{4n}$, &c., for $n=1, 2, 3, \dots, 9$.

The resolution of a number into factors of the above form is easily performed. Taking, for example, the number 1.087678, the object is to destroy the significant figure 8 in the second place of decimals; this is effected by multiplying the number by $1 - \frac{1}{10}$, that is, by subtracting from the number that ninth itself advanced two places, and we thus obtain 1.00068378. To destroy the first 6 multiply by $1 - .0006$ giving 1.00006381744, and multiplying successively by $1 - .00006$ and $1 - .000003$, we obtain 1.000000857692, and it is clear that these last six significant figures represent without any further work the remaining figures required. In the corresponding antilogarithmic process the number is expressed as a product of factors of the form $1 \pm \frac{1}{n}$.

This method of calculating logarithms by the resolution of numbers into factors of the form $1 \pm \frac{1}{n}$ is generally known as Weddle's method, having been published by him in *The Mathematician* for November 1846, and the corresponding method for antilogarithms by means of factors of the form $1 + (\frac{1}{n})^k$ is known by the name of Hearn, who published it in the same journal for 1847. In 1848 Mr Peter Gray constructed a new table to 12 places, in which the factors were of the form $1 - (\frac{1}{17})^k$, so that n had the values 1, 2, 3, 4, 5, and subsequent to this he constructed a similar table for factors of the form $1 - (\frac{1}{17})^k$. He also discovered a method of applying a table of Hearn's form ($1 \pm \frac{1}{n}$) of factors of the form $1 \pm \frac{1}{n}$ to the construction of logarithms, and calculated a table of logarithms of factors of the form $1 \pm (\frac{1}{17})^k$ to 24 places. This was published in 1879 under the title *Tables for the formation of logarithms and antilogarithms to twenty-four or any less number of places*, and contains the most complete and useful application of the method, with many improvements in points of detail. Taking as an example the calculation of the Briggsian logarithm of the number 48,867, whose hyperbolic logarithm has been calculated above, we multiply it by 6 giving 181,602, and find by Mr Gray's process that the factors of 1.81602 are

(1) 1.816	(5) 1.00170003
(2) 1.000007	(6) 1.0017802
(3) 1.0017698	(7) 1.00176412
(4) 1.0017780	(8) 1.0017840.

Taking the logarithms from Mr Gray's tables we obtain the required logarithm by addition as follows—

522	878	745	280	837	562	704	972	=	colog 3
119	255	889	277	936	638	553	918	=	log (1)
	8	040	050	738	157	610	226	=	log (2)
		259	708	022	625	458	597	=	log (3)
			338	749	636	752	424	=	log (4)
					388	538	964	=	log (5)
					261	445	278	=	log (6)
						178	929	=	log (7)
							148	=	log (8)

$$4.442 137 904 655 780 757 298 404 = \log 48,867$$

In Shortrede's *Tables* there are tables of logarithms and factors of the form $1 \pm (\frac{1}{17})^k$ to 16 places and of the form $1 \pm (\frac{1}{17})^k$ to 25 places; and in his *Table des Logarithmes à 27 Digits* (Paris, 1867) Réaumur gives a table of logarithms of factors of the form $1 \pm \frac{1}{n}$. In the *Essayer of Mathematics*, vol. iii, pp. 65-92, 1878, Mr Henry Wace gave a simple and clear account of both the logarithmic and antilogarithmic processes, with tables of both Briggsian and hyperbolic logarithms of factors of the form $1 \pm \frac{1}{n}$ to 20 places.

Although the method is usually known by the names of Weddle and Hearn, it is really, in its essential features, due to Briggs, who gave in the *Arithmetica logarithmica* of 1624 a table of the logarithms of $1 \pm \frac{1}{n}$ up to $n=16$ places of decimals. It was first formally proposed as an independent method, with great improvements, by Robert Flower in *The Essayer, a new way of making Logarithms*, which was published in 1771; and Leonelli, in his *Supplément logarithmique* (1802-8), already noticed, referred to Flower and reproduced some of his tables. A complete bibliography of this method has been given by Mr A. J. Ellis in a paper "On the potential radix as a means of calculating logarithms," printed in the *Proceedings of the Royal Society*, vol. xxii, 1881, pp. 401-407, and vol. xxxii, 1881, pp. 877-879. Reference should also be made to Hoppe's *Tafeln zur dreissigstelligen logarithmischen Rechnung* (Leipzig, 1876), which give in a somewhat modified form a table of the hyperbolic logarithms of $1 \pm \frac{1}{n}$.

The preceding methods are only appropriate for the calculation of isolated logarithms. If a complete table had to be reconstructed, or calculated to more places, it would undoubtedly be most convenient to employ the method of differences. A full account of this method as applied to the calculation of the *Table des Chiffres* is given by M. Lefort in vol. iv of the *Annales de l'Observatoire de Paris*. (J. W. L. G.)

LOGIC

1. LOGIC, in the most general acceptance of the term, may be regarded as the systematic study of thought. So wide a definition is certainly sufficient to comprehend all that may have been at various times included within the scope of logical doctrine, but in other respects it is of small value. It does not serve to mark off logic from philosophy as a whole, which is unquestionably the systematic exposition of thought, nor from psychology, which includes within its wider range what may well be described as the study of thought. Without some more accurate discrimination of the provinces and method of logic, neither the extent of matter to be included within the study nor the peculiarity of the method by which such matter is treated can be determined.

Preliminary queries of a similar kind are naturally encountered in the case of all other branches of human knowledge, and are generally answered by two methods. We may refer either to the distinct characteristics of the matter to be treated, or to the essential features of the method of treatment. We may determine the province of a science either by external division, by classification of objects according to their prevailing resemblances and differences, or by internal definition, by exposition of the fundamental characters of the method employed. By neither process, unfortunately, can an unambiguous answer be supplied, at least without much art, in the case of logic.

2 The reasons for the manifold difficulties encountered in the attempt to determine accurately the province of logic, whether by reference to a division of the sciences or by precise definition of the essential features of logical analysis, are not far to seek. The systematic classification of the sciences involves not only consideration of the contents of the sciences as empirically presented, but also certain leading principles or fundamental views, which are in essence of a philosophical character. According to the general conception of knowledge which in various kinds is manifested in the special sciences, there will be radically divergent methods of classification, and the province assigned to each member of the ensemble will, for the most part, have its limits determined according to the character of the general view adopted. Moreover, if any of the more prominent specimens of classification of the sciences be critically inspected, they will be found to presuppose a certain body of principles, of scope wider than any of the special disciplines, and to which no place in the ensemble can be assigned. In short, a systematic distribution of human knowledge into its distinctly marked varieties rests upon and presupposes a general philosophy, the character of which affects the place and function of each part of the distribution. Logic, as may readily be imagined, has therefore experienced a variety of treatment at the hands of systematizers of scientific knowledge. It has appeared as one of the abstract sciences, in opposition to those disciplines in which the character of the concrete material is the essential fact; as a subordinate branch of a particular concrete science, the investigation of mental phenomena; as a nondescript receptacle for the formulation in generalized fashion of the method and logical precepts exemplified in the special sciences. By such processes no more has been effected than to bring into light, more or less clearly, some of the characteristics of the supposed science, without in any way supplying an exhaustive and comprehensive survey of its boundaries and relations to other branches of knowledge. Thus, when logic is marked off from the concrete sciences and associated with mathematics in the most general sense, as the treatment

of formal relations,¹ and further differentiated from mathematics as implying no reference to the quantitative character of the most general relations under which facts of experience present themselves,² there is certainly brought to the front what one would willingly allow to be a common-place respecting all logical analysis, namely, that its principles are coextensive with human knowledge, and that all objects as matters of conscious experience have an aspect in which they are susceptible of logical treatment. But no more is effected. It is still left to a wider consideration to determine what the specific aspect of things may be which shall be called the *formal* and be recognized as the peculiarly logical element in them. There may be selected for this purpose either the general relations of coincidence and succession in space and time, or the fundamental properties of identity and difference, or the existences of classes, but in any case such selection depends upon and refers to a theory of the nature of knowledge and of the constitution of things as known. In truth, the notions of *form* and *formal relations* are by no means so simple and free from ambiguity that by their aid one can at once solve a complicated problem of philosophic arrangement. To lay stress upon *form* as the special object of logical treatment still leaves undecided the nature and ground of the principles which are to be employed in evolving a science of form, and therefore leaves the logical problem untouched.

Still less satisfactory are the results when logic is regarded as in some way a subordinate branch of the psychological analysis of mental phenomena.³ Neither the grounds on which such a classification rests, nor the conclusions deduced from it, seem beyond criticism. The simple facts that certain mental processes are analysed in logic, and that psychology is generally the treatment of all mental processes, by no means necessitate the view that logic is therefore the outgrowth from and a subordinate part of psychology. For it is clear, on the one hand, that logic has a scope wider than psychology, since in any sense of the term it has to deal with all the processes (or with some aspect of all the processes) by which on any subject knowledge is formed out of disjointed or disconnected experiences. And, on the other hand, since the subordination of one science to another, as species to genus, is fallacious, unless the two agree in fundamental characteristics, the position so assigned to logic would imply that in aim and method it shall be essentially one with psychology, a position equivalent to the negation of logic as a separate and independent discipline. It is not surprising therefore to find that so soon as logic has been distinguished as arising from psychology, and so dependent on it, the peculiarity of its position and functions compels the recognition of its more general scope and the reduction of its connexion with psychology to an amount small enough to be compatible with absolute independence. Strong

¹ *Ans. c.p.*, by H. Spencer, *Classification of the Sciences*, pp. 6, 12; H. Grossmann, *Die Ausdehnungslehre* von 1844 (1878), Einleitung, xxi.—xxii.

² Logic and mathematics, under this view, may be regarded either as generically distinct—which is apparently the opinion of Spencer, H. Grossmann, and Jevons—or as species of a more comprehensive genus, the theory of formal (symbolic) operations—which is apparently the opinion of B. Grossmann (see his *Formenlehre*, 737ff) and Boole (see his *Mathematical Analysis of Logic*, 1847, p. 4, and *Differential Equations*, 1869, chap. xvi., specially pp. 888, 890). An admirable treatment of that which is implied in Boole's method is given in Mr Veit's *Symbolische Logik*, 1891.

³ For this extremely common arrangement, see Hamilton, *Lectures on Metaphysics*, i p. 191–3; Ueberweg, *System der Logik*, § 6.

reasons, indeed, may be advanced for holding that logic is entirely to be separated from psychology, as differing from it in aim, method, and principle, that logical analysis is generically distinct from psychological, and that the two disciplines, while connected as parts of the general body of philosophical reflection, hold to one another a relation the reverse of that commonly accepted.¹

As to the endeavour to collect from consideration of the sciences in detail a body of precepts, the rules of scientific method, and to assign the systematic arrangement of such rules to one special discipline, called logic, it seems to stand on the same footing and to be open to the same criticism as the allied attempt to treat general philosophy as the receptacle for the most abstract propositions reached in scientific knowledge. There is a peculiar assumption underlying the supposed possibility of distinguishing between scientific method and its concrete exemplifications in the special sciences, and only on the ground of this assumption could there be rested the independence of logic as the systematic treatment of method. It is taken for granted, without examination, that the characteristic features of correct and well-founded thinking are palpable and general, and that we thus possess a criterion for marking off what is common to all scientific procedure from that which is special and peculiar to the individual sciences. An elaborate philosophic doctrine lies at the root of this assumption, and the position assigned to logic may easily be seen to depend, not on what is apparent in the argument, namely, comparison of the sciences with one another, but on what lies implicit in the background, the philosophic conception of the nature of scientific knowledge in general. Without reference to the ultimate philosophic view, no definite content could be assigned to logic, and it would remain impossible to distinguish logic from the sciences in detail.²

3. Thus the various attempts to define the province and functions of logic from general classification of the sciences, to define, in short, by the method of division, yield no satisfactory answer, and refer ultimately to the philosophic view on which classification and division must be based. A similar result becomes apparent when we consider the various descriptions of logic that have been presented as following from more precise and accurate determination of the essential features of logical analysis and method.

"The philosophical deduction or construction of the notion of logic presupposes a comprehensive and well-grounded view, whether of the nature and mode of operation of the human mind, a definite part of which falls under logical treatment, or of the problems and objects of philosophy in general, from among which in due order may be distinguished the particular problem of logic."³ The most elementary distinctions, by means of which, in the ordinary exposition of logic, progress is effected towards an accurate determination of the province of the science, not only refer to some such ultimate philosophic view, but lead to the most diverse results, according to the peculiarities of the views on which they are based. Of these elementary distinctions the following are at once the more usual and the more important,—the distinction between the province of logic and the province of the special sciences, as that between general and special; the distinction between

natural growth of knowledge, with its natural laws, and the normal procedure whereby grounded knowledge is obtained, with its normal or regulative principles; the distinction between knowledge as a whole and its several parts, immediate and mediata, with restriction of logic to the treatment of all or portion of mediata knowledge; the distinction between the constituents of knowledge as on the one hand given from without (in experience), and on the other hand due to the elaborative action of intellect itself. To one or other of these may be traced the common definitions of logic, and a brief consideration of their contents will be sufficient to show that they severally rest upon more or less developed general philosophic doctrines, and that their significance for accurate determination of the field of logic depends not so much on what is explicitly stated in them as on what is implied in the general doctrines from which they have taken their rise.

The distinction of logic from the sciences, as dealing in the abstract with that which is concretely exemplified in each of them, is certainly a first step in the process of determination about which there can be little or no doubt. But if the distinction remains vague, it is not sufficient to differentiate logic from many other disciplines, philosophical or philological, and if it be made more precise, the new characteristics will be found to involve some special view as to what constitutes the common feature in the sciences, and to vary with the possible varieties of view. As a rule, too, the added characteristics do not serve by themselves to mark off logical treatment as an independent kind of investigation. They are most frequently obtained by a general survey of scientific procedure. Thus it may be said that in all sciences there are implied clearly defined notions, general statements or judgments, and methodical proofs; logic therefore, as the theory of the general element in science, will appear as the treatment of notions, judgments, and proofs generally, or in the abstract. If so, then, unless some implied principle further determine the course of procedure, logic would be regarded as a merely descriptive account of the parts making up scientific knowledge, and it would be not only impossible to assign to it an independent position, but hard to discriminate it from psychology, which likewise deals with the parts of knowledge. If it be understood, however, or explicitly stated, that in all scientific knowledge there is community of method, resting on common principles or laws of knowledge as such, than clearly not only the province of logic, as now made identical with the treatment of the essence of knowledge, but the special nature of the theorems making up the body of logic, must depend upon the general conception of knowledge with which the thinker starts. In the view of logic taken, e.g., by Mill, the fundamental idea is that of *evidence*, under which must be included all the grounds for any judgment not resting on immediate perception. So far as verbal statement is concerned, the adoption of this as the root idea would not distinguish in any special way the treatment of logical problems resting on it, but in fact each problem is dealt with in accordance with the particular theory of what, from the nature of human knowledge, constitutes evidence. Logic thus involves, or in truth becomes, a theory of knowledge, and in the end, for general spirit and details of doctrine, refers to an ultimate philosophic view. There seems no escape from this conclusion. Start as we may, with popular, current distinctions, no sooner do logical problems present themselves than it becomes apparent that, for adequate treatment of them, reference to the principles of ultimate philosophy is requisite, and logic, as the systematic handling of such problems, ceases to be an independent discipline, and becomes a subordinate special branch of general philosophy.

The attempt to avoid this conclusion must of necessity

¹ It is to be acknowledged that most of the writers on logic who emphasize the connexion of psychology with logic introduce distinctions equivalent to the remarks above made, but the grounds for such distinctions and the conclusions to be deduced from them are not generally brought into clear light.

² See, for a clear statement of this impossibility, Comte, *Philos. Positive*, i. 34, 35. Definitions of logic as theory of method, which are based on general philosophic views (e.g., the definition by Sigwart, *Logic*, i. § 1), stand on a different footing, and are to be examined on different principles.

³ Twiss, *Die Logik, insbesondere die Analytik* (1825), p. 2.

take form in some discrimination of logic from other varieties which may with it be classed under philosophy in general, and such discrimination is usually effected by laying stress on one or other of the following characteristics.

(1) In the whole process of knowledge, it may be said, we are able to distinguish and to regard in isolation the methods according to which, from a combination of various elements, cognition of things grows up, and the laws according to which these elements must be ordered, if our subjective consciousness is to represent accurately and faithfully the relations of things. The laws of knowledge, there being understood by knowledge the whole sum of mental determinations in and through which the world of external and internal experience is realized for us, are of two distinct kinds, natural and normal. For the treatment of the natural laws the most appropriate title is psychology; for that of the normal or regulative laws the title logic is peculiarly appropriate. By the one science knowledge is regarded in its relation to the subjective consciousness, as so much of what enters into and constitutes the world of inner experience; by the other knowledge is regarded in its relation to truth, to the objective system, as the means whereby, for theoretical or practical purposes, an orderly and verifiable conception of this system is realized. A definite place seems thus secured for logic, but, if one may judge merely from the various attempts to expound the body of logical doctrines from this point of view, the characteristic feature is not yet sufficient to determine the boundaries of the science or the specific nature of its problems. In fact, the feature selected might be accepted as the distinguishing mark of logical-science by writers who would include under that common title the most diverse matters, and who would differ fundamentally in respect to the treatment of isolated problems. The metaphysical logic of Hegel, the empirical logic of Mill, the formal logic of Kant, might all claim to be developments of this one view of the essence of logic. So wide a divergence is clear evidence that the criterion selected, though possibly accurate, is not sufficiently specific, and that the interpretation of it, which in truth determines for each the nature and boundaries of the science, depends upon the view taken respecting knowledge as a whole in its relation to the objective order of experience, respecting the import of the so-called normal laws, and respecting the subjective elements supposed to constitute knowledge.

On all sides this particular definition of logic is beset with difficulties, which it cannot afford to dismiss by means of the simple demand that knowledge shall be accepted as somehow given. For, apart altogether from the danger that under so wide a term as knowledge many differences may be accommodated, it, then becomes impossible to do, more than treat in a quasi-empirical fashion mental facts, the nature and peculiarities of which are to be learned from some external source. In the later, more detailed examination of the view of logic here briefly described, it will be pointed out that the usual formula by which the several logical notions are introduced, viz., that their nature as mental facts is dealt with in psychology, from which logic borrows, is in fact much more than a formula. The logical peculiarities will be found to rest mainly upon the psychological characteristics as borrowed, while it is evident that no substantive, independent existence can be vindicated for a doctrine, the succession of whose parts, and their essential nature, are given externally.

(2) Some of the perplexities that arise when logic is treated as the theory of the normal laws of knowledge may be obviated by the current distinction between immediate and mediate knowledge. The normal laws of knowledge might be said to apply solely to the process of mediate cognition, and their final aim would be defined as harmony

between mediate knowledge and immediate experience. But it is difficult to distinguish with perfect accuracy between the two kinds of knowledge in question; it is impossible that the treatment of the logical problem should not depend entirely on the view taken as to the nature of that which differentiates mediate from immediate knowledge. Whether we express this as thought or as belief, its nature then becomes the all-important factor in determining the course of logical treatment, and further progress will manifest divergencies according as stress is laid on the subjective characteristics of thought, the laws to which, from its essential nature, all its products must conform, or on the limitations imposed by principles which have reference to the most general relations of the things thought about. In the one case a formal logic, of the type commonly known as the Kantian, would be developed, in the other either an empirical logic, like that of Mill, wherein the nature of notions, propositions, and reasonings is considered from the point of view of the empirical conception of experience, or a transcendental logic, like that involved in the *Critique of Pure Reason*, or a metaphysical logic, like that of Hegel, or a mixed doctrine, like that of Trendelenburg, Lotze, and Ueberweg. In short, the general philosophic view of thought is that upon which the character of logic as a science rests.

(3) There has above appeared, incidentally, one of the most current methods of solving the logical problem, by procedure from the distinction between that which is given to the mind in knowledge, and that which is supplied by the mind itself. No distinction seems more ample; none is in reality more complex. The opposition on which, in its popular acceptance, it rests is that between the individual concrete thinking subject and the world of objective facts, existing, as it were, to be cognized. The full significance of such an opposition, the forms in which it presents itself in conscious experience, the qualifications which must be introduced into the statement of it that it may have even a semblance of reality,—these are problems not solved by a simple reference to the distinction as existing. It may well be held that knowledge is, for the individual, the mode (or one of the modes) in which his relation to the universe of fact is subjectively seized, but it is not therefore rendered possible to effect an accurate and mechanical separation of knowledge into its matter and form. Even on lower grounds it may be held that by the employment of this criterion little or no light is thrown upon the logical question. For no determination is supplied by it of the universal characteristic of form as opposed to matter in knowledge, and a comparison of various expositions will show the most startling diversity of view respecting the nature and boundaries of the formal element in knowledge. It is of course true that in one sense any scientific treatment of knowledge is formal. Our analysis extends only to the general or abstract aspect of cognition, not to its actual details. But we are not, on that account, dealing with the form of knowledge. So soon as it is attempted to define more accurately what shall be understood by form then it is found that various views of logic arise, corresponding to the variety of principles supposed to be applied in the treatment of form. Thus the stricter followers of the Kantian logical idea, e.g., Manass and Spalding, recognize, as sole principles which can be said to be involved universally in the action of thought, the laws of identity, non-contradiction, and excluded middle, and in their hands logic becomes merely the systematic statement of these laws, and the exposition of the conditions which they impose upon notions, judgments, and reasonings. Analytical consistency, i.e., absence of contradiction, is on this view the one aspect of knowledge which is susceptible of logical treatment. On the other hand, the idea of a contribution furnished by the

mind itself to knowledge may lead to a more concrete and yet not less exact system of the forms of knowledge, if there be taken into account the real character of the operation by which such contribution is made. Thus in the logic of Uriol, from the view of thought as essentially the distinguishing faculty, by which definiteness is given to the elements entering into knowledge, there follows not simply an iteration of the principle that thought must not contradict itself, but a systematic evolution of the fundamental relations involved in the action of thought, in which the more specifically logical products, the notion, judgment, and reasoning, have a determinate place assigned to them.

Not only, then, may quite distinct provinces be assigned to logic by thinkers who start with the same idea of thought as contributing to knowledge, but, as may well be imagined, the treatment of special logical problems presents a most bewildering variety. The nature of judgment, the principle of reasoning, the characteristics of thought which is in accordance with logical rules, will be viewed differently according to the special interpretation put upon the functions of the subjective factor in knowledge. Here again we find that the really influential fact in the determination of the province and method of logical sciences is a general philosophic conception of knowledge or thought.¹

4 There remains yet one method by which a clear and sufficient definition of the province and function of logic may be attainable. It may be that the separation of logic from other philosophic disciplines has come about historically, and that the assignment to logic of a special body of problems and a special kind of treatment is due to the accidents of its development. We might therefore hope to gain from a comparative survey of the field of logic, as that has been historically marked out, some definite view not only respecting the specific problems of logical theory, but also regarding the grounds for the isolated treatment of them. That in the history of logic there should be found a certain continuity of doctrine and development may, however, be compatible with entire absence of a common body of received logical matter, and the result of an historical research may be little more than a statement of distinct conceptions regarding the nature and province of the science, leading to the inclusion of very distinct materials within its scope. It requires but a superficial investigation of that which at various intervals has presented itself as logical theory to arrive at the conclusion that the differences in general spirit and in the mass of details far outweigh any agreement as to a few detached doctrines and technical symbols. If the survey were limited even to the period preceding the attempts at radical reformation of philosophy in general, and of logic as included therein, to the period in which the Aristotelian doctrines, as they may be called, formed the common basis of logical treatment, we should be able to detect differences of such a kind as to indicate radically distinct fundamental views. The scholastic logic, which, even by itself, cannot be regarded as one theory with unimportant modifications, is most falsely described as Aristotelian. The technical terminology, the general idea and plan, and some of the formal details are certainly due to the Aristotelian analysis of reasoned knowledge, but in spirit, in ruling principles, and in the mass of details the method of the scholastic logic is alien to that of Aristotle. It will be shown later that the Aristotelian analysis is saturated with the notions, and aims of the Aristotelian metaphysics and general theory of knowledge, and that on this account alone, apart from

the introduction of many foreign ingredients, from Stoic, Arab, and Byzantine sources, into the scholastic system, an important difference must subsist between the original doctrine and that which presents itself as but its historical development. Even more radical is the divergence of modern logic from the Aristotelian ideal and method. The thinker who claimed for logic a special pre-eminence among sciences because "since Aristotle it has not had to retrace a single step, . . . and to the present day has not been able to make one step in advance,"² has himself, in his general modification of all philosophy, placed logic on so new a basis that the only point of connexion retained by it in his system with the Aristotelian may be not unfairly described as the community of subject. Both deal in some way with the principles and methods of human thinking, but as their general views of the constitution of thought are diverse, little agreement is to be found in the special treatment of its logical aspect. So when a later writer prefaces his examination of logical principles with the declaration that "logic is common ground on which the partisans of Hartley and of Reid, of Locke and of Kant, may meet and join hands,"³ we are not unprepared for the result that, with a few unimportant exceptions, his views of logical principle coincide with those of no recognized predecessor in the same field, diverge widely from either the currently received or the genuine Aristotelian doctrines, and lead to a totally new distribution, in mass and detail, of the body of logical theorems and discussions. Such divergence is, indeed, most intelligible. If one reflects on the significance which would be attached in any one of these logical systems, of Aristotle, of Kant, of Mill, to the *universal* or universalizing element of thought, and on the fact that such universal must manifest itself as the characteristic feature in all the important products of thinking, the notion, the judgment, the syllogism, the conclusion is inevitable that difference of view in respect to the essence must make itself felt in difference of treatment of details. The ultimate aim of proof, and the general nature of the methods of proof, must appear differently according as the accepted ground is the Aristotelian conception of nature and thought, the Kantian theory of cognition, or subjective empiricism.

If, adopting a simpler method, one were to inspect a fair proportion of the more extensive recent works on logic, the conclusion drawn would be probably the same,—that, while the matters treated show a slight similarity, no more than would naturally result from the fact that thought is the subject analysed, the diversity in mode of treatment is so great that it would be impossible to select by comparison and criticism a certain body of theorems and methods, and assign to them the title of logic. That such works as those of Trendelenburg, Ueberweg, Uriol, Lotze, Sigwart, Wundt, Bargmann, Schuppe, De Morgan, Boole, Jevons, and these are but a selection from the most recent, treat of notions, judgments, and methods of reasoning, gives to them indeed a certain common character; but what other feature do they possess in common? In tone, in method, in aim, in fundamental principles, in extent of field, they diverge so widely as to appear, not so many different expositions of the same science, but so many different sciences. In short, looking to the chaotic state of logical text-books at the present time, one would be inclined to say that there does not exist anywhere a recognized, currently received body of speculations to which the title logic can be unambiguously assigned, and that we must therefore resign the hope of attaining by any empirical consideration of the received doctrine a precise determination of the nature and limits of logical theory.

¹ In Rosenkranz, *Die Modificationen der Logik abgeleitet aus dem Begriff des Denkens* (1848), a similar conclusion is illustrated by an elaborate classification of possible modifications of the view of logic. Compare also Brandes, *Die Logik in ihrem Verhältnisse zur Philosophie geschichtlich betrachtet* (1856).

² Kant, *Kritik*, Vorrede, p. 13.

³ Mill, *System of Logic*, i. p. 18.

5. In order to make clear the reasons for this astonishing diversity of opinion regarding the province and method of logic, and so make some advance towards a solution of what may well be called the logical problem, it seems necessary to consider some of the leading conceptions of logic, with such reference to details as will suffice to show how difference of fundamental view determines the treatment of special logical problems. In this consideration the order must be historical rather than systematic. Not, indeed, that it is useful, nor is it proposed, to present an historical account of philosophy at large, or even of logic in particular, our purpose is merely to disentangle and bring clearly forward the nature of the principles respecting logical theory which have served as basis for the most characteristic logical systems. Such an inquiry will not only assist in explaining the divergencies of logical systems, but throw light upon the essence of logic itself.¹

In this historical-critical survey, the first section must naturally be devoted to a consideration of the Aristotelian logic. The records of Oriental attempts at analysis of the procedure of thought may, for our present purpose, be disregarded.²

The Aristotelian Logic.

6. In a remarkable passage at the close of the tract called by us the *Sophistical Refutations*, Aristotle claims for himself distinct originality in the conception of subjecting to analysis the forms or types of argument. "The system I have expounded had not been partially, though imperfectly, elaborated by others; its very foundations had to be laid. The teachers of rhetoric inherited many principles that had long been ascertained; dialectic had absolutely no traditional doctrines. Our researches were long, tentative, and troublesome. If, then, starting from nothing, it bears a comparison with others that have been developed by a mass of labour in successive generations, candid criticism will be readier to commend it for the degree of completeness to which it has attained than to find fault with it for falling short of perfection."³ Although the specific reference in this passage is to the analysis of dialectical argument contained in the *Topics*, the same claim might with justice have been made in regard to the more extensive analysis of the forms of reasoning in general which makes up the substance of the other books of the *Organon*. There had been, prior to Aristotle, much discussion of problems that would under any view be included under the head of logic, but no systematic attempt had been made to analyse knowledge as a whole in its formal aspect, to throw under general heads or classes the types of reasoning, whether dialectical or scientific, and to exhibit the general relations in which the elements of all reasoning stand to one another. After Aristotle, it became possible to refer all such discussions to a common head, and to view them as component parts of one systematic doctrine. In a peculiar sense, then, Aristotle may be described as the founder of logical science.

The precise nature of the inquiries falling within the scope of the Aristotelian logic may receive some preliminary explanation supplementary to that which can only be given by a careful study of the chief theorems of the system. If there be taken into account (a) the advance towards a theory of logical method contained in the speculations of earlier Greek thinkers, (b) the classification of philosophic discipline which underlies the body of Aristotle's writings, and (c) the general conception of the matter of logical analysis which may be deduced from any special or incidental treatment of the question in Aristotle. Of these in order.

7. (a) Logical discussions prior to Aristotle.

The inquiries which find a place in the Aristotelian logic are all, in a large sense, problems of the theory of knowledge. They arise, therefore, only in connexion with critical reflection on the nature, grounds, and method of knowledge. The earliest forms of Greek speculation, turning rather upon explanation of natural fact, being in essence attempts to reduce the multiplicity of known fact to unity of principle, contain, as a consequence, problems of a metaphysical character, which might involve problems of strictly logical analysis which may be deduced from any special or incidental treatment of the question in Aristotle. Of these in order.

¹ For a notice of works on the history of logic, see note A. p. 802.

² For notices of some of the more developed systems of Oriental logic, see note B. p. 802.

³ The above translation, which is somewhat free, is taken from Mr Porter's edition of the *Sophistical Elements*, p. 95.

history of philosophic speculation. In the first period of Greek speculation, the problem presented itself in its simplest, most direct aspect, and, after a few rough attempts at a quasi-physical explanation of the genesis of many out of one, these came forward, as reasoned, ultimate solutions, the Eleatic doctrine that one unity has laid being the Heraclitic counter-doctrine that only in change, in the many, is truth to be found, and the Pythagorean notion of number, harmony, as containing in abstract the union of the opposites, one and many. No one of these philosophic treatments can be said to contain specifically logical elements, but they raise questions of a logical kind, and, especially in the records of the Eleatic view, one can trace a close approximation to the critical reflection which marks the transition to a new order of ideas. Results which in these systems are stated with metaphysical reference only, reappear with new aspect among the sophists and the Socratic schools. The transition stage, indeed, partly aided by the atomic separation of objects far from a subjective sense experience, is mainly the effect of the sophistic and Socratic teaching. Socrates and the sophists have this in common that both treat the fundamental problem of philosophy as it had been handed down with special reference to the subjective experience of the individual. In the teaching of the sophists generally it is to be discerned the opposition between subjective reflection and objective fact, in that of Protagoras and Gorgias in particular there appear as problems of the theory of knowledge difficulties for the older metaphysics of Heraclitus and the Eleatics respectively. The Heraclitic principle of change is the general foundation for the doctrine that the momentary perception is the only fact of cognition, and upon it may be based the conclusion that all truth is relative to the individual state of the individual subject, and that judgment, as a mode of expressing truth, is a contradiction in itself. Thus the extremes Heraclitism, as a unity, rejected the proposition, or combination of words, as expressing a unity and permanence not to be found in things, and reduced speech to the symbolism of pointing with the finger. Less developed but not less clear is the connexion between the brief sceptical theses of Gorgias and the Eleatic doctrine of unity. As knowledge was impossible on the Heraclitic view, since it implied a synthesis not discoverable amidst incessant change, so Gorgias' knowledge was impossible, since in the synthesis was involved an element of difference, multiplicity, not reconcilable with the all-embracing unity of things. It is evident from the treatment of such views in Plato and in Aristotle, how many of the illustrations used in support of the general theses depended for their apparent strength on neglect of some of the elementary conditions of thought, and how inevitably reflection upon those difficulties led to the construction of a theory of thought. The first outlines of such a theory are to be found in the Socratic principle of the notion (or concept, as we may call it, for the notion as viewed by Socrates is certainly the concrete class notion, the ample result of generalization and abstraction), and to Socrates is assigned by Aristotle the first statement of two important logical processes—induction, or the collection of particulars from which by critical comparison a generalized result might be drawn, and definition, or the explicit statement of the general elements disclosed by critical comparison of instances. In the Socratic teaching, so far as records go, no explicit reference was made to the problems in connexion with which those processes are of greatest significance, but in the lesser Socratic schools on the one hand, and in Plato on the other, we find the new principle either brought to bear upon the old difficulties, or developed into a comprehensive method.

The Socratic concept contains in itself the union of one and many, but it is in nature subjective; it is a mode of knowledge. If, then, it be regarded as only subjective, the old difficulties reappear. How is it possible to reconcile, even in thought, an opposition so fundamental as that between unity and diversity? But there yet is a like irreconcilable opposition between the subjective counterparts of these objective relations, between the individual notion, the atom of knowledge, and the proposition or definition. How, indeed, can there be a combination in thought of that which is in essence irreconcilable? Wherever we take these questions, which draw mainly for theory of knowledge on the Heraclitic Pythagorean sources, or Antisthenes, who leans towards the Eleatic, or the Megarics, who also, in accordance with the Eleatic thoughts, devoted chief attention to the polemical aspect of the theory, we find a set of problems appearing, the solution of which impetively called for a theory of knowledge as the combination of one and many. Perhaps the most interesting of these early thinkers, so far as the history of logic is concerned, is Antisthenes, whose extreme nominalism presents the most curious analogies to some recent logical work.⁴ According to Antisthenes, the world of cog-

⁴ *Metaph.*, 1078b, 27-28.

⁵ On Antisthenes, see the third part of the *Thaïs*, which appears, beyond doubt, to refer to him (comp. Peipers, *Untersuchungen über das System Platons*, 1874, pp. 124-48), and Aristotle, *Metaphysics*, 1028a, 32; 1049b, 24; *Topics*, 1048b, 21.

simplest fact consists of combinations of elementary parts (*πρώτα*). These *πρώτα* appear in cognition as irreducible elements denoted by the simplest elements of speech, names. The name is the mark for the sense-impression by which each *πρώτον* is communicated to us, for they are only known by sense, and are strictly individual. A composite thing is known through the combination of names of its parts, and such a combination (*σύνθεσις*) is a proposition or definition (*λόγος*). Each thing has its specific *λόγος* (*οικείος λόγος*), and a judgment is merely the expression of this. There is therefore no distinction of subject and predicate possible; even identical propositions, the only possible forms of this theory, are mere repetitions of the complex name. Predication is either impossible or reduces itself to naming in the predicate what is named in the subject. It is the simple result of so consistent a nominalism that all truth is salutary or relative; there is no possibility of contradiction, not even of one's self.

The theory of Anaximenes, strange as it may at first sight appear, rested on certain metaphysical difficulties, which lie at the root of all the perplexity regarding the import of propositions, and it is not too much to say that these difficulties were kept continually in mind by Plato and Aristotle in their several attempts to explain the nature of knowledge. Both thinkers find themselves confronted with the ultimate question, What is the ground of unity in things known, and in what way does thought unite the detached attributes of things into a subjective whole? What is the nature of the unity which binds things, themselves in a sense unites, into classes or wholes, and how does it act in the judgment subject and predicate are, in a sense, set at one?

In Plato, for whom the solution was found in the participation in or immanence of ideas by things, we find more distinctly conceived the series of logical processes involved obscurely in the Socratic method. So far as positive statements regarding the ideas can carry one, it may be said that in essence these processes concern only the formation of or deduction from the concrete universal concept or general notion. The ideas, in the Platonic system, at least in reference to the thought which apprehends them, resemble most closely class notions. A deeper analysis often appears to attach to the relative processes of *induction*, whereby the resemblance of things, the idea in them, is disclosed, *definition*, whereby the content of the idea is made explicit, and *division*, whereby the external connection of ideas with one another, their system, is deduced, but such significance attaches to the merely metaphysical aspects of the theory, and had no particular bearing on the Aristotelian treatment of the same problems. Not much is given in Plato towards a theory of the proposition, though sometimes an analysis of its elements is sketched, and the method of division could yield only a few of the types of deductive reasoning. But, over and above these more definite contributions towards the construction of a theory of knowledge, there are general aspects of the Platonic work of not secondary importance for the Aristotelian logic. In Plato the fundamental differences of earlier philosophy views appear in a new phase, and are elevated to a higher stage. Sophistic method is analysed, not as in forms actually existing, but in its essential features, and the opposition between sophist and philosopher is viewed as the opposition between opinion and knowledge. Heraclite principle of change and Eleatic doctrine of unity are resolved into the more comprehensive opposition of the universal and the particular, while hints of an ultimate solution, of a universal which is at once and *per se* particular, are not wanting. The Socratic method of thought appears as that by which alone a solution of philosophic difficulties is to be obtained, and the consideration of thought in its relation to facts is marked out for special investigation. A deeper view of thought was thus made at once possible and necessary.

(8) Much, then, had been effected by Aristotle's predecessors in the way of preparing a definite body of problems and a method of dealing with them, problems and method which might fairly be said to belong to a theory of knowledge as such, and in the occasional references in the *Organon* to opinions of contemporaries it is evident that many isolated attempts at solution of such questions were being carried on. In Aristotle we find a systematic examination of many of these problems, but it is left by him doubtful what place in the general scheme of philosophy science should be assigned to the distribution into physics, mathematics, and first philosophy, or the wider classification of doctrines as poetic, practical, or theoretical, in no way enables us to class logic or the body of speculations making up the *Organon*. That the forms of proof analysed in these writings are of universal scope is unambiguously declared; that the first principles assumed in all proof are dealt with in first philosophy is also made clear; but the relations between the two doctrines so reciprocally related cannot be determined from any statement made by Aristotle himself. That he should have regarded the inquiries of the analysis as propaedeutic in character and should have held that those who assume to discuss problems of first philosophy ought to have made themselves acquainted with the general theory of proof is intelligible, and more than this significance cannot, we think, be assigned to the passage in the *Metaphysics*, on the ground of which the logical

inquiries have been classed as the general, common introduction to the whole system.¹ For the close connexion between the analytical researches of the *Organon* and the inquiry into essence or being as such forbids us to accept, in any strict sense, a separation of these as forming distinct and independent sciences. To metaphysics is assigned the consideration of the principles of proof, and the kind of inquiry making up first philosophy is described by Aristotle in a fashion which assimilates it most closely to the researches of the analytics. That which is left undecided by the Aristotelian classification is the relation of the logical inquiries to the organic whole of which first philosophy is the main or sole part. To obtain any fresh light we must turn to the consideration of indications supplied by Aristotle as to the nature of the inquiries grouped under the head *Analytics*.

9 (4) Such indications are unfortunately most scanty. As we probably have not the *Metaphysics* in its full extent actual or contemplated, the want of a clear separation between the inquiries belonging specially to first philosophy and those appropriate to the analytical researches may be due in part to the deficiency of our materials. There are, however, two lines of separation discernible, from which some useful inferences may be drawn. What we call the logic of Aristotle, *i. e.*, the treatise making up the *Organon* is roughly divisible into three parts.—(1) the formal analysis of syllogism and its allied types of reasoning, with the more particular discussion of the elementary parts of reasoning: the proposition; (2) the theory of scientific proof and deduction (apodictic); (3) the theory of probable arguments, or of reasoning based on currently received opinions and leading to conclusions more or less probable (dialectic). Certainly for Aristotle there was no such distinction between the first and the remaining two parts as would in any way correspond to the modern separation of general or formal logic from the logic of knowledge, or mental logic; the three parts in conjunction make up one body of doctrine. Now dialectic is very specially indicated as being of a formal character, *i. e.*, as dealing with no special matter, but with *κατά*, opinions, or types of opinions common to all sciences.² Apodictic, we may assume, is in like manner a formal study of which constructs knowledge rests, so-called, the nature of the principles on which knowledge rests, the special marks distinguishing it, and the method by which knowledge is framed. But in every body of doctrine we may distinguish, according to Aristotle, three things,—the genus or *γένος* of which we deal, with which the demonstration converges, the essential or fundamental attributes, qualities of these objects, which are to be demonstrated of them, and, thirdly, certain common axioms or principles of demonstration, not themselves demonstrable, and not entering as integral parts into the demonstration, but lying in the background as the security for the security of the argument employing them. Can anything corresponding to these three facts be discovered, if we assume for the moment, what certainly is not explicitly stated by Aristotle, that analysis constitutes a special body of doctrine? The genus or class about which the doctrine is concerned can only be reasoning itself, either as apodictic or dialectic, and the latter for a special reason may be left out of account, *ἀπεὸς*, then, is the matter concerning which the doctrine is put forward. But *ἀπεὸς* is a form of knowledge, that is to say, is subjective. The properties, therefore, of apodictic science can only be made clear if we consider on the one hand the objective counterparts of necessity and universality in thought, and on the other hand the nature of universality and necessity of thought itself. The common principles or axioms, finally, can only be such presuppositions as are made in apodictic or reasoning generally concerning thought in its relation to fact, as grasping or apprehending reality. The consideration of such axioms, if it has been already seen, pertains to first philosophy. Analytics then would appear as an independent doctrine, holding of first philosophy on the one hand, both in regard of the common axioms and in regard of the attributes of being, by which it is as possible object of science, and on the other hand referring to the subjective treatment of thought, whether in relation to principles or to fact generally.

A very similar result may be attained if we follow out a line of distinction indicated in more than one portion of the *Metaphysics*.³ Separating the modes in which being is spoken of into four—(1) *τὸ βεβαιὸν καὶ ἀμεταβάτον*; (2) *τὸ βεβαιὸν καὶ μεταβάτον*; (3) *τὸ ἄν καὶ ἄν καὶ ἐκ φύσεως τὸ ἐκ ἀνάγκης*; (4) *τὸ βεβαιὸν καὶ ἀμεταβάτον*—Aristotle excludes the second from the special researches peculiar to first philosophy, the study of being as being, but neither excludes it from general consideration in metaphysics as a whole,

¹ *Metaph.* vi. 1026b, 9. See Zeller, *Phil.* 2. d. Gr. 1. 2 (86 ed.), p. 194, n.; Bannov, *De Definit.* Not. 46, 47; Schwartz, *Comment. sup. Metaph.* vi. 1021; and, contra, Prantl, *Gesch. d. Logik*, I. 187. Prantl maintains the view that Aristotle intends to indicate the uses occupied by the analysis in his general scheme of philosophy.
² On Aristotle's use of the term *κατά* and its allies, see [its addition to White, *Phil. in Organ.*, p. 345-360] Schwartz, *Comment. sup. Metaph.* vi. 17, p. 48-51.
³ See *Anal. Post.* I. 1; *Ethic.*, I. 1, and in many passages. Cf. Heyder, *Method.* d. *Anal.*, p. 148.

⁴ *Metaph.* vi. 4, v. 20, 12. Cf. Schwieger, *Comment.* vi. 241, v. 29 sq., 106; and Brentano, *Reinhold des Aristoteles nach Arist.*, 21 sq.

nor handles it at length, deferring it either for more detailed treatment. A comparatively clear account, however, of what is understood by him under the idea of being as truth and non-being as falsity may be extracted from the various passages referred to, and little doubt can remain that being so regarded is in a peculiar sense the matter of analytical (i.e., logical) researches.

Being as truth and non-being as falsity refer to and rest upon combination and division of the elementary parts of thought. For truth and falsity have no significance when applied to things, but only to the connexion of thought which is dominated by the one principle of non-contradiction. Nay, thinking has not even immediate and direct reference to being as such, but only to being as the existent, as qualified, or quantified, or modified in some other way (i.e., according to the categories), and it is in its very essence the conjunction or unifying of elements. What cannot be conjoined, as, e.g., the notions of elementary ideas themselves, are not either true or false, and are not matters of thought. Thought thus moves in a definite sphere, that of the combinable or separable, the correspondence of concepts with real relations, and has its limits on the one hand in the elementary data apprehended by intellect (*noûs*—reason), and on the other hand in the infinite sea of particular, accidental qualifications of things (*συμβεβηκός*).¹ The possibility of contradictory assertions (for true and false judgments together make up this contradiction, *ἐκ τῶν ἀληθῶν καὶ ψευδῶν ἀποφάντων*) is the distinguishing mark of thought. Now it is this very possibility that lies at the root of all the analytical researches. Not, indeed, that one can assume for Aristotle a view which has appeared in later logical works, that all forms of logical reasoning are to be deduced from the principle of contradiction. Quite the reverse. The common axioms underlie all processes of proof, direct or indirect, but they do not enter into or form part of proof. Nothing can be deduced from them, but their authority can be appealed to against any one who refuses to allow a conclusion reached by a correct syllogism from true premisses.² (The nerve of logical proof would thus lie in the distinctive proposition; either this conclusion is to be granted or the principle of contradiction is denied.) Now the analytical researches are in especial the treatment of combination and separation in thought, or even the syllogism may be regarded as a special instance of combination and separation in the exposition of the forms of combination and separation we shall find a complete system extending from the unproved principles and exhibiting the methods according to which thought proceeds towards the determination of the essential properties of things or the discrimination under which things are the transitory and accidental attributes may be advantageously classed.

So far then as one can judge, the matter of Aristotle's analytical researches may be expressed as the concrete nature of thought, characterized by its fundamental attribute, the possibility of contradiction, contradiction, contradiction, contradiction, and having as its end the realization of systematic knowledge, i.e., the adequate subjective interpretation of being.

10. The indication that the analyses have to do with being as conceived by thought, conducted under the general axiom of non-contradiction and expressed in language, requires to be filled up by a more detailed treatment of the Aristotelian theory of thought in relation to being. Upon the characteristics assigned to thought or knowledge in this special relation, must depend the general nature of the Aristotelian logic, the determination of the scope of logical treatment, and the essence of logical method. For from a quite similar starting-point regarding the province within which logic moves totally diverse conclusions might be drawn respecting the precise function of logical method. One might have either a formal doctrine or *techné*, or a real methodology, either an attempt to evolve logical principles from the axiom of contradiction, or a development of the laws according to which thought necessarily setting under the aid axiom, proceeds towards the construction of knowledge. The history of logic clearly shows how differently the matter of the analysis may be viewed. For one of the possible conclusions, that logic is a techné or quasi-mathematical exposition of formal relations, has been accepted as the undoubted result of Aristotle's teaching, and has so prevailed as to make itself the current conception.³ The other, the view of logic as theory of the method of scientific thought, has been cast entirely into the background, so far as logical doctrines are concerned, and, if allowed at all, has been regarded as foundation for a species of applied logic, an appendix to the other.

11. Not much aid is afforded directly by any classification or division of the books now collected together as the *Organon*. As above noted, the *Prior* and *Posterior Analytics* with the *Topics* form one connected whole, while the *Categories* and the *De Interpretatione* stand apart as isolated treatments of special problems, not organically or necessarily part of researches. The genuineness of both these treatises has been doubted (see ARISTOTELIS, vol. II, p. 514), and it is not improbable that both are redactions of Aristotelian

material, perhaps drawing from other lost writings of Aristotle, perhaps based on oral teaching, by some Aristotelian scholar. A summary view of the contents of the other books will be found at vol. II, p. 516.

12. The logical researches as a whole manifest a strong unity, and at the same time refer to one fundamental opposition, that between *apodictic* and *dialectic* reasoning.⁴

The opposition between apodictic and dialectic is in the Aristotelian system the development of that which had already played so important a part in Plato and Socrates, the distinction between *science* and *opinion*. Knowledge in the strict sense had there presented itself as the generalized notion referring to being in its very essence, and resting on thought or reason. Opinion is the quasi-knowledge of the particular, referring to that which is not being but only accident, and resting on senses or imagination. In the Platonic method, this distinction had come forward as the underlying basis for the opposition of philosophy and sophistical rhetoric; in Aristotle a much more precise formulation is given of the characteristics of the two opposed forms of thought, and the connexion between opinion or dialectic and rhetoric-sophistical discussion is made more concrete and profound. Dialectic, with Aristotle, is the system resulting from the attempt to reduce to rule or generalize modes of argument which rest upon current received doctrines as principles, which move within the region of interests about which current opinions *pro* and *con* are to be found, and which terminate not in the decisive solution of a problem but in clearing the way for a more profound research or at least in the establishment of a *modus vivendi* against an opponent. Dialectic, then, has no special province; it deals with *κείν* or *ἐκείν*, and its methods are perfectly general. On the one hand, as being the application of reasoning, it refers to and employs the specific types of reasoning, syllogism and induction; on the other hand, as being applied to matters of opinion, and borrowing its principles from current floating data about matters of common interest, the type of reasoning tend in it to assume special forms resembling those employed in rhetoric (which is a kind of offshoot from dialectic—the application of dialectic to political principles). The province of dialectic being thus essentially vague, the matters about which dialectic reasoning is concerned being of the most fluctuating character, there must be, for Aristotle, the greatest difficulty in determining, *per se* and apart from the opposition to apodictic, what is the character of dialectic syllogism and induction. Nor can it be said that the interpreter of Aristotle has as any easy task in the endeavour to disentangle the frequently dual actual reasoning and in what way the forms which are assumed to be common both to apodictic and dialectic come to have any application to the fluctuating mass of current opinions. It is comparatively simple to say apodictic and dialectic differ in this, that the one rests on principles essential, necessary, seen to be true, while the other proceeds from data which are merely received as credible and as containing probable, received opinions on a subject about which there may be difference of view; and it may be added that in the one we reach conclusions which are essential, in which the predicate is necessarily and universally true of the subject, while in the other the conclusion remains like the data, credible merely, and is, at best, only one of the probable answers to a question. But there remains the difficulty, which is certainly not cleared up by any direct statement from Aristotle—of what nature is the syllogistic method that applies to material of this kind and what is the *νέστω* *προβάν* in a dialectic syllogism? There are two possible views—either that the principle of syllogistic inference is purely formal, deducible from the characteristics of thought as either affirming or denying in reference to a particular subject, and therefore capable of application either to probable or to necessary matter, or that the syllogism is explicable only as a form in which knowledge is established and is applicable but, *per se*, as one may express it, to probable matters. Under this second view, that a dialectic syllogism and reality of syllogistic inference would be traced to the correlative peculiarities of human thought and of the nature of the objects of thought, and it would follow that in strictness there is no dialectic syllogism. Such a conclusion at first sight appears to stand in sharp opposition to quite emphatic utterances of Aristotle, in which we are told that the principle of syllogistic inference is the necessary support, for the acts of example, that a dialectic syllogism, when framed, we should readily discern that the link of connexion between data and conclusion, the *νέστω* *προβάν*, as it may be called, does not in fact differ from that involved in the apodictic syllogism. The merely probable character of the data prevents the conclusion

¹ The most important treatments of the principles and details of the Aristotelian logic, which are here drawn upon freely, are (1) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (2) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (3) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (4) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (5) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (6) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (7) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (8) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (9) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (10) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (11) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (12) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (13) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (14) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (15) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (16) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (17) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (18) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (19) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (20) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (21) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (22) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (23) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (24) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (25) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (26) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (27) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (28) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (29) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (30) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (31) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (32) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (33) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (34) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (35) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (36) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (37) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (38) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (39) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (40) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (41) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (42) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (43) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (44) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (45) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (46) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (47) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (48) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (49) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (50) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (51) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (52) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (53) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (54) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (55) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (56) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (57) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (58) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (59) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (60) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (61) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (62) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (63) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (64) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (65) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (66) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (67) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (68) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (69) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (70) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (71) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (72) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (73) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (74) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (75) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (76) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (77) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (78) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (79) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (80) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (81) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (82) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (83) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (84) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (85) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (86) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (87) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (88) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (89) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (90) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (91) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (92) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (93) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (94) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (95) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (96) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (97) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (98) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (99) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (100) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (101) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (102) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (103) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (104) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (105) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (106) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (107) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (108) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (109) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (110) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (111) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (112) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (113) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (114) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (115) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (116) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (117) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (118) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (119) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (120) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (121) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (122) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (123) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (124) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (125) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (126) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (127) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (128) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (129) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (130) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (131) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (132) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (133) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (134) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (135) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (136) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (137) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (138) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (139) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (140) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (141) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (142) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (143) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (144) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (145) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (146) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (147) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (148) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (149) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (150) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (151) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (152) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (153) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (154) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (155) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (156) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (157) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (158) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (159) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (160) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (161) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (162) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (163) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (164) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (165) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (166) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (167) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (168) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (169) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (170) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (171) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (172) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (173) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (174) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (175) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (176) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (177) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (178) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (179) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (180) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (181) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (182) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (183) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (184) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (185) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (186) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (187) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (188) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (189) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (190) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (191) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (192) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (193) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (194) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (195) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (196) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (197) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (198) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (199) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (200) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (201) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (202) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (203) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (204) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (205) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (206) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (207) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (208) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (209) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (210) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (211) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (212) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (213) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (214) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (215) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (216) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (217) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (218) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (219) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (220) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (221) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (222) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (223) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (224) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (225) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (226) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (227) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (228) *infer* *opinion*, that of Franz (Quint. & Logic, I, pp. 87-94); (2

from having a higher value than mere likelihood, but does not affect the chain of inference, which proceeds on assumptions identical with those involved in apodictic. Aristotle is chary of any examples of dialectic syllogism, and indeed, if one considers that all forms of modality are investigated in the general analysis of syllogism, it becomes difficult to see what specially distinguishes dialectic inference. It is not to be denied, however, that the investigation of the grounds for the coexistence of dialectic and apodictic is incomplete in Aristotle, as it confessedly is in Plato

... unless, these can be shown beyond possibility of question that Aristotle does lay down purely formal rules for syllogism, *aletheia* and *episteme* simply from the fundamental axiom of thought—and the evidence on which such a view is based will be examined later—we do not obtain much light from the opposition between dialectic and apodictic. More important results, however, are gained when we consider the Aristotelian doctrine of genuine knowledge, of *arêteis*; for, among the numerous elements that here fall to be noted, some are of quite general import, and apply to the whole process of the formation of knowledge.

13 Apodictic knowledge generally is definable through the special marks of its content. It deals with the universal and necessary, that which is now and always, that which cannot be other than it is, that which is what it is simply through its own nature. It is the expression of the true universal in thought and things, *τὸ καθόλου*. Further, as a method, *ἀποδεικτικὴ* is characterized by the fact that it is a method of proceeding from a connecting link derived, as well as by the primacy of its result. It rests on the first, simplest, best known, unprovable elements of thought, the *πρώτα καὶ ἀμετάβλητα*, which are not themselves in the strict sense matters of apodictic science, they are *ἀμετάβλητα*. In all the intermediate processes of scientific proof there is involved generally this dependence upon previously established principles, and, when apodictic science is concerned, these principles are themselves established principles, are seen to be the prior ultimate elements, assumptions in thought about things, as one may provisionally describe them. The peculiar connexion involved is simply what we understand by the principle of syllogism. No syllogism is possible without the universalizing element, the *καθόλου*, and knowledge in its essence is universalizing. The conclusion of the syllogism is the universal, which is attached to the subject of the conclusion or closing together of the two aspects of all thought and being, the universal and particular.

The fuller explanation of apodictic truth refers us to three points of extreme importance in the Aristotelian theory of knowledge, the precise nature of the *καθ'αυτὸν*, which presents itself as the characteristic of the *ἐπιστήμη*, the nature of the *ἐνδεχόμενα*, or the *ἐνδεχόμενα* in things, on which the possibility of *ἀποδεικνύναι* is founded, and the forms of thought through which the universal and particular facts are subjectively realized. The three are most closely connected, and as they involve the main distinctive of the Aristotelian philosophy, we must give a general sketch of them.

First then of *τὸ καθ'αυτὸν*, the characteristic term in the explanation of knowledge. This notion is essentially double-sided. On the one side it is the universal of empirical knowledge, the generic or *κατὰ γένος* of the *ἐπιστήμη*, the *κατὰ γένος* of the *ἐνδεχόμενα* or ground of the empirical universal—it is *τὸ καθ'αυτὸν κατὰ γένος*, that which is in, for, and through itself, the essential. Now the essential, *κατὰ γένος*, is, in the first place, either that which enters into the composition of the *ἐνδεχόμενα*, or, finally, that which is *ἡ ἑστὶν* as the cause or ground of a fact or event. Thus the function of thought (of apodictic) is the exposition with reference to a determined class of objects of all that necessarily inheres in them, on account of the elementary facts which determine their existence in the world. In this range of knowledge, the *ἐνδεχόμενα* are not knowledge, but in these individuals the elementary parts, causally connected, and leading to ulterior consequences, form the general element about which there may be demonstrative sciences. The thought of the *ἐνδεχόμενα* is not a mere *ἐνδεχόμενα* but has the character of the peculiar restriction of its very nature the subjective rule.

zation of the notion of things, and the principles expressing this restriction, the logical axioms, may be appealed to if demonstration be opposed groundlessly, but these axioms do not enter into the process of demonstration. "When the apodictic process has attained its end, that is, when all the universal propositions relating to a given class, with insight into the necessary character of the predication in each case, have been gathered up, then the *καθόλου* of knowledge in respect to that class has been realized."⁸

14 Probably the example of apodictic truth Aristotle bases chiefly in mind is mathematical science, and in his treatment of the characteristic marks of this doctrine most of the peculiarities of apodictic occur. In mathematical science abstraction is made of all that is extraneous to the objects considered, of those qualities which give to them their physical existence, and the result is what is not to be conceived as entities, self-existing. They are not even to be conceived as existing only in mind, as ideal types, they truly exist in things, but are considered separately (*ἐξ ἀπαρτησεως*). The chief principles of mathematical science are few and definite, and the proof proceeds by deduction from them to the particular theorems known to the concrete and relatively more known. As in the proof generally, so in mathematical demonstration, an essential quality (*κατὰ φύσιν ἀπὸ αὐτῆς*) may be proved of a subject, and yet such quality may be still accidental, i. e., not predicated of the subject as such, but as a consequence of its nature. The truth is deduced from the constituent mark of that which enters into the subject, as, e. g., a given figure's exterior angles are equal to four right angles. Why? Because it is an isosceles triangle. Why has it an isosceles this property? Because it is a triangle. Why has a triangle this property? Because it is a figure. Why has a figure this ultimate, it completes our knowledge, *καὶ καθόλου τὴν τέχνην*. Thus the range of mathematical proof extends from the *εἶδη*, the original definitions, which at the same time assume the existence of the things defined, through the determinations *κατὰ φύσιν* to the qualities which are predicated of the subject as such, and finally to the proof to be in a sense *κατὰ φύσιν*, while a continuous series of middle notions concerning which there cannot be much ambiguity, effects the transition. Moreover, in mathematical science, one can see with the utmost evidence the correlation of reason and sense, which will presently be seen as the basis of all knowledge, and the general history of knowledge. The *εἶδη* are not to be conceived as innate, but as possessed before experience. They are seen or envisaged, intimated in perception by *αἶσθησις*, and induction here as elsewhere is the process by which perceptions are gathered together for the reflective process of abstraction. The *εἶδη* are not innate in any individual, more evidently than in any other case, it is visible that the *εἶδη* of thought and sense. The demonstration which employs a diagram does not turn upon any properties of the diagram which are there for some only, not for reason, but upon the general elementary properties of the diagram, which are the basis of its development, and which is potentially contained in the *εἶδη* and the *αἶσθησις*. Mathematical thinking operates is brought forward into actuality by the constructive processes through which the proof is mediated, and the potential knowledge contained in the intuition of mathematics becomes actual through the process of constructive thought.

Finally, the relation of pure mathematical reasoning to that found in sciences generically one with mathematics, *e.g.*, optics, astronomy, harmonics, &c., furnishes an interesting example of the relation between reasoning based on fact and on causal ground.⁹

16. The process of *anagoge* generally and of mathematical demonstration in particular has brought into clear light the prominent characteristic of knowledge according to the Aristotelian view. Knowledge must always be regarded from two sides, as having relation to the universal, and as bearing upon the particular.¹⁰ It is an *anagoge* from the particular to the universal, and from the universal to the individual. The fundamental notion of *anagoge* is that the integral element in the Aristotelian theory of science, but also the guiding principle in his scientific method.¹¹ In all cases we require to keep in mind the necessary correlation of the particular facts and the general grounds, the multiplicity of effects and the unity of causes. The particular is not apart from the other. Universals as such are not at all other than the particulars. There are no grounds of existence. Particulars, such as infinite, indivisible

¹ Cf. *Toivola*, pp. 184

² Cf. *Topica*, pp. 104n, 105.
³ See especially *Metaphysics*, *Gamma*, 83 sq., and compare the elaborate notes of Kamppe, *Brinkmann's Theorie des Seins*, p. 220 (also p. 84). Grote (*Aristotle*, I, p. 268n) remarks: "Complete cognition (*to theuton*), according to the view here set forth) consists of one mental act corresponding to the major premises, another corresponding to the minor, and a third including both the two in concursive juxtaposition." This involves both the first and the second.⁴ The comparison between this and the Aristotelian doctrine of *synesis* in the relation to *episteme* will not escape attention.

² *Anai, Poet.*, 73b, 26, καθόλου δὲ λόγῳ ὁ ὢν κατὰ παντός τε ἐνέργειαν καὶ καθ' αὐτό καὶ ἡ αὐτὴ See *Index Aristotelicae*, s. v., pp. 255-57, and on καθ' αὐτό compare Heyder, *Method. d. Arist.*, 810 n., and Bonitz, *Com. in Met.*, pp. 265-66. On the distinction between καθόλου and γένος, see Bonitz, *Com. in Met.*, p. 290, 300; Zeller, *Ph. d. Gr.*, II, 1, p. 205, 206.

⁴ Cf. Prantl, *Ge. & Logik*, i. 121, 122, who has

^a Prunell. 1. 126

² *Anal. Pol.*, 1, 24, 86n. 2.

¹¹⁸ Cf. the passage from *De Memor.*, p. 480, quoted by Brandis, *Aristoteles*, p. 1188, —συμβαίνει γὰρ τοῦ αὐτοῦ πάλιν ἐν τῇ ψυχῇ καὶ ἐν τῇ διαίτησιν· ἵνατι τὸ γὰρ ἔστιν προσεχόμενον· τῷ γὰρ πᾶσι ἀπομνημονεύειν ἵνα τοὺς ἐπιθυμῶντας, ὅπως γράφομεν ἀπομνημονεύειν κατὰ τοὺς πᾶσι καὶ πᾶσι ἀπομνημονεύειν, καὶ μὴ πᾶσι νοῦν, τίθεται πρὸ ἀπομνημονεύοντος, ποτὶ δὲ οὐδὲ ἡ πᾶσι. ἐν δὲ ἡ φύσις ἡ γὰρ πᾶσι, ἀπομνημονεύει, τίθεται μὴ πᾶσι ἀπομνημονεύειν, ποτὶ δὲ ἡ πᾶσι μὴ πᾶσι. Cf. also *Met.*, vi 10 and 11. Aristotle's view strongly resembles, in this point at least, that of Kant.

* See *Metaph.*, I, 2, p. 1061a. Some interesting remarks on the process of mathematical construction and its relation to syllogistic proof will be found in Ueberweg's *System der Logik*, §101, p. 278.

¹⁰ Cf. specially Annot. Fr., II, 21.

¹¹ This is excellently put by Bucken, *op. cit.*, pp. 44-55.

comment is induction, of the nature of which something has already been said. The obscure chapter in which the formal analysis of induction is undertaken, a chapter which has much exercised the ingenuity of commentators,¹ presents difficulties of varied kinds. An opposition is indicated between syllogism and induction, yet induction is treated as a kind of syllogism, that is, freely interrelated, induction is so analyzed as to show that in it, also, there is the union of general assumption and particular detail which is characteristic of syllogistic reasoning. Further, Aristotle seems to waver between induction as a kind of inference, through which we arrive at general principles, and as a species of proof, and his teaching is therefore perplexed by the want of some clear statement regarding a difficulty in the theory of induction, which is still far from perfect solution. For, according to Aristotle, induction *as such*, starting from the particulars of sense, and proceeding by comparison of similar cases and enumeration of all the similarly constituted members, never, even when the enumeration is complete, attains to probative force.² It is still a syllogism of *fact*, not of ground or reason, there is a distinction of kind between the survey of empirical detail, even when complete, and the assertion of causal connection between the characteristics of the class and its deduced properties.³ Thus, perception of the law (*νόμος*) from induction is a kind of new element in the process; it is recognition by means of the empirico-critical survey which is the essence of induction.⁴ Induction makes clear only, and does not prove.⁵ If we interpret according to more modern phraseology, this peculiarity may be expressed as the distinctive feature of inductive research based on facts or effects. We do not regard the inquiry as terminating in the establishment of a law until it is possible to reverse the process and show that from the assumed cause the effects do actually follow. Otherwise we have a conclusion of "coexistence" merely—an empirical rule or generalization. If, bearing in mind these sources of difficulty, and also the conviction which for Aristotle always obtains between empirical details and grounds of reason, we consider the example given in the obscure chapter before us, some light may be cast on the exposition there given. The example selected is one touched upon by Aristotle in other two passages, in the treatises on *Metaphysics* and in *Physics*. In *Anal.*, II, 18.⁶ As regards the first of these, reference is desirable only to bring out the fact that causal nexus is the *καθόλου* in question, the second is of the utmost importance as clearing up what has always seemed an obscurity in the account of the inductive syllogism. In chapters 15-17, *Anal. Post.* II, Aristotle considers the relation of cause and effect as the essential basis of proof, and he points out with much clearness the difference between the fact as cause of knowledge and the cause as ground of existence and proof. In some cases cause and effect are so united, so reciprocal, that we may infer from one to the other. But the doubt arises, may there not be a causal nexus for any given attribute in which case all such inferences from effect must become problematical. Aristotle's solution is remarkable, both in itself and in its bearing on the inductive syllogism. Suppose the attribute β as found in all individuals of a class A , and also in individuals of class B, C , etc. In order to discover the cause, investigations must be carried on until we have a defined number of classes A, B, C , etc., in all of which β is found, and which comprehend all cases of the presence of β . Then that which is also common to A, B, C , etc., may be regarded as the cause of β , say α , an attribute α . If this attribute α be really the cause of β , it will enter into its definition; it will be its definition. There must, however, be a connection of α and β of this universal and reciprocating kind, and yet a might not be the cause in question, it might be only a fact from which β could be inferred, the real cause γ , which gives rise to β , lies in the background. Characteristic of causation, then, is constant reciprocal conjunction of facts. Even if it be admitted, then, that there may be more causes for a phenomenon than one, it will yet be true that each of these causes will be manifested in one class of phenomena where there will be the universal reciprocating coexistence that is characteristic of the relation in question. Thus the attribute longevity observed in all animals and in human beings may be due to different causes, e.g., to absence of gall in the one case, to predominance of solid, dry matter in the other. But in each case there will be a definite species characterized by the constant conjunction

of the cause and the effectum, the whole class long-lived animals and the class gall-less animals will coincide.

Turning now to the chapter on inductive syllogism, we find induction defined as inference through the minor that the major belongs to the middle. Here evidently major and middle are regarded not as determined by form only but naturally distinct, and we must assume that by middle term we are to understand the ground or reason of the attribute (major term) characteristic of a defined species or group (the middle term). Were our knowledge complete and scientific, we should be able to express this in apodictic form—whatever animal has no gall is long-lived, man, horse, etc., animals having no gall; therefore they are long-lived. The progress of knowledge, however, may be from the empirical details. We may have given to us the fact of the attribute, long-liveness, in the group of animals, man, horse, etc., and discover that these long-lived animals are also wanting in gall. If then, in accordance with the rules above sketched, there can be discovered a reciprocating relation between want of gall in animals and long-liveness, if we can constitute a class distinguished by conjoint presence of gall-lessness and longevity, we have the basis for an inductive proof. We may infer therefrom that gall-lessness *is, in this species*, the cause of longevity. Such a reasoning is founded on particulars given, and as the coexistence is given, the conclusion seems to be immediately drawn; there does not appear to be mediation or use of a middle term; nevertheless the middle term is implied, not in the supposition that the two classes reciprocate, but in the transference from empirical coexistence to causal nexus.

Aristotle's mode of stating this argument has presented so many difficulties of interpretation that various emendations have been proposed. Grote, e.g., who has not apprehended why the class long-lived animals should be taken universally—"we are," he says, "in no way concerned with the totality of long-lived animals,"—suggests an emendation which makes the essential part of the induction turn upon the extension of what we know regarding some gall-less animals to all of that class. But this is not the inductive step according to Aristotle. Induction has not to prove or assume that α and β , found coexisting in some members of a species, coexist in all of that species; this the universe of discourse must grant as the basis of the argument. The inductive step is the transference from this universal coexistence to causal nexus. Apodictically, we should say, if α is the cause of β , then all A which possesses α possesses β ; thus reasoning from cause to effectum. Inductively we say, all which possesses β has α ; therefore α is the cause of β . Induction, as dealing with particulars, starts with the senses, data, and resting upon the more evident fact in order to point towards the essential ground or reason, is therefore more persuasive, more palpable, more adapted for popular inquiries, and relatively more apparent. Syllogistic proof, on the other hand, is more stringent, more efficacious in establishing a scientific conclusion or position.

Aristotle's mode of dealing with induction, in so far at least as any specific process is designated by that term, seems on the surface to diverge widely from modern logical theory, and we look in vain in his analytical researches for consideration of the methods of observation and experiment which has come to be recognized as the essential portion of a doctrine of inductive reasoning. Yet it may fairly be argued that in modern theories the term induction is used with great laxity, so as to cover either all processes connected with scientific method or some one special variety of scientific reasoning, and that the difference between the Aristotelian and modern views

¹ The following is the relative position of chap. 28 of bk. II of the *Anal. Post.*—"Now induction and syllogism share in the same nature, but differ in the manner of the means of the conclusion term that the major term is predicable of the middle" (that is to say, of coming from given facts that an attribute found in all of them is predicable of some other attribute also found in all of them). The example, if β be the middle term, A and B the extremes, we know, by means of C , that A is predicable of B ; for this is the inductive process. Thus let A be long-lived, B the want of gall, C individual long-lives (as long-lived). If A is predicated universally of C (that is to say, the attribute A is found in all the examples before us), "for also that which is long-lived is long-lived" (that is to say, as given fact, gall-lessness and longevity in the species group, before we coexist). If, wanting gall, thus is predicated universally of C , if then B and A be reciprocally connected, it does not extend beyond the middle term. Thus we do not find other animals than the long-lived animals enumerated which are devoid of gall; it is necessary that A should be predicable of B . For it has been shown previously that if two terms are predicable of the same thing, and if the extremes reciprocate with one of them, then the other of those predicable will be predicable of that with which the first reciprocates. Thus, if A is predicable of C and C is the complex of all the individual cases." The last sentence is extremely hard to interpret. The expression *β ἀναγο* occurring in it is generally the technical word for the middle term, but as in the syllogism there is no middle, for we do not find the predication, this signification would seem to contradict the words *ἀναγο* *ἀναγο*. Hamilton reads *β ἀναγο*, which makes the argument intelligible and coherent with the passage immediately referred to in *Metaphysics*, viz. *Anal. Post.* II, 21, 38, 21-22. Probably Aristotle uses *β ἀναγο* here as equivalent to *β ἀναγο* in the induction which the induction process is based upon. In the passage above, the essence of the Aristotelian induction does not lie in the universalizing of C , but in connecting in one proposition the attributes A and B found to coexist in some group C . There is thus in some no middle, for we do not reach; in another sense there is, for C is the material link connecting A and B . Aristotle then might naturally use *ἀναγο* for C , and emphasize the process of induction in which there was a reduction to a common term, viz. C . But, however, induction regarded after this fashion results merely in the constitution of a group or class characterized as possessing two attributes in common.

¹ *Anal. Post.* II, 28. Cf. Whewell, *Cambr Phil Soc. Trans.* vol. II, 1836; Hamilton, *Lectures*, II, 268-271; Grote, I, pp. 268-74; Heyder, II, 268, Kämpfe, 188-29.

² On induction and syllogism, cf. Heyder, *op. cit.* II, 268, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, and chap. 3, § 1 in which this last similarity is viewed as being valid in scope than the basis of induction. This last sentence implies an enumeration, see *Anal. Post.* II, chap. 28, 29, *Anal. Post.* II, chap. 2, § 1. Thus induction even when complete is not deductive, see *Anal. Post.* I, chap. 1, C. On this distinction, see *Anal. Post.* II, 18, where a very fine description of deductive and inductive proof occurs.

³ Compare the passages above noted, and see the various expressions used in the discussion regarding the relation of universal and particular in *Anal. Post.* II, 21, p. 274, 275, 276.

⁴ *Anal. Post.* II, 6, p. 210, 33, *op. cit.* *ὅτι ἡ ἀναγωγή ἐστὶν ἀποδεικτική, ἀλλ' ἄρα ἀναγωγή ἐστιν*. Cf. *Metaphysics*, *Met.*, I, p. 288, n. On *Anal. Post.* II, 18-19, see the valuable summary by Grote, I, pp. 268-68.

temporal significance, but he also notes that in universal judgments there is no reference to any specific time, and also that the copula, the verb *is*, has no existential meaning. He is thus driven to the enumeration of a view, common among recent logicians, that the judgment is a reflective or critical act, pronouncing on the truth or falsity of a contemplated separation or conjunction of facts, while, on the other hand, the very contemplation of conjunction or separation has appeared as the essence of the judgment. So, in dealing with opposition, he distinguishes contradictories from contraries, and is inclined to refer the second to the given nature of facts, whereas extreme opposition of members falling under the same genus is presented. Modality, likewise, he treats confusedly, in the assignment of the modal relations to the predicate does not sufficiently determine their place in a theory of judgment, nor explain the relation in which they stand to the judgment as the simplest activity of thought.

Further, in dealing with the quantity of judgments, Aristotle is perplexed by his own theory of what constitutes generality. He is compelled to throw together universal judgments of a totally distinct kind,—empirical and rational, as one may call them,—and though the underlying view that empirical universality is the expression of, and is dependent on, rational consciousness is sufficiently clear in the doctrine of proof, it is not carried out to its consequences in the doctrine of judgment. Finally, to note only the crowning difficulty, the theory of proof and of definition turns upon the nature of the essential connexion of attributes in a subject, but the explanation of essence is precisely the business of the system of a theory of essence is not wanting, but it does not seem possible so to unite them as to form a consistent whole. The greatest obscurity still hangs over the fundamental part of the system, the nature of the *spora* which are apprehended by *voia*, of the specific nature of attributes *essētia* to their subjects, and of the *forma hypotē* from which particular sciences start. That the *hypothēsis* *essētia*, so frequently adduced as integral parts of proof, are analytical judgments¹ cannot be accepted without such qualifications as to render the use of such a term misleading, but what their precise nature is remains in the Aristotelian system undetermined.

Logic from Aristotle to Bacon and Descartes.

20. The long history of philosophic thought from Aristotle to the beginning of the modern period furnishes no new conception of logic so complete as that of Aristotle as to require detailed treatment, but exhibits variations in special additions, corrections, and new points of view numerous enough to account for a certain radical change in the mode of regarding logic which is, for our present purpose, the only interesting feature. This change may perhaps be expressed not inaccurately as the tendency towards formalizing logic. Gradually the Aristotelian came to have his boundaries extended in one way by the introduction of new matter, and narrowed in another by restriction of logical consideration to one special aspect of knowledge. Much in the history of this movement still remains in obscurity, but the general result is sufficiently clear. The periods into which this historical development of logic throughout this long interval may be naturally divided, with their main characteristics, are the following: (1) *The Peripatetic School*, represented by Theophrastus and Eudemus, following in the main the Aristotelian tradition, but deviating in certain fundamental respects, and on the whole treating the matter of logical research as though it were separate from and independent of the theory of knowledge as a whole. To this school is due the distinct recognition of the hypothetical and disjunctive proposition and syllogism, and the more complete enumeration of the possible valid modes of ostensive reasoning. In both cases the additions are made to turn upon purely formal considerations. The hypothetical and disjunctive judgments are treated as given *termini*, to be discussed in ordinary language and expression, not as resting upon any fundamentally distinct principle or activity of thought.² The addition of five indirect moods to those recognized by Aristotle as belonging to the first class proceeds on the purely formal ground of difference in position of the middle term in the two premisses. (2) *The Epicurean and Stoic Logics*. Of these the Epicurean presents no points of interest. The Stoic logic, on the other hand, is the first example of a purely formal doctrine based on and associated with a thoroughly scientific theory of epistemology. In essence the Stoic doctrine is identical with that of Aristotle, above noted, and it is interesting to observe that, under the purely nominalist theory, logic becomes almost identical with the doctrine of expression, or rhetoric. The theory of naming, and that of the

conjunction of names in propositions, are the fundamental portions of the body of logic. Naturally the Stoic doctrine tended to increase the bulk of logic by introducing numerous disjunctions of language, and by signaling varieties of judgment dependent on varieties of verbal expression. (3) *The conception of Logic among the Romans*. Here there must be distinguished the quasi-rhetorical logic, such as is found in Cicero, which is altogether Stoic in character, and the Aristotelian logic, as developed by Boetius with the additions of the later commentators. In Boetius one notes specially the technical or formal character of the treatment, which was of special importance historically, from the fact that the earlier scholastic writers derived their main knowledge of logic from certain of the treatises of Boetius. (4) *The scholastic Logic*. On the details of the scholastic logic it is not necessary to enter, but there must be noted the following points as of interest in determining what may well be called the current conception of the Aristotelian logic in modern times. The earlier scholastics, in possession of but few of Aristotle's writings, added nothing of importance to the body of logical resources, and the permanent aspect of discussion, the nature of universals, did not, through any of its solutions, affect the treatment of logical doctrines. The introduction of the body of the Arabic writings was contemporaneous with the introduction of the Arab writings and commentaries into western Europe, and there grew up therewith a more developed treatment of what may be called the psychological element of logic. The logic of the later scholastics is characterized by two points of interest, historically unconnected, but having a natural affinity,—the one, the introduction of an immense mass of special disjunctions, mainly verbal, making up the body of the *Perma Logica*; the other, the influence of the nominalist conception of thought.³ The peculiarity of the nominalist view is the severance of immediate apprehension from discursive thought, the assignment of all matter of knowledge to the one, and of all form to the other. But form, under this conception of discursive thought, can be found only in the generalizing function of signs or names; accordingly the fundamental processes of logical thought are regarded as so many modes of application of names. The later nominalist logicians were thus naturally led to the existence of immense subtleties and digressions on the theory problems of the *Perma Logica*, while at the same time the peculiar inner difficulty of the theory became apparent as the consequences were worked out. (5) *The Renaissance against Aristotelianism and the Humanist Modification of Logic*. Little of positive value for logical theory is offered by the numerous works representing this stage of historical development. Yalla, *Logica*, the other, the influence of general criticism in general spirit and detail, present a rhetorical-grammatical logic that resembles most closely Cicero's eclectic reproduction of Stoicism. Ramus, the only logician of the period with historic renown, contributes really nothing to the history of logic, his innovations consisting mainly in the deletion of the most valuable portions of the genuine Aristotelian logic, the insertion of preface and interesting examples, and finally rearrangement or redistribution of the heads under which logical doctrine was expounded. The Ramist school, most numerous and flourishing, produced no logical work of the first importance.⁴

The net result of this whole period was the severance of a certain body of doctrine, formal in character (the theory of second intentions), from theory of knowledge generally, and from all the concrete sciences. The boundaries and even the functions of this doctrine remained unified, for difference regarding fundamental points of extra-logical theory led to difference in mode of treatment, as well as to difference in conceptions of the end and value of logic.

Logic of Bacon and Descartes.

21. Modern reform of logic, by which may be understood the attempt to place logical theory in a more close and living relation to actual scientific method, begins with Bacon and Descartes. To both the scholastic logic presented itself as the essence of a thoroughly false and futile method of knowledge. Neither had the acquaintance with the genuine Aristotelian system enabled in order to distinguish the elements of permanent value from the worthless accretions under which these had been buried, and, as a natural consequence, the views of both have a far closer resemblance to the Aristotelian doctrine than might be supposed from the attitude of opposition common to them. Both thinkers were animated by the spirit of reformation in science, and both emphasize the practical and of all speculation. For both, therefore, logic, which to neither is of high value, appeared to be a species of practical science, a generalized statement of the mode in which intellect acquires new knowledge, in which the mind proceeds from known to unknown.⁵ But such a conception of logic is, if the expression be permitted, formal; that is to say, the actual province of logic is not determined thereby, but aware determination from

¹ As Zeller will have it, see *Ph. d. Gr.* II, § 321, n. Doubtless Aristotle does define an essential attribute as being one contained in the subject or one of which the subject notices is an integral part; but this relation of *essētia* to the definition is not to be identified with the modern view of the analytical relation of subject and predicate.

² The nature of hypothetical inference and the law are recognized with the greatest distinctness by Aristotle. From his theory of essence as causal, and any distinction of kind between an epistemic (epistemic) syllogism and a hypothetical of the type contemplated by later logicians was impossible and needless.

³ The first of these is no doubt as Freilich has laboured to prove, Byzantine in origin, but it still remains doubtful whence the Eastern logicians drew. The most probable source is the Stoic writings.

⁴ See note C, p. 608.

⁵ Comp. *Princip. Phil.*, Pref., *De Aug. Sc.*, bk. I, chap. 1, 2.

the further idea of the nature of knowledge and the ultimate constitution of that which is to be known. When this point is reached, a radical divergence presents itself between the views of Descartes and Bacon, consequent on which appears a radically divergent statement of the main processes and methods of logical theory.

To Descartes the ideal of cognition is the mathematical, that is, in which from assumed and distinct data we proceed by strict sequences of proof to determine accurately and completely the nature of complex phenomena. Such an ideal, extended so as to embrace knowledge as a whole, dominates the whole of the Cartesian speculation, and, as in the case of the Socratic doctrine of knowledge, is the ground of the Cartesian doubt. Perfect certainty, i.e. clearness and distinctness of principles, logical consequentials, &c. deduced from them, and exhaustive enumeration of details—such are the characteristics of completed knowledge. There follow naturally therefrom the main processes of knowledge—*intuition*, by which the simple data and axioms are apprehended; *induction*, or exhaustive enumeration of the elementary factors of any phenomenon; *deduction*, or determination of the complex as the necessary result of the combination of simple factors. To the processes of induction and deduction, when viewed more generally, the titles analysis and synthesis may be given.¹ On other portions of logical theory Descartes does not enter, and the text-books of the Cartesian school, even the celebrated Port Royal logic, do little more than expound with some freshness such of the older material as seemed capable of harmonizing with the new conception.

Two things only require note in respect to the Cartesian logic, apart from its freshness and completeness, the one is the obscurity which hangs over the nature of intuition, the other is the step in advance of the scholastic logic effected in the assimilation of deduction to synthesis. As regards the first, the criteria laid down by Descartes, viz. clearness and distinctness, are unsatisfactory and ambiguous. It is evident that he implied under these clear and distinct recognition of necessity in the data, or principle, but the nature of this necessity is never made clear.² As regards the second, it was of importance to signalize, as against the scholastic view, that the universal in thought or reasoning was not only of the nature of the class notion, that genera and species were not necessarily natural, but were themselves products of the mind, formed by reasoning, and based upon essential connexion of facts. In this Descartes was but returning to the genuine Aristotelian doctrine, but his view has all the advantage derived from a truer and more scientific conception of what these connexions in nature really are.

32. What is the logic of Bacon springs likewise from the peculiarities of the underlying conception of nature. The inductive method, expounded in the *Novum Organum*, as, however, only part of the Baconian logic, and, since it is commonly regarded as being the whole, a brief statement of what Bacon included under logic may here be given.

Turning logic as the doctrine which deals with the use and object of the intellectual faculties, Bacon divides it (in this approximating somewhat to the extended division of the Stoic logicians) into (1) the art of inquiry or invention, (2) the art of examination or judgment, (3) the art of memory, and (4) the art of elocution or tradition. The third and fourth divisions are unimportant; the first and second might be called respectively the theory of the acquisition of knowledge and the theory of evidence or proof. The art of inquiry is subordinated to the art of the discovery of arts and the art of the discovery of arguments. The second of these Bacon regards as identical with the *Topos* of the Greek and Roman dialectic, and therefore as of comparatively slight value. Of the first there are two main branches,—(A) *Experientia Literata* and (B) *Interpretatio Naturae*. The art of judgment has two subdivisions—*the examination of methods of reasoning*—induction and syllogism—*which resembles the older analysis*, and *the examination of errors of reasoning*—whether these be epistemical, i.e. the logical fallacies of the older doctrine, or errors of interpretation to be removed by careful criticism of scientific terms, or arising from erroneous tendencies of the mind (the doctrine of *idola*)—*which resembles the older treatment of dialectic*.

The peculiarity of the Baconian logic, then, must be sought in the processes included under the art of discovering arts or knowledge. Among these the syllogism is not included. It is a process with no practical utility, it involves premises of which the truth is simply assumed, and consequently its conclusions can have no validity beyond that of the premises. Its efforts to determine the particular from the general, but in fact nature is much more subtle than intellect, and our generalizations, which are but partial abstractions, are quite inadequate to afford exhaustive knowledge of the particular; it throws no light upon the essential part of cognition as a process

in formation, viz. the method by which we are to obtain accurate notions of things, and judgments based on those notions. Moreover, the deductive or syllogistic procedure favours and encourages the tendency to rush generalization, to the formation of a universal axiom from few particulars, and to the uncritical acceptance of that axiom. If syllogism exist at all, there must be a prior process, that of generalizing by rigid and accurate methods from experience itself. Syllogism is not entirely worthless. It is of particular service in some branches of science (e.g. the mathematical), and generally may be employed so soon as the principles of a science are well established, but it is a subordinate and secondary method.

The art of discovery, then, is the method of generalizing from experience. What this method shall be depends entirely on the thinker's conception of experience. Now Bacon's conception is perfectly definite. Observation presents to us complex natures which are the results of simpler, more general forms or causes. From the complex phenomena these forms are to be sifted out by a methodical process of analysis and experiment. A general proposition is one stating the connexion between complex natures and their simple forms or causes, it is, therefore, the result of a graduated process. No doubt there may be generalizations based only on an ingenious comparison of the complex phenomena as they are presented to us, such a process Bacon calls *Experientia Literata*, and the maxims recommended for it much resemble the ordinary methods of experiment, but truly scientific knowledge is only to be obtained by the complete inductive method. The characteristics of this inductive method follow at once from the nature of the object in view. The fact which is sought can be detected only by examination of cases in which the given complex effect is present, in which it is absent, and in which it appears in different degrees or amounts. By a critical comparison of these cases we may be able to detect, and, were the enumeration exhaustive, we must infallibly detect, by process of exclusion or elimination, a phenomenon constantly present when the effect is present, absent whenever the effect is absent, and varying in degree with the effect. Such a phenomenon would be the form in question,—the cause of the given fact or attribute. Exhaustive enumeration is, of course, in itself, and therefore the method of exclusion can never be perfectly carried out, but all additional aids have significance only as supplying in part the place of exhaustive enumeration. We may, on the basis of a wide examination, frame a first generalization (*first vintage* as Bacon metaphorically calls it), and proceed to test its correctness by carrying out the critical comparison with it. If we were to proceed under the guidance of our leading principle, take advantage of certain typical cases presented by nature, or force cases by experiment in such a way as to supersede the enumeration. There are *perogrative* instances, critical phenomena, helpful in discovery of the cause of a phenomenon. Of other *anecdotal*, or rules to which under the titles are given by Bacon, and it would be hazardous to conjecture as to their significance.³

The Baconian logic, then, or at least what is peculiar to it, is thoroughly conditioned by the peculiarities of the Baconian metaphysics or conception of nature and natural processes. As to the novelty of the logic, this to us does not appear to lie in the mere fact that stress is laid upon induction, nor do we think it correct to assign to Bacon the introduction of the theory of induction as an integral portion of logic. But it consists in the new view taken of what constitutes the universal in thought, a view which may be inadequate, but which colours and affects every process of thought, and therefore every portion of logical theory. It is but the sequence of Bacon's narrow view of the essence of syllogism that he should set induction in opposition to deduction, and regard syllogism as of service only for communication of knowledge. His inductive methods are throughout syllogistic in this respect, that they take the processes of thought involve the combination of universal and particular. Experience is nature itself, and that is to say, viewed under the light of a general idea or notion.

Logic on the Basis of Psychological Empiricism.
Locke, Hume, Mill, Comte.

23. The universal element in thought which is recognized by Bacon as present received from him no special treatment. His theory of the nature of knowledge affords no explanation of the origin, significance, and validity of the notions involved in inductive procedure. The *Essay on the Human Understanding*, which carries out in the domain of inner experience the practical tendency of the Baconian method, supplied from the point of view of individualism the metaphysical theory common to both, a certain psychological theory of the universal element in knowledge, and thereby afforded a new foundation for logical doctrines. The *Essay* contains, in an unsystematic fashion, much that bears directly on logic (e.g., the whole discussion on names, the classification of the significance of

¹ See *Regulae ad directionem ingenii*, Nos. 2, 3, and especially 7. The celebrated rules of speculation (*de Methodo*) are only a more popular statement of the same process.

² The ultimate standard is, no doubt, necessity for a thinking subject. What never is connected with the existence of the thinking being without it this existence is inconceivable. But to give this ideal its own position, see the first, the *Copius error*, is for Descartes the fundamental difficulty of his philosophy.

³ See *Op. II*. In addition to perogrative instances there are mentioned—supporters of induction; destruction of induction; variation of the investigation according to the nature of the subject; preference of the subject to the investigation; application to practice; preparation for investigation; ascending and descending scale of existence.

judgments, the criticism of syllogistic argument), but of more importance than those detached and direct portions is the general principle which underlies the whole view of human knowledge. This principle is unity that of psychological genesis. All the complex facts of knowledge are regarded as mechanical compounds due to the coherence of simple data, the facts of inner and outer sense. The method of Locke is that which underlies and determines all the logical work of one very important school of logicians.

It is not difficult to enter into details of Locke's own contributions to the foundation of logic. But it may be pointed out that from his position there were two possible lines of development. In his view the primitive impressions, the facts of inner and outer sense, were in themselves primitive facts of cognition; they were cognitions (it is the very essence of Locke's method to identify a simple impression of sense with the knowledge of a simple sense fact). The processes of abstraction, comparison, *i. e.*, judging and reasoning, were exercised upon their data, and these products were, in consequence, of a secondary and, so to speak, artificial character. It was natural that a thinker who identified impression of sense with knowledge of a sense fact should maintain that the secondary formations of thought (general ideas, general propositions, syllogisms) were not indispensable for cognition; that we could and did reason from particulars to particulars. At the same time Locke admitted the secondary processes as having actual existence, and in one important case (that of the judgment of coexistence, with which may be taken the idea of substance and of real relation) seemed to allow that in judgment something was added to the primitive data. It was possible, then, for development from Locke's position to proceed either by offering an explanation of the added elements, which should be in stricter harmony with the fundamental doctrine of psychological genesis, or by throwing them entirely out of account and concentrating attention on the primitive data as the only materials of cognition. The first is the line taken by Hume, which finds its logical completion in Mill; the second is the line taken by Comenius.

Hume has an easy task so long as he merely subjects Locke's position to negative criticism, for the added elements, the ideas of substance, relation, cause, &c., are clearly inept and defenceless when the facts to be linked by them are already contemplated as so many completed, isolated cognitions. But where connectedness of cognition is in question, and where some explanation is demanded of the relations which seem to supply the universal rule in thinking, Hume's task is not so simple, and his final answer that these relations are psychological growths or products of association is neither satisfactory in itself nor quite in keeping with other portions of his doctrine. Hence, however, we find the first thorough attempt to construct a theory of knowledge on the basis of psychological empiricism or individualism, and the first contribution to a doctrine of inductive proof as portion of this more comprehensive theory. Briefly, so far as logic is concerned, Hume offers as explanation of the universal in thought association of ideas, but does not treat of logic specially or in detail.

The complete statement of the theory of knowledge from the psychological point of view is that contained in Mill's *System of Logic*.

The aim of that work is the exposition of the theory of knowledge. Now knowledge, the term being taken in a wide sense, is characterized by one quality mainly, *vis*, evidentiary force. For every item entering into the sum of our beliefs at any moment, immediate perception being discontinued, there may be reasons advanced, adequate or inadequate. The exposition of the relations between beliefs and their evidence or grounds is logic, and logic is thus in one sense or formal, inasmuch as the relations of evidence and belief are general, not dependent on the special nature of the facts believed, and in another sense real, in that knowledge is conceivable only in strictest relation to the things known.

Now, the exposition of the general nature of grounds of belief is in fact identical with a theory of the universal element in thought or cognition, and this theory is the essential portion of Mill's logic. It being assumed that the facts with which knowledge is concerned are minds, bodies, states of consciousness, and the relations (coexistence, sequence, identity) among those states, and that propositions express, therefore, existence, coexistence, sequence, or resemblance, on what is based any inference going beyond a present perception? The propositions which make up cognition, strictly so called, are not more expressions of momentary states; they are expressions of belief regarding the more or less constant relations of fact. They are, in fact, cognitions. The theory of proposition and of reasoning is one. On what, then, do such conclusions rest?

The warrant for any conclusion based upon experience, and referring to experience itself, can be found only in experience or in some principle derived from experience. It may be shown that evidence for a conclusion is adequate, if we can compare this evidence with the kind of evidence on which a wider conclusion, frequently or constantly verified, rests. This comparison of particular evidence with more general evidence is the preliminary

answer furnished by Mill. But what is the general evidence referred to, and what is the principle founded on it? The general evidence is the repeated experience of constancy of connexion among groups of phenomena, and the principle founded on it is that of the existence of uniformity or rather of uniformities in nature. The evidence and the principle are purely psychological in character, that is to say, repeated experience, beginning with familiar cases and extending itself as time goes on, produces, by the natural laws of association, an assumed belief that phenomena as a whole, or at least in the main, are connected together in constant, uniform, invariable series. Such a belief, once established, serves as an ultimate criterion of proof, and as an index for research. We proceed on our investigations in the light of this principle, and the tests by which we estimate the validity of evidence for any particular inference as to uniformity are generalized statements deducible from it. So soon as our evidence is of such a character that, in the case before us, repeated the inference of uniformity is warranted or the general principle must be held not to apply to this particular case, we have proof as cogent as experience can afford.

The universal in knowledge, then, is this naturally formed assumption regarding the course of nature. The logic of knowledge is the exposition of the modes in which evidence is obtained, of the tests by which its validity is estimated, and of the forms in which evidence and conclusion are connected.

The characteristic features of the subordinated processes of proof are at once deducible from this fundamental view. For if the simplest form of inference by psychological law, the transition effected by association from one particular case to another resembling it, and if the essence of proof consist in comparison of the evidence for any one conclusion with the type of evidence for the general assumption regarding nature (or at least a wider portion of nature), it is evident that syllogism, in the ordinary ascription of the term in which it implies a concrete general proposition, a particular assumed thereunto, and a conclusion, is neither a primitive form of inference nor a valid mode of proof. Doubtless we do in reasoning employ general propositions in order to express the determination of some particular belonging to the same class, but the general proposition is itself a conclusion, resting on evidence of the same kind as the one described, and the essence of syllogistic reasoning is not the subsumption of a particular under a general in which it is included, but the expression of belief that the evidence for the general proposition is adequate to cover all the particular cases, including those which have not been taken into account in formulating the general major premise of a syllogism is the record of a previous induction, and the syllogistic process, bringing forward a new case, is a valuable method for testing the adequacy of the previous generalization. As to generalization itself, this basis of evidence to be sought in experience, apprehended by observation and reflection, did experience present to us isolated phenomena, *i. e.*, phenomena so arranged that enumeration of the elementary constituents, whether antecedents or consequents, were possible, then our inductive procedure must be regulated by these canons or axioms which express the kind of evidence already referred to as establishing uniformity. These canons or axioms, however, are, like the Baconian method of exclusion, tests for an ideally perfect experience, and they, therefore, only lie in the background of actual scientific procedure, which has to employ other processes, both of inference and of proof. For, if we can in no way obtain more than a knowledge of the coexistence of facts, we are unable to bring our evidence into conformity with the inductive canons, save in the ideal instance in which absolutely exhaustive experience both of positive and negative cases is possible. Inferences as to law or uniformity of coexistence must here be based on numerical calculation of probability, and the canons themselves in the peculiar numerical form appropriate to propositions of probability. Further, if the phenomena under investigation be complex, so that the canons of either observation nor experiment are immediately applicable, the process of investigation must necessarily be the combined method of analysis and synthesis, and analysis, aided by hypothetical conjecture, formulating such general laws of elementary factors as are known or presumed to exist in the case in question; synthesis, combining these laws and calculating with greater or less numerical exactness, according to the nature of the matter, the probable combined effect, the whole tested by critical comparison of the calculated result with the actual phenomena. Here, as one can see, syllogistic procedure appears in its true scientific aspect as the form of thought by which we pass from the simple to the more complex, from the elementary essence or cause to the complex accident or effect. The elementary causes, no doubt, have no more cogent evidence than that which can be afforded by experience viewed in the light of our psychological assumption of uniformities, nevertheless the whole procedure of scientific investigation is recognized as being essentially of the type which is somewhat imperfectly called by Aristotle

So far, then, as the logic of Mill is concerned, and apart from the undeniable richness and completeness of knowledge with which the various processes are treated, we note but one fundamentally new feature, namely, the explanation offered of the universal element

sphere of apprehension. According to this view the whole province of knowledge is excluded from logic, and it is assumed that knowledge is somehow given, mechanically, without the co-operation of processes, if not identical with, yet strongly resembling, those recognized as logical. Herbert does not succeed in vindicating an independent place for a purely formal logic.

The Kantian Logic.

27. The critical method, which has so influenced general philosophy that all later speculation refers more or less directly to it, has at the same time profoundly modified later conceptions of the sphere and method of logic. From the Kantian philosophy there spring directly the three most important modern doctrines of logical theory,—that which, with many variations in detail, regards logic as a purely formal science, the science of the laws of thought or of the laws under which thought as such operates, and of the forms into which thought as such develops, that which, likewise with many variations, unites logical doctrines with a more general theory of knowledge, and finally that which identifies both logic in the narrower sense and theory of knowledge with an all-comprehensive metaphysic.

It is matter of history that the critical system was developed mainly from the basis of the Leibnizian logic and metaphysical theodice, and it is likewise matter of history that Kant, even in the speculative work which was to so large an extent antagonistic to these theories, remained under the influence of some of their cardinal positions.¹ In particular the view of logical thought as purely discursive, analytic in character, a view never by Kant harmonized with his general system, is a relic, most significant for the development of his logic, from the Wolfian reproduction of Leibniz's philosophy. This historic bias is not to be lost sight of in attempting to acquire a clear idea of the special place and function assigned by Kant to logical theories.

But a brief reference to the general result of the critical philosophy will suffice to introduce the more special treatment of the Kantian logic. Knowledge, or real cognition, which is analysed in the *Kritik* in reference to its origin and validity, appears, when subjectively regarded, as a compound of intuition and thought, of sense and understanding. The isolated data of sense experience do not in themselves form parts of cognition, but are only cognized when related to the unity of the conscious subject, when the subject, as it may be put, has consciousness of them. This reflex act, resembling in some respects Leibniz's apprehension, or process of uniting in consciousness, is the act of understanding, and is itself only conceived or explained. Only through its means do representations become cognitions. The forms in which the synthetic act of understanding is carried out are, as opposed to the intuitive data on which they are exercised, discursive or logical in character. Essentially they are *rules* and *principles* governing the judgments, and, as judgments, they imply a general element with which the particular of sense is combined, and in the light of which the particular becomes intelligible. In ultimate analysis it appears that no particular, whatever be its empirical character, can become an intelligible fact, save when determined through some specific act of understanding, through combination with some specific notion or general element.² Combination of particular and general is thus the very essence of understanding, the mark of knowledge as such. In every term of cognition the same elements may be discerned as necessarily present. The consideration of the ultimate modes of intellectualization, of the series of acts by which understanding subsumes the particular, draws the particular into the unity of cognition, may be called in a large sense logic. If the consideration be specially directed to the mode in which, by means of this combination, knowledge arises, and therefore includes discussion of the wide problem regarding the relation between understanding and objectivity in general (the matter of knowledge taken generally), the special title transcendental logic may be used. But if, concentrating attention solely on the kind of operation implied in understanding, we endeavour to lay out fully the modes in which understanding proceeds in the construction of knowledge, making abstraction of all questions regarding the origin, worth, significance of knowledge itself, the consideration is of a more general character, and may receive the title of general logic.³

The understanding, then, like everything else, works according to laws, the laws of its own nature. If we abstract from all that may characterize the matter considered, and take into account solely the laws according to which understanding must act, we may construct a purely formal doctrine, a theory which is rational both in matter and in form, for the matter consists of the laws of reason, and the form is prescribed by the very nature of reason,—a demonstrative theory, for nothing can enter between, which cannot be shown to have its ground in reason,—a completed theory, for although the matter of thought is infinite and infinitely varied, the modes in which the understanding must operate if unity of

cognition is to result, are finite and capable of exhaustive statement,—and a theory developed from its own basis, and standing on a needed psychology or metaphysic, but deducible from the meta idea of understanding as that which introduces unity into representations, whether given (empirical) or *a priori* (pure).

Were this the only determination of the province of logic given by Kant, the question which at once arises as to the possibility of any such independent doctrine would receive an easy solution. For it is evident that logic, as a theory of the form of thought, could consist only of a portion of the more general doctrine, by whatever title that be known, in which the nature of understanding as synthetical activity is unfolded. The distinction on which Kant lays stress between matter and form, a distinction employed by all subsequent writers of his school, is ambiguous and misleading. If by matter be meant the particular characteristics of the things thought about, in which sense we might speak of judgments of physical, chemical, grammatical matter, and so on, then to say that logic does not take this into account is perfectly right. If logic be a philosophic discipline at all, a theory in any way concerned with thinking, it is at once evident that it can in no way deal with the specialities of any particular science. But this distinction between matter and form is by no means identical with another, lying in the background, and too frequently confused with the first, the distinction of understanding as a faculty *per se* with its own laws, deducible from its mere notion, and understanding as the concrete real act of thinking. What Kant calls the meta idea of understanding, and what in other writers of his school appears as a definition of thought, is really nothing but a reference to what has presented itself in the wide inquiries of the *Kritik* as the complex nature of the synthetical activity of understanding. Kant himself never attempts to deduce from the notion of understanding the varied characteristics of logical forms, and his followers,—e. g., Hegel,—even they are consistent, start from concepts as expressing the bare notion of thought, and regard all other forms of thought as combinations of concepts.

But Kant does introduce another element into his treatment of the province of logic, one not original to him, but of the utmost importance for later developments from his point of view. He inquires what Kant calls the elements among the elements which form the matter of logical treatment, and defines these as two in number—(1) formal consequence, (2) non-contradictoriness. By formal consequence we are to understand the relation between a conclusion and its premisses, no inquiry being raised as to the truth or validity of the premisses. By non-contradictoriness we are to understand that, logically, notions, judgments, reasonings can be subjected to treatment only in regard to the absence of explicit contradiction among the factors entering into them. Thought, which introduces unity and unity into experience, must certainly introduce formal consequence and preserve analytic truth or correctness. Formal logic, then, treats only of these formal qualities of all products of thought.⁴

The detailed treatment of logic, so far as that can be gathered from the very brief summary (*Logik, Werke*, iv. 289-340), shows with the utmost clearness how impossible it was for Kant to deduce the forms and relations of thought from the mere notion of understanding, even when coupled with the principles of formal consistency and consequence. Assuming that understanding is the discursive faculty, the faculty of cognizing the many particulars through the one concept or notion, Kant deals first with concepts (*Begriffe*) as general or discursive representations. He is careful to avoid an error into which many of his followers have fallen, that of regarding *Begriffe* in a mechanical fashion as a specific kind of *Vorstellung*, distinguished only by containing a few of the marks making up the single intuitions. He rightly notes that cognition proceeds by subsuming the particulars under the common elements contained in them, and that the generality of the concept thus rests upon the relation in which it stands, as reflective ground of cognition, to the particulars. The characteristics of concepts, as possessing extent and content, are treated briefly, after the fashion familiar in the more detailed logics of his school. It is, however, when the doctrine of judgment is reached that the distinction of logic most appears with greatest clearness. Judgment is defined "as the representation of unity in the consciousness of distinct representations, or the representation of the relation of

¹ Two at least of the followers of Kant have worked out the system of logic from this point of view,—the one, Dierksen, in his *Logik*, mentioned in the introduction (1850), the other, the late Professor Demme, in his *Principien der Logik*, Kassel, recognizing the distinction between the two modes of determining formal laws, and adapting the result, and so therefore led to the error of deducing the science of the laws and forms of thought, but as the science treating of formal thought, or of the formal element in the forms of thought. In other words he recognized that the statement of the forms of thought must be introduced into logic *ab extra*, from psychology or what not, and thus logic, accepting these, has to consider the formal element (non-contradictoriness) as a condition, but to have the doctrine brought thus to its ultimate basis, for it is there apparent that there is no independent science called logic, but only one comprehensive doctrine, which may be called *logico-psychic*, or *epistemic*, embracing all thought. Illustrations of the ways in which contradictoriness manifests itself may be offered, and a careful logical grammar may thus be afforded, but these do not make up any science or theory.

² See article Kant, vol. xiii, pp. 840, 832.

³ It does not seem necessary to advert more in detail to the divisions and subdivisions of logic drawn out in the *Kritik*, pp. 38-42 (Hartenstein's ed., 1868).

Throughout the Kantian work there appears a constant tendency to regard the ego, or central unity of self-consciousness, as merely abstract, as related mechanically, not organically, to the complex of experience in which its inner nature is unfolded. This tendency finds expression in various ways. Thus the synthesis, which has been shown to be the essential basis of cognition, is regarded as on its objective side a union of intellectual function and receptivity of sense, and the contributions from either side are viewed as somehow complete in themselves.¹ Knowledge, in accordance with this, might be considered to be the mechanical result of the combination or coherence of the two, a combination which in the last resort must appear to the conscious subject as contingent or accidental. (2) Knowledge, the systematic union of universal and particular in experience, is thought as containing in some obscure fashion a reference to the most real world, the realm of things in themselves, and therefore as being, in antithesis thereto, strictly subjective. The processes of thought, by which unity is given to experience, thus manifest themselves as limited in scope, and as being the very ground or reason of the restriction of knowledge to phenomenal in opposition to noumenal reality.²

The presence of these two difficulties or perplexities in the Kantian system, which are, indeed, at bottom but one, led to revision of transcendental logic in two directions. The one line proceeded from the analysis of knowledge as the product of intellectual function and receptivity, and, uniting therewith metaphysical conceptions of varied kinds, culminated in a doctrine of cognition which, retaining the distinction between real and ideal as ultimate, endeavored to show that the forms of the ideal, i. e., of thought, and the forms of reality were parallel. Logic, under this new conception, appeared as a comprehensive theory of knowledge, the systematic treatment of the modes in which thought, conditioned by its own nature and by the nature of the reality upon which it is exercised, develops into knowledge, i. e., of the modes in which a representation of things characterized by universality and evidential force is obtained. On the whole this is the position assigned to logic by Schleiermacher, whose view is followed in essentials, though with many variations in detail, by a large and important school of logical writers.³

The second direction may be characterized generally as the attempt to develop fully what is involved in Kant's conception of thought as the essential factor of cognition. Any opposition between metaphysics as dealing with the real and logic as dealing with the ideal element in knowledge appears, in this view, as a mere effort of false abstraction to separate the nature of reality as it is from the way in which it is thought. The system of pure determinations of objectivity, which Kant had imperfectly sketched, is not to be regarded as a piece of subjective machinery, because it expresses the inmost conditions of intelligence as such. Nothing is more real than the ego, than intelligence or thought. Transcendental logic, or logic which is at the same time metaphysics, is the only discipline to which the title logic by right belongs. For it contains the complete system of the forms in and through which intelligence is realized. The notion, judgment, and syllogism are doublets of forms of thought, but they have their definite content. They are the modes in which the forms of objectivity are realized for intelligence, and are thus at once abstract and concrete. The so-called formal logic is a mere *caput mortuum*, a descriptive study of some few types of the application of thought to matters of experience. On the whole this is the view of logic developed through Fichte (and in part Schelling by Hegel), and the Hegelian system shall here be regarded as its complete and only representative.

Logic as Theory of Knowledge.

29. The position assigned to logic as theory of knowledge and the range of problems included in it are determined by the general philosophic view of the distinction between the reality to be apprehended by thought and the subjective nature of thought itself. There may be, therefore, numerous variations in the mode of treating logic with general adherence to the one point of view.⁴ In the *Deutsche* of Schleiermacher, for example, the fundamental characteristic is the attempt to unite some portions of the Kantian analysis of cognition with Spinozistic metaphysics. Knowledge as regarded as the complex combination of intellect, the formative, unifying, idealizing, and organizing or organizing of sense. The generality or common validity of cognition rests on the uniform nature of organization and on the identity of all ideas in the one

ideal system. The objective worth of cognition is referred on the one hand to the determined connection between the real universe and the organization through which the individual is part of the real order of things, on the other hand to the ultimate metaphysical parallelism between the system of ideas and reality. The primary forms of knowledge, notion, and judgment, distinct from one another only as being knowledge viewed under as stable, now as a process, correspond to the ultimate elements of the real, the permanent force or substance and its variable manifestations. Syllogism and induction, with the subordinate processes of definition and division, analysis and synthesis, are technical modes of the organization of notions and judgments, modes by which inchoate notions are rendered definite, by which incomplete judgments are rendered complete.⁵

That there is much valuable and suggestive material in this mode of regarding logic is undoubted, and in the discussion of isolated forms of knowledge, such as judgment, it is always desirable that there should be kept in mind the reference to the ultimate character of objectivity. But the whole point of view seems imperfect and open to such objections as will always present themselves when a principle is not carried out to its full extent. It may, for propaedeutic purposes, be desirable to separate the handling of logical forms from metaphysics, but such separation cannot be complete. The system of forms of reality to which the forms of knowledge are assumed to correspond must in some way enter into knowledge, and they cannot enter in as an absolutely foreign ingredient, to which knowledge has simply to conform itself. For, if so, these metaphysical questions would be discoverable only by an analysis of concrete knowledge, and they would remain as inference from the nature of cognition, not as data directly known. The cardinal difficulty which appears in all treatments of logic from this point of view is that of explaining how there comes to be known as objective system of things with characteristic forms or aspects, and it is not hard to see that the acceptance of a reality as formed is but a robe of the pernicious abstraction which gave rise to the Kantian severance of knowledge from noumenal reality.⁶ In short the position taken by Schleiermacher and his school, as final standing ground, is but an intermediate stage in the development of that which lay implicit in the cry implicit in the Kantian system.

Moreover, it is hardly possible to assume this point of view without tending to fall back into that mechanical view of knowledge from which Kant had endeavored to free philosophy. If there be assumed the severance between real and ideal, it is hardly possible to avoid that it is characterized by a certain arbitrariness. From the observed or conjectured psychological peculiarities of inner experience. The real appears only as ultimate point of reference, but in no other way determines the form of knowledge. The characteristic relations which give content to notions, judgments, and syllogisms are deduced psychologically.⁷ In the long run, it would not do to be found that the real key to the position is the belief, more or less expressed, that the systematic view of thought as comprehending and evolving the forms of reality is an unattainable ideal,—that metaphysics, to put it briefly, is impossible. To some extent this is the position taken by Lotze, whose cautious and ever thoughtful expositions are invariably directed to the elucidation of the real *modus*, the real roots of perplexity or incompleteness of doctrine. In his view logical forms are the modes in which thought works up the material, supplied in inner experience by the psychological mechanism of the soul, in conformity to the ultimate presuppositions with the aid of which alone can harmony or ethical and aesthetic completeness, be gained for our conceptions of things. But with this doctrine, which approaches more clearly than any other of the type to the metaphysical logic, there is coupled the reverse that any actual point of view from which the development of these presuppositions, their rationality, their truth, their certainty, is possible is unattainable. Our confidence in them is finally of an ethical character, and depends upon our conviction of the ethical end or purposes of all the surroundings within which human life and

¹ Perhaps the most complete treatment of logic from this point of view is that of George, *Logik als Wissenschaftstheorie*, 1888. Ueberweg, dissenting from Schleiermacher's view of syllogism and the systematic treatment of logic, does not more fully what is in his view the aspects of reality corresponding to the typical forms of knowledge. Transcendental endeavor to fill up the gap between real and ideal by emphasizing the community of character, however inexact, as the ultimate reality, and constructiveness in knowledge, the central

² Thus we find in Schleiermacher (*Phil.*, §§ 123-5) that the ultimate difference of ideal and real is accepted as simple datum. In Ueberweg (*Logik*, § 8) and elsewhere there is constant reference to an inner creation of forms, out of which are the metaphysical categories, but the actual treatment is altogether independent of these forms, and we may conjecture that, in the last resort, Ueberweg would here explain the characteristics of logical theories by reference merely to the psychological mechanism than to a supposed nature of things. See also Lotze, *Phil.* §§ 60-62, and thus approximated to the position of Beneke rather than to that of Schleiermacher.

³ This tendency, which appears in Schleiermacher and Ueberweg, and indeed in all the modern school (George's *Logik* is a notable example), is due to a lack of firm psychology, is prominent in Beneke. It is curious to note a parallel result in the logical theory of Mr H. Spencer. Mr Spencer supposes himself to be directed in referring to the nature of things, but in fact he is actually in the forms of reasoning developed by him is of psychological origin (see *Pr. of Psych.*, II § 302-3).

¹ See vol. xiii, pp 861, 862.

² It is unnecessary to consider what exactly was Kant's teaching on either of these points, or what the significance of the relative doctrine may be in his system. It is sufficient, for the present purpose, to indicate the general tendency of the work, for from the later developments take their rise.

³ See, for an examination of the more prominent members, Ueberweg's *Logik*, § 64, a work which, though not complete, is covered by the main expression.

⁴ It appears an historic error to identify the point of view here referred to with the Aristotelian. The notion of a parallelism between the forms of reality and the forms of knowledge, to be covered by the main expression, is due to whether in Aristotle or in Plato, of the doctrine that knowledge is knowledge of being.

importance, whether there remains over and above the difference between the more immediate determinations of thought and its more complex or reflective modes an essential difference in knowledge between thought and reality. In less careful critics the oversight simply leads to the contention that we shall always repeat the problem of knowing and being as insoluble, and shall view knowledge as a mechanical, subjective product.

Many of these objections doubtless result from a very simple fact, more than once alluded to in this article. Particular distinctions, apparently the most elementary, frequently involve and are unattainably apart from a developed, though not necessarily consistent or well grounded, conception of thought in general. Thus the emphasis laid upon thought as essentially subjective, as being merely the system of operations whereby the individual brings into order and coherence in his own experience what is furnished *ab extra* through the natural connection in which he is placed to the objective world, seems at first sight the most simple and direct consequence of the actually given distinction between the individual as one natural unit and the sum of things comprehending him and all others. But, on analysing more closely the title for applying to philosophical problems a view which is that of practical life, and doubtless legitimate and necessary within that sphere, we readily become aware of a whole series of speculative assumptions implicit in that view, and possibly without any adequate justification. At all events, whether or not the view be ultimately defensible, and in the same form in which it is at first assumed, it is unphilosophical to start in the treatment of a difficult and important discussion from principles so ambiguous and undetermined. The practical difference between the individual agent and the external sphere within which his individual operations are realized and which is therefore treated by him, from his point of view, as external, throws no light *per se* on the nature of the ultimate relation between the individual thinker as such and the world within which his thought is exercised. The confusion between ultimate distinctions and practical points of view is productive of most pernicious consequences not only in logic specially but in philosophy at large.

Criticism of the Chief Logical Schools.

§1. It will probably be now apparent that determination of the nature, province, and method of logic is, and has always been, dependent on the conception formed as to the nature of knowledge. Discussions regarding the precise definition of logic are not more analysing than the best mode of expressing in terms the nature of a subject actually agreed upon; variations in the treatment of particular portions of logical discipline do not arise from more or less accurate discrimination of the nature and relations of given material; nor are differences in respect to the amount to be included or excluded in the expression of difference as to the range of the same fundamental principles. The grounds for divergence are much more deeply seated, and, looking back upon the historical survey of the main conceptions of logical science, it seems quite impossible to hope that by comparison and selection certain common points of view or methods may be extracted, to which the title of logical might beyond dispute be applied. The logic, as one may call it, of each philosophical theory of knowledge is an integral part or necessary consequence of such theory; and its validity, whether in whole or in part, depends upon the completeness and coherence of the explanation of knowledge in general which forms the essence of that theory. Any criticism of a general conception of logic or special application thereof, which does not rest upon criticism of the theory of knowledge implied in it, must be inept and useless. It is not possible to include such expanded criticism in an article like the present; there remains there only on the aspect of these various logical schemes which may be subjected to special and isolated examination, viz., the inner coherence of each scheme as presented by its author. Naturally such an examination can be applied only to views which imply the separate existence of logic as a body of doctrine developing into system from its own, peculiar principles. When it is a fundamental position to deny the separate existence of logic, but is one with the all-comprehensive doctrine or theory of the ultimate nature of cognition, it is not possible to criticize such conception of logic separately; criticism of logic then becomes criticism of the whole philosophical system. In most of the views brought before us, however, a special place has been assigned to logic; it is therefore possible to apply internal criticism to the more important of these general views, and to consider how far the pretensions of logic to an independent position and method are substantiated.

From the foregoing remarks it will also have become apparent that a general classification of logical schools, as opposed to the reference of these to ultimate distinctions of philosophical theory, is impossible. A distribution into formal (subjective), real (empirical), or, as certain German authorities designate it, *Wissenschaftstheoretisch*, and metaphysical conceptions of logic is rather confusing than helpful. For the formal logics of the Kantian writers, of Hamilton, and of Maassel are distinct, not only from one another,

but from such equally formal logics as those of Hobbes, Condillac, Leibnitz, Herbert, Ulricz, Boole, De Morgan, and Jevons. Logics theory of knowledge presents quite special features when handled by Mill, or by Schlägelmacher, Ueberweg, Bencke, and Wundt. And it cannot even be admitted that the threefold classification affords room, without violence, for the Aristotelian logical researchers. There are no points of agreement and difference so unambiguous that by their aid a division can be effected.¹

§2. Few conceptions of logic contain, with so little real ground, such professions of completeness and independence as that developed in the writings of the Kantian school.² According to this view, logic is a pure science, having as its special material the form of thought, demonstrative in character and with theorems capable of complete deduction from the elementary principles contained in the very notion of form as opposed to matter of thought. But, when one comes to the examination of the system itself, one finds (a) that the notions of form and matter are much too nebulous to limit themselves readily to analysis, and that explanations of what exactly constitutes form fluctuate between a merely negative definition (whatever is not treated in any other science, philosophical or otherwise) and a psychological deduction from the assumed nature of thought;³ (b) that the really important factor in determining the contents of logical science is psychology, from which science more is borrowed than the mere preliminary definition of thought; (c) that demonstrative character rests entirely on an abstract interpretation of the laws of identity and non-contradiction; (d) that throughout the whole system there is not a trace of development, merely the reiterated application of the law of identity and contradiction, or of some confused distinction between form and matter, to logical products, the notion, judgment, and syllogism, whose nature, characteristics, and distribution are arbitrarily accepted from psychology or general criticism or vice versa. Thus, in the majority of cases, logicians who simply followed the lines indicated by Kant introduced into their system without any criticism, the fundamental distinctions contained in the *Kritik der reinen Vernunft*. The fourfold scheme of quantity, quality, relation, and modality was applied without hesitation, though in varied and always arbitrary fashion, to notions; judgments were accepted as being categorical, hypothetical, and disjunctive in kind, though the differences are altogether foreign to the logical principle applied; and generally no attempt was made to do more than treat, in an abstract fashion, some aspects of a procedure of thought determined in all its phases by extra-logical considerations.

§3. The best and most desirable result of such a procedure of thought is a logical system which is commonly associated with the name of Sir W. Hamilton spring entirely from this view of notions. For, if notions be regarded as the elements of thought, then the judgment which elaborates them can only present itself as the explicit statement of immediate relations discernible among notions. These immediate relations reduce themselves, for Hamilton, to one,—the quantitative relation of whole and part,—and, attention being concentrated on the extensive reference of concepts, the eightfold scheme of propositional forms is the natural consequence. To such a scheme the objections are manifold. It is neither coherent in itself, nor expressive of the nature of thinking, nor deduced truly from the general principle of the Hamiltonian logic. For it ought to have been kept in mind that extension is but an aspect of the notion, not a separable fact upon which the logical processes of elaboration are to be directed. It is, moreover, sufficiently clear that the relation of whole and part is far from exhausting or even adequately representing the relations in which things become for intelligent entities of cognition, and it is further evident that the procedure by which types of judgment are distinguished according to the total or partial reference to extension contained in them assumes a stage and amount of knowledge which is really the completed result of cognition, not that with which it starts, or by which it proceeds. The utility of basing logical theorems on psychological premises, a method involved in the procedure of most explications of formal

¹ Nor are more detailed classifications, such as those of Rosenkranz (*Die Methodik der Logik*, 1842), Prunt (*Logik*, 1848), Rehm (*Elemente der Logik*, 1880), of service, except when historical.

² Under this head Kant himself, for reasons above given, is not included; the view entertained by him is too different from the others.

³ Much criticism on Hamilton's confused statements regarding forms (*Elements of Metaphysics*, 428-464), is perfectly applicable to the generality of the Kantian theories on logic.

⁴ See, e.g., Krug, *Logik*, § 31 et seq.

⁵ The extension of a notion has no numerical or quantitative definiteness. To formulate the judgment as expressing definite amounts of extension, therefore, presupposes complete empirical survey of what, by its very essence, remains necessarily and is specially noteworthy in its indefiniteness. To speak of judgment as a judgment such as only *some A* is *all B* assumes total and perfect knowledge of the whole sphere of *A* and *B*. It is in the strictest sense of the word external. Hamilton, it may be added, is not at all clear in his work, and a coherent doctrine of syllogism from the point of view taken in the treatment of the judgment.

logic, may well be matter of doubt. For psychology, as ordinarily conceived, has certainly close relations with logic, but in aim and in point of view is distinctly opposed or at all events subordinate to it. The psychological investigation of thought, if carried out consistently, must take one of two forms, either that of description, in which thought, like any other mental fact, is regarded *ad extra* as that upon which attention and observation are to be directed,—in which case therefore any relations of thoughts among themselves must be of such an external nature as can be presented in the field of observation, or that of genesis, development, in which the subjective processes of mind are viewed as forms of the one grand process wholly identical with observation and the individual consciousness. Investigations from the first point of view are diametrically opposed to the logical treatment of thought, for in the latter the essential feature, the reference in the subject, with its mental forms, to an objective order within his experience is entirely wanting. Such investigation is abstract; it proceeds upon and remains within the limits of a distinction drawn in and for conscious experience, a distinction the grounds, significance, and modes of which require to be treated by a larger and more comprehensive method. Investigations from the second point of view are subordinate to logic in the wider sense, for the treatment of the subjective processes therein is illuminated and determined by the general principles regarding the nature and meaning of conscious experience which it is the sole function of logic to bring forward and establish. The psychology which Hamilton generally has in view is that commonly called empirical, and with his conception of it the two sciences, logic and psychology, are really identical.

83. A possible exit from the difficulties or assumptions of the current Kantian logic may be sought by following out and consistently applying the hint contained in Kant's distinction of analytic and synthetic thought, analytic and synthetic truth. It may be said that all thinking involves the fundamental law of identity and non-contradiction. That in these laws only is to be found the characteristic and most general feature of thought, that in them only is the form, or element contributed by mind itself, to be detected. Logic would thus be regarded as the explicit statement of the conditions of non-contradictoriness in thought, as the evolution of the formal element of thought, and since in these laws truth only as non-contradictoriness be discovered without material aid, as the theory of analytic thought. Such is the position assigned to logic by Twisten, Mansel, Spalding, and some others, and the consequences of that which inevitably leads are sufficiently interesting to require that some special attention shall be given to it. In the first place, then, it seems evident that the fundamental distinction implied, that between analytic and synthetic thought, is wrongly conceived. That analysis and synthesis are methods of cognition, differing in many important respects, is undoubted, but such difference has in a sphere altogether alien to that within which the present distinction is to be sought. Analytic thought, as here conceived, is only to be understood when taken in reference to the judgment, and then also in reference to a peculiarity in the Kantian doctrine. Kant, emphasizing the principle that judgment is essentially the form in which the particulars of experience is determined by the universal element of thought, but identifying this universal with a formal concept (resembling, therefore, a class notion), contemplated a class of judgments in which the predicate was merely an explication of the subject notion. Such judgments, had the matter been more fully considered, would have appeared as far from primary, and Kant has himself, in the most unambiguous language, indicated the correct view that analysis is consequent and dependent on synthetis,—that analytic judgments, therefore, are merely special applications of abstracting thought within a sphere already treated, handled, formed by thought. Mansel, too, whose views are generally acute if not profound, has signified as the primitive unit of cognition the so-called psychological judgment, which is essentially synthetic in character. The logical judgment, in fact, about which his conception of logic centres, as recognised as a posterior act of reflection, directed upon formal notions, and is not in any way to be regarded as containing what is a common, universal feature of all judgments.

In the second place, even granting what cannot be maintained, that the process of thought is mere explication of the content of previous knowledge, and that the theory of logic has to do with a comparatively small and subordinate portion of cognition, there is in such a principle the nucleus of development. We may take up in succession class-notions, judgments, reasonings, and in relation to each referate, as the one axiom of logic, that the consistent elements shall be non-contradictory; but such a treatment is only possible in relation to a material already formed and organized. The utmost possible value being given to such a view, logic, under it, could be but a petty and unimportant doctrine.

Finally, there is involved in the doctrine of analytic thought, and in the consequences to which extension will next be drawn, a peculiar and one-sided conception of identity or of the principle of identity as an element in thought. Historically this conception has played a most important part: it lies at the root of all nominalist

logic from Antisthenes downwards, and has found metaphysical expression of the most diverse kinds. *That things are what they are* is the old fashion in which a well-nigh forgotten English writer states what is taken to be the universal foundation of all thought and knowledge. The representatives of things in our subjective experience, the units of knowledge, may be called notions, and, accordingly, that each notion should be what it is appears as the corresponding logical axiom. The whole process of thought is therefore regarded as merely the explicit statement of what each notion is, and the separation of it by direct or indirect methods from all that it is not. The judgment, essentially the active movement of thought, is reduced to the mere expression of the identity of a notion, and in truth, were the doctrine consistently carried out, Antisthenes's conclusion that the judgment is a fallacious and inept form of thought would be the necessary result. When such a conclusion is not drawn, its place is generally taken by much vague declamation regarding the limited, imperfect, and uncertain character of our knowledge, which is regarded as asymptotically approaching to the adequate determination of truth.

The conception which underlies this view is the abstract separation of thought from things which has been already noted, but the genuine principle is a deduction therefrom. Knowledge or thought is treated externally as a series of isolated units or parts, and the results of cognition— notions, judgments, and reasonings—are viewed as the constituent factors. Thus, *e.g.*, when it is said that a judgment is the expression of an identity, there are possible only two modes of explanation,—the one, that the identity is referred to is that between the original notion (subject) as unqualified by its predicates and the same as qualified, in which case manifestly the result of the judgment is taken as being its constituent essence; the other, that the identity is that of the applicability of distinct names to the same fact, in which case we accept without further inquiry and exclude from logical consideration the processes of thought by which the application of names is brought about, and assume as being the procedure of thought itself that which is its consequence. Under all circumstances, difference is as important an element as identity in the judgment, and to concentrate attention upon the identity is to take a one-sided and imperfect view.

84. So soon, however, as the real nature of thought has been thrown out of account as not concerned in the processes of logic, so soon as the law of non-contradiction, in its manifold statement, has been formulated as the one principle of logical or formal thinking, there appears the possibility of evolving a vast system of the conditions of non-contradictoriness. The ultimate units of knowledge, whatever we call them, whether notions or ideas or classes or names, have at least one characteristic,—they are what they are, and therefore exclude from themselves whatever is contradictory of their nature. They are combined positions and negations, that which is posited or negated being left undetermined,—referred, in fact, to matter as opposed to form. With respect to any article of thought, therefore, the only logical requirement is that it shall possess the characteristic of not being self-contradictory, and the only logical question is, what exactly is posited and negated thereby. Complex articles of thought viewed in like manner as complexes of positions and negations may have the same condition demanded of them and the same question put regarding them. A judgment and a syllogism, if narrowly investigated, will appear to be merely complex articles of thought, complexes of positions and negations. Proceeding from such a conception there may be treatments more or less systematic and fruitful. In the hands of certain logicians, such as Twisten, Mansel, Spalding, and the like, little else effected, for, as the forms of thought are accepted as given and as having their characteristic otherwise fixed (by psychology or critical theory of knowledge), the treatment resolves itself either in to repetition, in respect to each, of the underlying logical condition, or into the erection of a specific kind of thought (analytical) which has no other feature save its correspondence with the said condition. But it is clear that restriction by any psychological or critical doctrine of thought is an arbitrary limitation. It is useful only to regard the operation of thought as establishment of positions and negations, and to develop, by whatever method, the systematic results of such a process. Hobbes's doctrine of thought as dealing with names and as essentially addition and subtraction of nameable features, Boole's doctrine of thought as the determination of a class, Jevons's view of thought as simple apprehension of qualities,—any of these will serve as starting point, for in all of them the fruitful element is the same. The further step that the generalization of the system of thought must take a symbolic form presents itself as an immediate and natural consequence.

85. By the application of a symbolic method is not to be understood what has been practised by many writers on logic—the illus-

¹ John Sergeant. See *The Method in Science*, by J. S., 8vo, Lond., 1868, pp. 164, 166. This curious book contains much interesting matter.

² On the difficulty of attempting to treat judgments (or equations) some excellent remarks will be found in *De Tracy, Mémoires*, iii. 182-184, cf. *De la Méthode*, i. 28-34.

tration of elementary logical relations by numerical or algebraic signs or by diagrammatic schemata. The expression has the significance which it bears in mathematical analysis, and implies that the general relations of dependence among objects of thought, of whatsoever kind, in correspondence with which operations of perfectly general character are carried out, shall be represented by symbols, the laws of which are determined by the nature of these relations or by the laws of the corresponding operations. The mere use of abbreviations for the objects of treatment is not the application of a symbolic method¹, but so soon as the general relations of, or general operations with, these objects are represented by symbols, and the laws of such symbols stated as deductions themselves, then arises the possibility of a symbolic development in method of treatment, which may lead to more or less expanded results according as the significance of the symbols is more or less general. This quantity, whether discrete or continuous, presents, as an aspect of phenomena, relations of a highly general kind, and is therefore peculiarly the subject of symbolic treatment. Currently, indeed, the treatment of quantity is assumed to have the monopoly of symbolism, but such an assumption is not self-evidently true, and it is permissible to inquire whether methods non-quantitative do not present relations of such generality that they, too, can be symbolically dealt with. It is, however, a further question whether the generality of the relations and therefore the significance of the symbols in such cases, although subject to some special conditions not necessarily involved in the nature of quantity, do not spring from the fact that we treat the matters as quantities of a special kind, and so unscrupulously find ourselves applying quantitative methods. In other words, it remains to be investigated, after the preliminary definitions and axioms of any symbolic method have been laid down, whether the conception of thought with which we start, or a special feature distinctly quantitative in character, has been the truly fruitful element in after-development of this system.²

The first step in any symbolic logic must evidently be the determination of the nature and laws of the symbols, and, as these follow from the nature and laws of operations of thought, the first step is likewise a statement of the essential characteristics of thinking. As above noted, there have been adopted various modes of expressing this characteristic, and in some cases the mode adopted is not one from which any generally applicable symbolic rules of procedure could have followed. If, on the other hand, we adopt, as representing special views, first, that which proceeds from the idea of thought as essentially the process of grouping, classing, determining a definite set of objects by a mark or notion, and second, that which proceeds more generally from the conception of thought as consisting of a series of self-identical units, to be specially determined in obedience to the law of self-identity.³ Adopting the first view, we find that processes capable of symbolic representation, by the customary algebraic signs of addition, subtraction, equivalence, multiplication, and division, have a perfectly general significance in reference to the combination, separation, equalization of classes, to the imposition and removal of relations on a class, that to the symbols there can therefore be assigned a set of general laws; and that any peculiarity of these symbolic laws which differentiates them from the laws of like symbols in mathematical analysis is detachable from the notion of thought with which we started, and is consequently to be carried along with them in all the after development. Symbolic representation of relations of classes follows with equal directness from the general notion that by any such relation a new group is determined in reference to the original groups, or rather that the position or negation of a new group (or series of groups) is given, definitely or indefinitely, as the result of such a relation.

With this aid of the symbolic laws so reached, the logical problem as such may then be approached. Given any number of logical terms (ϵ , classes, or, as it may be better put, positions and negations) connected together in any relations, to determine completely any one in reference to the others, or to express any one in terms of the others. The symbolic procedure, expounded with marvellous ingenuity and success by Boole, may take various forms, and may be simplified by many analytical devices, but consists essentially in determining systematically how given positions and negations,

definite or indefinite, combine with or neutralize one another. A more detailed account of these formal processes is beyond our limits.⁴

The first question which suggests itself in connexion with Boole's symbolic logic is the necessity or advisability of retaining the difference between classes, or the description of thought as classification. Do the symbolic laws really depend to any extent on the logical peculiarities of class arrangement? Mr. Venn, who emphasizes this feature in Boole's scheme, has, however, done good service in leading up to a different explanation. The general reference to objects, which is also noted as implied in all Boole's formulae, has nothing to do with the possible difference of conceptual or material doctrines of the proposition, and, in fact, as all distinctions of thing and quality, resemblance and difference, higher and lower, subject and predicate vanish, or are absorbed in the more general principle underlying the symbolic method, phrases such as classification, extension, intension, and the like should be banished as not pertinent. Nay, the usual distinctions of quantity and even of quality either disappear or acquire a new significance when they are brought under the scope of the new principle. "What symbolic logic works upon by preference is a system of dichotomy, of x and not x , y and not y , and so forth."⁵ In other words, quantitative differences require to find expression through some combination of the positions and negations of the elements making up the objects dealt with,⁶ while the usual qualitative distinctions are merged in the position or negation of various combinations.

The whole philosophy then of classification and its allied processes seems needless when used to denote the simple determination of objects thought. The literal signs express, not "classes," but units, determined in and for thought as self-identical. For this reason then it appears that the view of the foundations of the symbolic methods of logic taken in Grassmann's *Ergebnisse* is more thoroughgoing, and more closely represents the underlying principles, than that involved in Boole's formulae and expounded in detail by Mr. Venn.

Grassmann, as above stated, deduces logical relations as a particular case of the more general laws necessarily attending the quantities (ϵ , determined contents of thought), extracted by himself from all peculiarities which may be due to their special constitution, quantities exhibit certain formal relations when they are combined (added, subtracted, &c.). Each quantity is a unit of thought, a definite position, and of such units there are but two classes, elements and complexes. Units of thought, which are self-identical, and therefore subject to the specific law that addition of each to itself or multiplication of it by itself yields as result only the original unit, are notions. The theory of notions, therefore, is the development of the general formal conditions of units under the special restrictions imposed by their nature, by their self-identity.

There appears very clearly in Grassmann's treatment the essence of the principle on which symbolic logic proceeds. Thought is viewed as simply the process of positing and negating definite contents of units, and the operations of logic become methods for rendering explicit that which is in each case posited or negated. To apply symbolic methods, we require units as definite as those of quantitative science, and the only laws we can employ are those which spring from the nature of units as definite. Now it seems a profound error to reduce the whole complex process of thinking to this restricted position of self-identical units. Undoubtedly if we start from any given fact of thought, ϵ , ϵ , ϵ , a judgment, and inquire what can be exhibited as involved in it, we have before us a problem of analysis, the solution of which must take form in a series of positions and negations, but our thinking is not therefore as a whole more analysis. More analysis, more explicit connections of thought among the objects of our conscious experience are established is not the mechanical aggregation of elementary parts. The relations which give intelligible significance to our experience are not simply those of identity and non-identity. It is an altogether abstract and external view of thought, resting on all probability on an obscure metaphysical principle,⁷ that would treat it as in essence the composition and decomposition of elementary atoms, of ϵ , ϵ , as Anaximenes would have called them. It has, indeed, been imagined that a symbolic logic might be developed, which should be independent in all its foundations of any such metaphysical or psychological assumptions, but this is an illusion. No logical method can be developed save from a most definite conception of the essential nature and *modus operandi* of thinking, and any system of symbolic logic finds it necessary, if it is to be complete and consistent, to adopt some such view, that above criticized, to regard thought as purely analytic, as dealing with compounds or

¹ Thus one would not describe Aristotle's use of letters for the terms of his syllogisms, nor the current logical abbreviations of \mathcal{A} , \mathcal{B} , and \mathcal{M} in the case, as before, in any true sense of the word, as the application of a symbolic method. The instructive work of Mr. Venn (*Symbolic Logic*, 1881) should be consulted. Mr. Venn has not only in his title to the contrary, but he has expounded generally the character of Boole's logic with a care and skill that leave nothing to be desired, but he has, independently of any real contribution to logical analysis, put in his true light the nature of symbolic method in logic. He has rendered it impossible, even for the outsider, to complain that symbolic logic is an arbitrary application of mathematical method to logical material.

² An excellent note on symbolic logic will be found in Lotze, *Logic* (Old ed., 1880), pp. 42-48.

³ Some of these, as, ϵ , Lambert's and Peirce's, are noted and discussed by Mr. Venn (*Symbolic Logic*, xxiii.-xxviii., and *passim*).

⁴ The first is the view taken by Boole (and expounded with great fulness in Venn, as above), that the truth-bricks of logic are the *Formae* and *Modi*, 1872, especially \mathcal{B} . Die *Begriffstheorie* oder *Logik*.

⁵ Mr. Venn's work is here again irretrievable. Jevons's *Principles of Science and Studies in Deductive Logic* should be here consulted, especially the *Operational* and *Formal* chapters, which give very elegant and simple methods.

⁶ Venn, as above, p. 128.

⁷ Venn, as above, p. 128.

⁸ See Die *Begriffstheorie* oder *Logik* (1872), p. 48. Schuler (op. cit.) follows Grassmann's view with the use of class phrases.

⁹ As above noted, p. 800.

[illegible]

conclusion requires a similar analysis. See, for instance, the discussion of the fallacy of the composition in the previous section. The fallacy of the composition is grounded has been shown to fall in explaining the observed fact, the thesis may be stated in an absolute and definitive form (type 9). The remaining seven topics are then concerned with the discussion which may arise when an opponent attempts to establish the thesis by means of the fallacy of the composition. The analysis of the fallacy of the composition may be joined (type 11). Should the adversary be unable to establish his antithesis, he may resort to deceit, bringing forward arguments, illogically arranged and devoid of force (12), which soon leads to the employment of apostrophs (13) or merely apostrophs (14). The fallacy of the composition may be used to underline and signalize and discuss various well-known forms of fallacy. The destruction of all these fallacious arguments reduces the opponent to the employment of futile, irrelevant responses, which undermine his own position (15). The discourse of which completes his discourse and reduces him to silence (16).

Expositions of this dialectic system are not yet available in such kind and amount as would enable one to do full justice to it. Evidently much patience and a very considerable knowledge of the current philosophical view would be requisite in order to appreciate at their true worth many apparently formal,

and in some cases subunits, divisions. Of accounts which may be consulted and the following seem the more important—Colebrook's *Essays on the Religion and Philosophy of the Hindus*, from which the expositions in Hitter (*Op. d. Phil.*, II, 383 ff.), Hoepf (*Werk*, III, 161-167), and Cousin (*Revue Générale*, 1828, 1829), are taken; Colebrook's *History of the Religions of the Hindoos* (4 vols. 1811, later editions with title altered, in 1815, 1857, 1821); Wilschmiedman, *Philosophus im Fortgang der Weltgeschichte* (1834), especially pp. 186-190; M. Müller, appendix to Schopenhauer's *Weltanschauung* (1852), pp. 184-197; Williams, *Hindus Hindooism*, pp. 71-88; Ch. Hialat, articles "Indoent," "Göttern," "Nyaya," "Kantada," in the *Dictionnaire Philosophique*, and "Nyaya," "Nyaya," in the *Encyclopédie*, both in 1828; in the *Memoriae de rebus sanctis* of *Indica*, *Poliothes*, tom. III.

NOTE C

[illegible]

LOGOS. This term is one of the most constant factors in ancient speculation. As it is double-sided, however, expressing both *reason* and *word*, the conceptions which it covers differ widely. Taken broadly the doctrine of the Logos may be said to have run in two parallel courses—the one philosophical, the other theological; the one the development of the Logos as reason, the other the development of the Logos as word, the one Hellenic, the other Hebrew.

1. To the Greek mind, which saw in the world the *κόσμος*, it was natural to regard the world as the product of reason, and reason as the ruling principle in the world. So we find a Logos doctrine more or less prominent from the dawn of Hellenic thought to its eclipse. It rises in the realm of physical speculation, passes over into the territory of ethics and theology, and makes its way through at least three well-defined stages. These are marked off by the names of Heraclitus of Ephesus, the Stoics, and Philo.

It acquires its first importance in the theories of Heraclitus. There it is intimately associated with the dominant ideas of a flux in all things, and of fire as the material substrate or primary form of existence. On the one hand the Logos is identified with *σύνεσις* and connected with *δίκη*, which later seems to have the function of correcting deviations from the eternal law that rules in things. On the other hand it is not positively distinguished either from the ethereal fire, or from the *εὐαγέριον* and the *ἀνθρώπινον* according to which all things occur. In consistency with his hylozoic doctrine Heraclitus holds that nothing material can

be thought of without this Logos, but he does not conceive the Logos itself to be immaterial. Whether it is regarded as in any sense possessed of intelligence and consciousness is a question variously answered. But there is most to say for the negative. This Logos is not one above the world or prior to it, but in the world and inseparable from it. Man's soul is a part of it. It is *relation*, therefore, as Schleiermacher expresses it, or reason, not speech or word. And it is objective, not subjective, reason. The process of transition between opposites, in which all things are involved, is a process according to orderly relations and definite measures, and the Logos is the eternal principle of this world-process which shows itself in the form of a constant conflict between opposites. Like a law of nature, objective in the world, it gives order and regularity to the movement of things, and makes the system rational.¹

Between Heraclitus and the Stoics comparatively little was done in developing a special Logos doctrine. With Anaxagoras a conception entered which gradually triumphed over that of Heraclitus, namely, the conception of a supreme, intellectual principle, not identified with the world but independent of it. This, however, was *νοῦς*, not Logos. In the Platonic and Aristotelian systems, too, the Logos appears. But it is subordinate to other more distinctive conceptions, and lacks the definiteness of a doctrine. With Plato the term selected for the expression of the principle

¹ Cf. Schleiermacher's *Herakleitos der Dunkle*, &c.; Bernays's *Herakleitos*; Gladisch's *Herakleitos und Zoroaster*.

The Hebrew Logos and the Old Testament doctrine reach their climax in the prologue to John's Gospel. The three conceptions of the active Word, the Angel, and the Wisdom of God, which had been fused in the Rabbinical idea of a Memra, meet there in the final grandeur of the Word of God incarnate. The question of the *genesis* of the Johannine doctrine has been greatly debated. There is a remarkable similarity between John's terms and Philo's. But this is due mainly to the fact that John and Philo made use of the same inherited phraseology for the expression of their several doctrines. The Johannine doctrine is not derived from the Philonic. The Logos of Philo is distinctively reason; the Logos of John is Word. The one is metaphysical; the other is theological. In Philo the Logos is the divine principle that creates and sustains. In John the Logos who creates also redeems. In Philo the Logos hovers midway between the personal and the impersonal. In John he is a distinct personality. To Philo the idea of an incarnation of God is alien and abhorrent. The heart of John's doctrine is the historical fact that the Word was made flesh.

In many of the early Christian writers, as well as in the heterodox schools, the Logos doctrine is influenced by the Greek idea. The Syrian Gnostic Basilides held (according to Irenaeus, i. 24) that the Logos or Word emanated from the *vous*, or personified reason, as this latter emanated from the unbegotten Father. The completest type of Gnosticism, the Valentinian, regarded Wisdom as the last of the series of *aeons* that emanated from the original Being or Father, and the Logos as an emanation from the first two principles that issued from God, Reason (*vous*) and Truth. Justin Martyr, the first of the sub-apostolic fathers, taught that God produced of His own nature a rational power (*δυναμις τὴν λόγον*), His agent in creation, who now became man in Jesus (*Dial. c. Tryph.*, chap. 43, 50). He affirmed also the action of the *λόγος σπερματικός* (*Apol.* i. 46; ii. 13, 50). With Tatian (*Orat. ad. Gr.*, chap. 6, 4c.), the Logos is the beginning of the world, the reason that comes into being as the sharer of God's rational power. With Athenagoras (*Suppl.*, chap. 9, 10) He is the prototype of the world and the enengizing principle (*ἀνὰ καὶ ἐνέργεια*) of things. Theophilus (*Ad Autol.* i. 10, 24) taught that the Logos was in eternity with God as the *λόγος* in the counsel of God, and that when the world was to be created God sent forth this counsellor (*σὺμβουλος*) from Himself as the *λόγος προφορῆς*, yet so that the begotten Logos did not cease to be a part of Himself. With Hippolytus (*Refut.* x. 33, 4c.) the Logos, produced of God's own substance, is both the divine intelligence that appears in the world as the Son of God, and the idea of the universe immanent in God. The early Sabellians (comp. Euseb., *Hist. Eccl.* vi. 33; Athanas., *Contra Arian.* i. 17) held that the Logos was a faculty of God, the divine reason, immanent in God eternally, but not in distinct personality prior to the historical manifestation in Christ. Origen, referring the act of creation to eternity instead of to time, affirmed the eternal personal existence of the Logos. In relation to God this Logos of Son was a copy of the original, and as such inferior to it. In relation to the world he was its prototype, the *ἀνὰ θεόν*, and its redeeming power (*Contra Cel.* v. 606; *Prag. de Princip.* i. 4; *De Princip.* i. 109, 824).

Literature.—In addition to the histories of philosophy (e.g., those of Hübner, Overweg, Zeller, &c.), the commentaries on John's Gospel (Müller, Godes, Wüst, &c.), and the systems of Biblical theology (Oschler, Schultze, Hauser, &c.), the following writings deserve special notice.—Schleier, *Lehrb. der N-T. Zeugnisschichte*; Hauser, *Neu-Testamentliche Zeugnisschichte*; Helmke, *Lehre vom Logos in der griechischen Philosophie*; Schultze, *Die Doctrina de Logos*; Hilgen, *Philos. Begriff*; Philo: Deussen, *Geschichtliche Darstellung der Jüdisch-alexandrinischen Religions-Philosophie*; Dörner, *History of the Development of the Doctrine of the Son of God*; Raben, *Philosophische Kirchenlehre*; Weber, *System der Abhängigen und Selbständigen Theologien*; Gromann, *Quantitative Philosophie*. (S. D. F. S.)

LOGROÑO, an inland province of Spain, the smallest of the eight modern divisions of Old Castile, is bounded on the N. by Burgos, Alava, and Navarra, on the E. by Navarra and Zaragoza, on the S. by Soria, and on the W. by Burgos. The area is 1945 square miles, with a population in 1877 of 174,425. It belongs entirely to the basin of the river Ebro, which forms its northern boundary except for a short distance near San Vicente, and is now navigable throughout the entire length of the province; its drainage takes place chiefly by the rivers Tiron, Oja, Najerilla, Iregua, Lea, Cidacos, and Alhama, all flowing in a north-easterly direction. The portion skirting the

Ebro forms a spacious and for the most part fertile undulating plain, called La Rioja in its western part; but in the south Logroño is considerably broken up by offshoots from the sierras which separate that river from the Douro. In the east the Cerro de Lorenzo rises to a height of about 7725 feet, and in the south the Pico Santa Ines is upwards of 7380 feet. The mineral resources, which are believed to be considerable, are as yet undeveloped. The products of the province are chiefly cereals, good oil and wine (especially in the Rioja), fruit (except oranges and lemons), silk, flax, and honey. The industries, which are unimportant, include spinning and weaving. Logroño is traversed by the Ebro valley railway, which connects Miranda del Ebro with Zaragoza; on this line are situated all the towns of the province with a population exceeding 5000—Haro, Logroño, Calahorra, and Alfaro.

LOGROÑO, capital of the above province, is situated on the right bank of the Ebro, which is here crossed by a handsome stone bridge of twelve arches, dating from 1138; the surrounding plain is well cultivated and fertile, producing the rich Rioja wine. The city is the seat of the usual provincial authorities, civil and military. It has a theatre, and several hospitals and convents. The parish church claims great antiquity. The population in 1877 was 13,393; the trade and industries are unimportant.

The district of Logroño was in ancient times inhabited by the *Berones* or *Vorones* of Strabo and Piny, and their *Varia* is to be identified with the modern suburb of the city of Logroño now known as *Varea* or *Barea*. The place fell into the hands of the Moors in the 8th century, but was speedily retaken by the Christians, and under the name of *Lucenonis* appears with frequency in mediæval history. Logroño was the birthplace of the painter Navarrete (d. 1610) and of Espartaco; the latter died there on January 9, 1678.

LOGWOOD is a valuable dye-wood, the product of a leguminous tree, *Hæmatoxylon campechianum*, native of Central America, and grown also in the West Indian Islands. The tree attains a height not exceeding 40 feet, and is said to be ready for felling when about ten years old. The wood, deprived of its bark and the sap-wood, is sent into the market in the form of large blocks and billets. It is very hard and dense, and externally has a dark brownish-red colour, but it is less deeply coloured within. The best qualities come from Campeachy, but it is obtained there only in small quantity. A large export trade in logwood of good quality is carried on from Honduras and Jamaica, and inferior qualities are exported from St Domingo, Martinique, Guadaloupe, &c. The wood was introduced into Europe as a dyeing substance soon after the discovery of America, but for many years (from 1881 to 1863) its use in England was prohibited by legislative enactment on account of the inferior dyes which at first were produced by its employment.

The colouring principle of logwood exists in the timber in the form of a glucoside, from which it is liberated as hæmatoxylin or hæmatin by fermentation. Hæmatoxylin was first isolated by Obernal in 1810, and its constitution was subsequently investigated by Erdmann, who found it to have the formula $C_{14}H_{11}O_6$. It forms two crystalline hydrates, the principal combination being with three molecules of water. This hydrate, $C_{14}H_{11}O_6 \cdot 3H_2O$, is a colourless body very sparingly soluble in cold water, but dissolving freely in hot water and in alcohol. By exposure to the air, especially in alkaline solutions, hæmatoxylin is rapidly oxidized into hæmatin, with the development of a fine purple colour. The reaction consists in the elimination of two atoms of hydrogen, thus—hæmatoxylin hydrate $(C_{14}H_{11}O_6 \cdot 3H_2O) + O =$ hæmatin $(C_{14}H_9O_6 \cdot 3H_2O) + H_2O$. This reaction of hæmatoxylin is exceedingly rapid and delicate, rendering that body a valuable laboratory test for alkalis. It is remarkable that the difference of two atoms of hydrogen between colourless hæmatoxylin and coloured hæmatin is precisely that which exists between the white and the blue forms of indigo. By the action of hydrogen and sulphurous acid, hæmatin is easily reduced to hæmatoxylin.

Logwood is prepared for use by dyers, &c., in the form of chips and raspings, and as a solid brittle black extract. Chipped logwood is moistened with water and spread in thin layers till a gentle fermentation sets up, whereby, under the influence of liberated ammonia, hematoxylin is formed from the glucoside. By exposure to the air, through repeated turnings of the mass, hematein is developed from the hematoxylin, and the chips gradually become coated with the brilliant metallic green crystals of hematein. Logwood extract, largely used in calico printing, is obtained from exhausted chips and raspings by lixiviation, the solution being concentrated at as low a temperature as possible.

The principal use of logwood is for dyeing wool and woollen goods, on which it produces, with various mordants, shades of blue from a light lavender to a dense blue-black, according to the amount of logwood used. It is more employed in combination with other dye-stuffs than as the sole tintorial agent, the best and most permanent blacks on wool, known as woaded blacks, being first dyed blue in the indigo vat, and finished black with logwood and bichromate of potash. In calico-printing logwood is used to produce steam purple, for the production of which the calico is mordanted with stannate of soda, and printed with a strong solution of logwood extract thickened with starch. By steaming, the hematein of the logwood combines with binoxide of tin precipitated in the fibre, and thus develops a bright purple colour. Logwood blacks, which are a standard product of print works, are produced by mordanting with iron liquor, passing the calico through a logwood solution, and developing and fixing the colour by treatment with a weak solution of bichromate of potash. Logwood blacks assume a bright red tint by the action of dilute acids, a test by which they can readily be distinguished from aniline and other fast blacks. Logwood is also largely used in the preparation of Inx (qn) , and to a small extent in medicine. The imports of logwood into the United Kingdom during the year 1880 amounted to 62,280 tons, the estimated value of which was £192,392.

LOHARDAGA, or **LOHARDUGA**, a district in the lieutenant-governorship of Bengal, India, between 23° 20' and 24° 39' N. lat. and 85° 22' and 85° 58' E. long., is bounded on the N. by Hazaribagh and Gaya, on the N.W. and W. by Mirzapur district and Sargodhā and Jashpur states, and on the S.E. and E. by Singhbhum and Manbhum districts. It comprises Chutia Nāgpur proper, and the Palāmau subdivision. Chutia Nāgpur is an elevated table-land, forming the central and south-eastern portion of Lohardāgā district; its surface is undulating, and the slopes of the depressions lying between the ridges are cut into terraces covered with rice. Palāmau, which forms the north-western portion of the district, consists on the east and south of spurs thrown off from the plateaus of Hazaribagh and Chutia Nāgpur, while the remainder of the tract is a tangled mass of isolated peaks and long irregular stretches of broken hills. The average elevation of Palāmau is about 1200 feet above sea-level, but some peaks rise to over 3000 feet. This part of the district contains no level areas of any extent, except the valleys of the North Koel and Amlānt rivers, to which rice cultivation is confined. The principal rivers of Lohardāgā are the Subarnarekhā and the North and South Koel. The entire district was probably at one time overgrown with dense forest, but the forest area has been continually dwindling, owing to the spread of cultivation and the practice of girdling the *sal* trees for resin.

The census of 1872 disclosed a total population of 1,287,138 (631,549 males and 655,579 females), spread over an area of 12,044 square miles; of these only 81 were returned as Europeans and 8 as of mixed race. The aboriginal element is very strongly represented—the Mundas numbering 169,051; Kols, 132,104; and Uraons, 171,810. The most numerous among the semi-aboriginal tribes are—the Bhuiyās, 46,008; Khawās, 33,678; Bhogtās, 33,432; and Desdās, 26,228. The Hindu number 741,962, and the Mohammedans 83,811. The Christian population is larger than in any other Bengal district, except the metropolitan one of the

Twenty-four Parganas. In 1873 the total Christian population numbered 12,781, of whom 12,667 were natives, nearly all belonging to the aboriginal tribes of Mundas and Uraons. Most of them are poor, but they possess considerable influence, and are rising in public esteem. The two missions are the German Lutheran and Church of England, which successfully work together and by aid.

The population is entirely rural, Ranchi town (12,086) being the only place with more than 5000 inhabitants. Rice forms the staple crop; other crops are wheat, barley, Indian corn, millets, peas, gram, chickpeas, *pada*, cotton, and tobacco. Opium cultivation was introduced in 1869, and in 1874-75 yielded 245 cwts. There are two small tea plantations. Mildew and blights occasionally attack the crops; droughts seldom affect any considerable area. The principal trading places are Garwa in Palāmau. Stock lac, *tesu*, catechu, silk cocoons, hides, oil-seeds, *ghā*, cotton, and rice are here collected for exportation, while rice and other food grains, brass vessels, piece goods, blankets, broad cloth, silk, salt, tobacco, spices, drugs, and beads are brought to market for local consumption. The manufactures consist of shell-lac, inferior articles of brass and iron work, coarse cloth, blankets, mats, baskets, rope, and rude pottery. Iron, lime, and soapstone are worked in small quantities; gold is washed by the poorer classes from the sands of the rivers. An important coal-bearing tract, known as the Daltonganj coal-field, covers an area of nearly 200 square miles, and lies partly in the valley of the Koel river, and partly in that of the Amlānt. The net revenue of the district in 1879-80 was £103,940, and the expenditure £22,463. The population in 1878-79 numbered 908,347 with 8088 villages. The climate of the table-land of Chutia Nāgpur is said to be superior to that of any other part of India, except the lower ranges of the Himalayas. The hot weather extends over almost six weeks, commencing about the 20th April, but is never really oppressive. The rainy season lasts from the middle of June to about the first week in October. The principal diseases are malarious fever and rheumatism of a severe type.

LOIRE (Lat., *Liger*), the first of the rivers of France in length of course (836 miles) and extent of basin (14,079 square miles), has its headwaters in the great central plateau, and is considered to take its rise in the Clercier de Jone, in the department of Ardèche, at a height of 4604 feet above the sea,—though the Allier branch, which has its source about 30 miles west, in the department of Lozère, at the foot of Maure de la Gardille, 4093 feet above the sea, has an almost equal course. The two streams continue to run parallel till the upper Loire turns westward and is joined by the Allier in the neighbourhood of Nevers. All the more important affluents of the upper and middle part of the Loire—as the Cher, the Indre, the Vienne, respectively 198, 162, and 231 miles in length—have their gathering grounds in the central plateau. In the north-east the basin of the Seine comes so close (at one place to within 6 or 7 miles) that the versant towards the Loire has hardly anything to contribute; and it is not till within 65 miles of the estuary that we find an important tributary, the Maine, bringing down the drainage of the Brittany plateau. At certain seasons the Loire is navigable for ships as far as Nantes (33 miles), for boats as far as La Noire (other 618 miles), and for rafts as far as Retournac; but for six months of the year navigation is practically impossible.

In the volume of water there is all the irregularity of a mountain torrent, at the Boc d'Allier, for instance,—the meeting point of the two head streams,—while the maximum current is 353,200 cubic feet per second, the minimum is 10,800 cubic feet, and above Orleans the range lies between 81,800 and 650. During the drought a slender thin and feeble stream threads their way between the sandbanks of the channel, while at other times a stupendous flood pours down and submerges wide reaches of land. In the middle part of its course the Loire traverses the western portion of the undulating Paris basin, with its Tertiary marls, sands, and clays, and the alluvium carried off from these renders its lower channel incognitum, the rest of the drainage area is occupied by crystalline rocks, over the hard surface of which the water, undiminished by absorption, flows rapidly into the streams. A fall of from 3 to 4 inches over the whole river basin is sufficient to pour 35,320,000,000 cubic feet of water into the channels. When the rain is general over the whole area, the floods on the different branches reach the main river at different times; but when, through any cause, two or more of them arrive at the same time, inundations of the most serious character result. Attempts to control the river must have begun at a very early date, and by the close of the Middle Ages the bed between Orleans and Angers was enclosed by dykes 10 to 12 feet high. In

1753 a double line of dykes or *turres* 23 feet high was completed from Bec d'Allier downwards. This great work had, however, the serious defect that the channel was so much narrowed that the embankments are almost certain to give way as soon as the water rises 16 feet (the average rise is about 14, and in 1846 it was more than 23). In more modern times the importance of the water-way from the sea to Nantes led to the embanking of the lower part of the course; but instead of a depth of 10 feet, being secured, as the engineers anticipated, there is no more at full tide than 13 feet. One of the practical results of the state of matters has been the commercial development of Saint Nazaire and Paimboeuf, and the comparative decline of Nantes as a great shipping port. Best of all, the general embankments of the river, several of the towns along the Loire have constructed special works to defend themselves against the floods; Tours, the most exposed of all, is surrounded by a circular dyke. Various schemes for the systematic regulation of the Loire have been discussed. It has been proposed to construct in the upper valleys of the several affluents a number of granite dams or reservoirs from which the water, stored during flood, could be let off into the river as required. A reservoir of this kind, formed by the engineer Mathieu at the village of Pissay, about 15 miles above Roanne, and capable of retaining from 8500 to 4500 million cubic feet of water, has greatly diminished the force of the floods at Roanne, and maintained the comparative equilibrium of the current during the dry season. There is a canal (167 miles) along the left bank of the Loire between Roanne and Briare, and the Canal du Berry connects this with the navigable part of the Cher. The Canal du Centre extends from Digoin on the Loire to Chalon on the Saône; the Canal du Nivernais and the canals starting from Orleans and Briare communicate with the Seine; and the Nantes canal opens up the way to Lorent, Brest, and Dinan. The canals of the Saône and the Dure (20 and 28 miles respectively) are mainly for irrigation purposes.

See H. Bierry, *Tourisme, Jeunes, et canaux de la France* (Paris, 1878), and his papers in *Rev. des Deux Mondes*, February and March 1875.

LOIRE, a department of central France, made up of the old district of Forez and portions of Beaujolais and Lyonnais, all formerly included in the province of Lyonnais, lies between 45° 16' and 46° 15' N. lat. and between 3° 40' and 4° 45' E. long., and is bounded on the N. by the department of Rhône-et-Loire, on the E. by those of Rhône and Isère, on the S. by Ardèche and Haute-Loire, and on the W. by Puy de Dôme and Allier. Its extreme length is 78 miles from north-west to south-east, and its extreme breadth from east to west is about 43 miles, the area being 1838 square miles. Until 1790 it constituted a single department along with that of Rhône. About an eighth part of the whole area belongs to the basin of the Rhône. The Loire, which has a fall within the department from 1365 feet to 886 feet, traverses alternately a series of narrow gorges and of broad plains, the beds of ancient lakes, including that of Forez between St Rambert and Feurs, and, lower down, that of Roanne. Of its affluents the most important are the Lignon du Nord, the beautiful valley of which has been called "La Suisse Forezienne," and the Ais on the left, and on the right the Oudaine (on which stand the industrial towns of Chambon-Fegerolles and Firminy), the Furens, and the Rhin. To the Rhone the department contributes the Gier, upon which are situated the industrial towns of St Chamond and Rive de Gier, and which forms a navigable channel to the Rhone at Givors. From Mont Pilat descends the Dôme, in the valley of which the workshops of Annonay begin. In the west are the Forez mountains, which separate the Loire basin from that of the Allier; their highest point (Pierre sur Haute, 5381 feet) is 12 miles west from Montbrison. They sink gradually towards the north, and are successively called Bois Noirs (4239 feet), from their woods, and Monte de la Madeleine (3800 to 1640 feet). In the east the Rhone and Loire basins are separated by Mont Pilat (4705 feet) at the north extremity of the Cévennes, and by the hills of Lyonnaise, Tarare, Beaujolais, and Charolais, none of which rise higher than 2950 or 3280 feet. The climate of the department varies according to the elevation: on the heights it is cold and healthy, unwholesome in the marshy plain of Forez, mild in the valley of the Rhone. The

annual rainfall is 39 37 inches on the Forez mountains, but only 24.79 at Roanne. More than half of the area consists of arable lands; one-seventh is occupied by forests, and one-seventh by meadows.

The plains of Forez and Roanne are the two most important agricultural districts, but the total production of grain within the department is insufficient for the requirements of the population. The pasture lands of Forez support a large number of horned cattle, sheep, goats, and pigs. Fairly good red wine is also grown within the department; potatoes, leguminous plants, beetroot, hemp, and colza are also cultivated. Forestry are reared, and bee-keeping is a considerable industry. Among the hills replantation has been set on foot. The Bois d'Or forest yield good-sized pines and large quantities of wood for mining purposes. The so-called Lyons chestnuts are to a large extent obtained from Forez; the woods and pasture lands of Fiat yield medicinal plants, such as mint. The chief wealth of the department, however, lies in the coal deposits in the St Etienne basin, the second in importance in France. The basin, which stretches from south-west to north-east between Firminy and Rive de Gier, is about 20 miles in length and 6 in breadth. In 1881 the output amounted to 3,454,612 tons of coal and anthracite, giving employment to 12,000 workmen below and 5000 above. The presence of coal has naturally encouraged various forms of the metal-working industries. At St Etienne there is a national factory of arms, in which as many as 6000 have been employed; apart from other factories of the same kind carried on by private individuals, the production of hardware occupies 7000 persons, locks, common cutlery, chain cables for the mines, files, and nails are also made. Cast steel is largely manufactured, the aggregate production of all sorts of steel amounting in 1880 to 114,029 tons; the Loire workshops supply the heaviest constructions required in naval architecture. The glass industry has its centre at Rive de Gier. St Etienne employs more than 50,000 persons in the fabrication of silk ribbons, to an annual value of £4,000,000; over and above this must be reckoned the manufacture of elastic ribbons and laces, and the dressing of raw silk. The armament of Roanne manufactures cotton goods, has over 11,000 looms, each employing three persons. That of Nagnat produces table linen. In the mountains between Haute-Loire and Puy de Dôme the women make black laces and embroidery. The department has numerous flour-mills, paper works, tanneries, boat-building yards, silk-spinning works, and velvet, plush, and hat factories. There are three arrondissements—St Etienne, Montbrison, and Roanne. The capital is St Etienne. The population, 290,908 in 1801, was 590,618 in 1876.

LOIRE, HAUTE-, a department of central France, made up of Velay and portions of Vivarais and Gévaudan, three districts formerly belonging to the old province of Languedoc, of a portion of Forez formerly belonging to Lyonnais, and of a portion of lower Auvergne, is bounded on the N. by Puy de Dôme and Loire, on the E. by Loire and Ardèche, on the S. by Ardèche and Lozère, and on the W. by Lozère and Cantal, and lies between 44° 40' and 46° 25' N. lat. and between 3° 5' and 4° 30' E. long., having an extreme length of 68 miles, a maximum breadth of 54 miles, and an area of 1916 miles. It belongs almost wholly to the Loire basin, but a few square kilometres to the north of Mont Mézenc are drained by the Erioux, a tributary of the Rhone. The highest point, Mont Mézenc, on the borders of Ardèche, is 8745 feet; it belongs to the Cévennes system, which sends ramifications throughout the entire department, giving it a mean altitude of 2950 feet. Reckoning from east to west are the Boutières, the Mègal or Meygal, the Velay hills, those of La Marguerite, and finally the Lugnet. The first mentioned ridge separates Haute-Loire from Ardèche, and ranges from 3280 to 4590 feet; it has a crust of lava thrown out from Mont Mézenc; efforts towards replantation are being made. Meygal presents a series of jagged peaks, recalling the Pyrenees on a small scale. It also has been covered by an immense flow of lava some 37 miles long and 490 feet thick, through which the Loire has forced a passage by means of gorges more than 1600 feet in depth. The highest point of the Meygal properly so called is upwards of 4590 feet. The Velay hills, which separate the Loire from the Allier (mean height about 3300 feet), consist of granitic rocks overlaid with the eruptions of more than one hundred and fifty craters, one of which

is now occupied by the singular lake of Bouchet. Westward from the Allier are the forest-clad granitic hills of La Marguerite, which rise to a height of nearly 5000 feet. The Lugnet massif (3500 feet) rises in the north-west of the department on the left bank of the Allagnon, a tributary of the Allier. The river Loire, to which the department owes its name, enters at a point 16 miles distant from its source, and 2923 feet above the level of the sea. Within the 63 miles of its course through the eastern portion of the department, first in a northerly and afterwards in a north-easterly direction, it falls 1655 feet. The Allier, which joins the Loire at Nevers, traverses the western portion of Haute-Loire in a northerly direction, entering at a point 25 miles distant from its source, and 2369 feet above the sea; it traverses a narrow and deep valley overlying by lofty hills, and falls 1090 feet. The chief affluents of the Loire within the limits of the department are the Borne on the left, joining it near Puy, and the Lugnet, which descends from the Mézère, between the Bouchères and Moygny ranges, on the right. The climate, owing to the altitude, the northward direction of the valleys, and the winds from the Cévennes, is cold, the winters being long and rigorous. Storms and violent rains are frequent on the higher grounds, and would give rise to serious inundations were not the rivers for the most part confined within deep rocky channels. Two-fifths of the area is occupied by arable lands, one-fifth by natural meadow and by orchards, and a somewhat smaller proportion by wood. The rest consists of pasture lands, vineyards, and uncultivated lands.

Numerous cattle of the celebrated Mézère breed are reared, and also sheep and mules. The crops raised are wheat, maiz, rye, barley, oats, maize, potatoes (in large quantities), hemp, clover, and second-class wares. The woods yield jun, fir, oak, and beech. Large quantities of aromatic and pharmaceutical plants are found in the Mézère massif. The department has two coal basins, those of Brassac and Lengons, both on the Allier; in 1880 their total output was 225,153 tons. Copper, iron, zinc, argentiferous lead, granite, antimony, barytes, and fluor spar are also obtained, and there are good quarries of trachyte and limestone, as well as numerous unutilized mineral springs. Lace-making in various materials is the most extensive industry, occupying from 150,000 to 180,000 persons, and producing goods to the annual value of about 41,000,000. Ribbons and cloth are manufactured to some extent, and silk-dyeing, wool-spinning, cotton-weaving, various kinds of smith work, paper-making, glass-blowing, brewing, wood-sawing, and flour-milling are also carried on. There are three arrondissements—Puy, Bilande, and Yssingeaux; the capital is Puy. The population in 1876 was 318,721.

LOIRE-INFÉRIEURE, a maritime department of western France, is made up of a portion of Brittany on the right and of the district of Retz on the left of the Loire, and lies between 46° 45' and 47° 40' N. lat. and between 55° and 2° 33' W. long., being bounded on the W. by the ocean, on the N. by Morbihan and Ille-et-Vilaine, on the E. by Maine-et-Loire, and on the S. by Vendée. Its greatest length from east to west is 76 miles, its greatest breadth 65 miles, and its area 2654 square miles. The surface is very flat, and the highest point, in the north on the borders of Ille-et-Vilaine, is only 377 feet. The line of hills skirting the right bank of the Loire, and known as the "sillon de Bretagne," nowhere attains a height of 265 feet; below Savennay they recede from the river, and the meadows give place to peat bogs. North of St Nazaire the Grande Brière, measuring 9 miles by 6, and rising scarcely 10 feet above the sea-level, still supplies old trees which can be used for joiner work; a few scattered villages occur on the more elevated spots, but communication is effected chiefly by means of the canals which intersect it. The district on the south of the Loire lies equally low; its most salient feature is the lake of Grandlien, covering an area of 27 square miles, and surrounded by low and marshy ground, but so shallow (5·5 feet at most) that

drainage would be comparatively easy. The Loire has a course of 68 miles within the department, its width above Nantes varies from 1300 to 3280 feet, and its volume at Nantes, where the tide begins to be felt, is never under 700 cubic metres per second. It has numerous islands. At Paimboeuf it is nearly 2 miles broad, but narrows again opposite St Nazaire before finally entering the ocean. The bed is not sufficiently regular to allow easily the passage of vessels drawing more than 10 feet of water. On the left bank a canal of 9 miles is about to be opened between Fellerin, where the dikes which protect the Loire valley from inundation terminate, and Paimboeuf. The principal towns on the river within the department are Ancenis, Nantes, and St Nazaire (one of the most important commercial ports of France) on the right, and Paimboeuf on the left. The chief affluents are on the right the Erdre and on the left the Sèvre, both debouching at Nantes. The Erdre has a succession of broad lakes which give it the appearance of a first class river, it forms part of the canal from Nantes to Brest. The Sèvre, on the other hand, is hemmed in by picturesque hills, at the point where it enters the department it flows past the famous castle of Clisson. Apart from the Loire itself, the only navigable channel of importance within the department is the Nantes and Brest canal already referred to, fed by the Isac, a tributary of the Vilaine, which separates Loire-Inférieure from Ille-et-Vilaine and Morbihan. The climate partakes of the general Armorican character in respect of humidity, but is Girondine in its mildness. At Nantes the mean annual temperature is 54° 7 Fahr., and there are one hundred and twenty-two rainy days, the annual rainfall being 25·6 inches. Of the entire area nearly two-thirds is arable, one-seventh is occupied by meadows; and vineyards, woods, heath, lakes, pools, and marshes occupy the remainder.

The quantity of live stock is considerable—820,000 horned cattle, 180,000 sheep, 80,000 pigs, 38,000 horses, asses, and mules. Industry also is varied, and there is a good deal of bee-keeping. Wheat, rye, buckwheat, oats, and clover are produced in great abundance, leguminous plants are also largely cultivated, especially near Nantes. Beetroot, hemp, and chestnuts represent, along with wine and cider, the chief remaining agricultural products. The woods are of oak in the interior and pine on the coast. The department has deposits of tin, lead, and iron, which are hardly wrought, if at all. North-west from Ancenis a little antimony is obtained from a coal-bed which is a prolongation of that of Anjou. The salt marshes, about 6000 acres in all, occur for the most part between the mouth of the Vilaine and the Loire, and on the Bay of Bourgneuf. The salt manufacture, which as late as 1874 produced 48,475 tons, is now decaying. There are also quarries in the north-east of the department, and the granite of the sea-coast and of the Loire up to Nantes is quarried for large blocks, while the limestone about Châteaubriant occupies numerous kilns. The industries of the department are well developed. Steam-engines are built for Government at Indret, a few miles beyond Nantes; the forges of Basse-Indre are in good requis for the quality of their iron; and the production of the lead-smelting works at Concarneau amounts to several millions of francs annually. There are also considerable foundries at Nantes, Chantenay, and St Nazaire, and shipbuilding yards at Nantes, St Nazaire, Paimboeuf, and Grand. Among other industries may be mentioned the preparation of pickles and preserved meats at Nantes, the curing of salmon at Cholet and in the neighbouring communes, salt-reining, the great sugar refinery at Nantes, and the tobacco manufacture also there. Fishing is prosecuted along the entire coast. Nantes, formerly one of the most important of French ports, has now given way before St Nazaire, the trade of which in 1878 exceeded 1,500,000 tons. The principal imports are coal, colonial wares, wood, metals, manure; the exports are wine, salt, preserved meats and pickles, flour, refined sugar, and butter. The department is divided into five arrondissements—Nantes, Ancenis, Châteaubriant, Paimboeuf, and St Nazaire; Nantes is the capital. The population in 1876 was 612,972, an increase of 243,657 since 1801.

LOIRET, a department of central France, made up of three districts of the ancient province of Orléanaise,—Orléanaise proper, Gâtinais, and Dunois,—together with portions of the Isle of France and Berri, lies between

47° 30' and 48° 30' N. lat. and between 1° 30' and 3° 8' E. long., and is bounded on the N. by Seine-et-Oise, on the N.E. by Seine-et-Marne, on the E. by Yonne, on the S. by Nièvre and Cher, on the S.W. by Loire-et-Cher, and on the N.W. by Eure-et-Loir, its greatest length, from north-west to south-east, is 75 miles, its greatest breadth, from north to south along the meridian of Paris, 60 miles, and its area 2614 square miles. The name is derived from the Loire, a stream which issues from the ground some miles to the south of Orleans, and after a course of about 7 miles falls into the Loire; its large volume gives rise to the belief that it is a subterranean branch of that river. The Loire traverses the department by a broad valley which, though frequently devastated by disastrous floods, is famed for its rich tilled lands, its castles, its towns, and its vine-clad slopes. To the right of the Loire are Gâtinais (capital Montargis) and Beauce, the former district is so named from its *gâtines* or wildernesses, of which saffron is, along with honey, the most noteworthy product; Beauce, on the other hand, a monotonous tract of corn-fields without either tree or river, has been called the granary of France. Between Beauce and the Loire is the extensive forest of Orleans, which is slowly disappearing before the advances of agriculture. South of the Loire is Sologne, long barren and unhealthy from the impermeability of its subsoil, but undergoing gradual improvement in both respects by means of pine plantation and draining and manuring operations. The surface of the department presents little variation of level, the highest point (on the borders of Cher) is 900 feet above the level of the sea, and the lowest (on the borders of Seine-et-Marne) is 220 feet. The watershed on the plateau of Orleans between the basins of the Seine and Loire, which divide Loiret almost equally between them, is almost imperceptible. The lateral canal of the Loire from Roanne stops at Briare; from the latter town a canal connects with the Seine by the Loing valley, which is joined by the Orleans canal at Montargis. The only important tributary of the Loire within the department is the Loiret, the Loing, a tributary of the Seine, has a course of 40 miles from south to north, and is accompanied throughout first by the Briare canal and afterwards by that of Loing. The Essonne, another important affluent of the Seine, entering Loiret at Maleherbes, takes its rise on the plateau of Orleans, as also does its tributary the Juine. The department has the climate of the Sequanian region, the mean temperature being almost the same as that of Paris; the number of rainy days is one hundred and twenty, and the rainfall varies from 18½ to 27½ inches according to the district, that of the exposed Beauce being smaller than that of the woody Sologne. Two-thirds of the entire area is cultivable; between one-sixth and one-seventh is under wood; vineyards occupy one-twentieth, and the remainder is taken up by meadows, heath, and marsh.

A large number of cattle, sheep, asses, pigs, and goats are reared; poultry, especially geese, and bees are plentiful. The yield of wheat and oats is much in excess of the consumption, the crops of rye, barley, meslin, potatoes, bestroot, colza, and hemp are also very important. Wine is abundant, but of inferior quality. Buckwheat supports bees by its flowers, and poultry by its seeds. Saffron is another source of wealth. The woods consist of oak, elm, birch, and pine; fruit trees thrive in the department, and Orleans is a great centre of nursery gardens. The industries are brick and tile making, and the manufacture of fustice, for which Chen is one of the most important centres in France. The Briare manufacture of porcelain bottoms and necks employs 1500 workmen. Flour-mills are very numerous. There are iron and brass foundries, which, along with agricultural implement making, bell-founding, and the manufacture of pins, needles, and files, represent the chief metal-working industries. The production of hosiery, wool-spinning, and various forms of wool manufacture are also engaged in. A large quantity of the wine grown is made into vinegar (*vin deigre* d'Orleans). The tanneries produce excellent leather; and paper-making, sugar-refining, wax-blessing, and the manufacture of acetone (in one factory) complete the list of industries. The exports are principally

corn, flour, wine, vinegar, live-stock, and wool. The four arrondissements are those of Orleans, Chen, Montargis, and Fichault. The capital is Orleans. The population in 1876 was 360,903, an increase of 70,764 since 1861.

LOIR-ET-CHER, a department of central France, consists of a small portion of Touraine, but chiefly of portions of Orléanais proper, Bloisais, and Dunois, districts which themselves formerly belonged to Orléanais. It lies between 47° 11' and 48° 8' N. lat. and between 0° 36' and 2° 15' E. long., and is bounded on the N. by Eure-et-Loir, on the N.E. by Loiret, on the S.E. by Cher, on the S. by Indre, on the S.W. by Indre-et-Loire, and on the N.W. by Sarthe, the greatest length (north-west to south-east) being 78 miles, maximum breadth 31 miles, and the area 2452 miles. Its name is derived from the Loir and the Cher, by which it is traversed in the north and in the south respectively. The Loir divides it into two nearly equal portions, the district on the right of the Loir being known as Beauce, while that on the right of the Loir again is called Perche, on the left of the Loir is Sologne. The surface of Perche is raised, and reaches a maximum height of 840 feet, its woods alternate with hedged fields and orchards, and rapid rivulets water the green valleys. Beauce is a rich agricultural country, where the monotony of the endless fields of corn is broken only by the houses grouped together in villages, or by the stacks which surround them. Sologne was formerly a region of forests, of which that of Chambord is one of the last remains. Its soil, formerly barren and unhealthy, has been considerably improved within recent years. The Cher and Loir traverse pleasant valleys, occasionally bounded by walls of tufa, in which numerous dwellings have been excavated; the stone extracted, after hardening by exposure to the air, has been used for building purposes in the nearer towns. Within the department the Loir has a course of 66 miles, the Cher of 50, and the Loire of 37. With the help of the Briare canal the last-mentioned is navigable throughout. The chief remaining rivers of the department are the Beuvron, which flows into the Loire on the left, and the Sauldre on the right of the Cher. All these named have a south-westerly course, following the slope of the department. The climate is temperate and mild, and healthy if Sologne be left out of account. The mean temperature ranges between 52° and 53° Fahr., and the rainfall is 25½ inches. Of the total area more than a half is arable, one-sixth is under wood, and one-sixth is waste; vineyards, meadows, and pasture lands occupy the remainder.

Sheep are extensively reared, and the Perche breed of horses is much sought after for its combination of lightness with strength. There are more than twenty thousand beehives within the department. Beauce is the most productive district; in 1876 it yielded 543,000 quarters of wheat, 556,000 of oats, and 1,600,000 bushels of potatoes, beans, meslin, rye, barley, buckwheat, bestroot, maize, colza, and hemp. In the same year the production of wine amounted to 27,000,000 gallons, the most valuable being that of Chen du Cher. The forests are an important source of wealth. Sologne supplies pine and birchwood for furnace fuel, and in the neighbourhood of Blois there are oak, elm, and chestnut plantations. In the river valleys fruit trees and nursery gardens are numerous. Formerly the speciality of Loir-et-Cher was to supply Europe with gun flint. Building stones, and also clay for bricks and pottery, are also abundant. The chief industries are the manufacture of cloth at Romorantin (where spinning, ribbon-making, and tanning are also carried on), of white leather and gloves at Vendôme, distilling, glass-making, paper-making, pottery-making, and the like. The exports are wine, branly, vinegar, wood, cloth, wool, leather, grain, legumes, wax, and lard. Of the castles which adorn the department the finest and most famous is that of Chambord, near the left bank of the Loire opposite Blois (the capital). The three arrondissements are those of Blois, Romorantin, and Vendôme. In 1876 the population was 272,684, an increase of 55,721 since 1861.

LOJA, or LOXA, a town of Spain, in the province of Granada, lies in a beautiful valley through which flows the Genil, here crossed by a Moorish bridge, about 33 miles

by rail west from Granada. The situation is very steep, and the streets in consequence are extremely crooked and irregular. The castle stands on a rock in the centre of the town, which, from being the key to Granada, was once a place of great military importance. The manufactures of Loja consist chiefly of coarse woollens, silk, paper, and leather. Salt is obtained in the neighbourhood. The population in 1877 was 18,249.

Loja, which has sometimes been identified with the ancient *Tipula*, or with the *Lozeta* (*Lozeta*) of Ptolemy, first clearly emerges in the Arab chronicles of the year 890. It was taken by Ferdinand III. in 1233, but was soon afterwards abandoned, and did not finally fall under the arms of Castile until May 23, 1499, when it surrendered to Ferdinand and Isabella after a siege.

LOKEREN, a town of Belgium, in the provinces of East Flanders and district of Termonde, on the Durme (a small but navigable stream by which it communicates with the Scheldt), and 11 miles from Ghent on the railway to Antwerp, which is there joined by the lines to Termonde and Alost, and to Zelzate. It is a busy manufacturing place, with cotton factories, ropewalks, and bleach-works, &c. The church of St Lawrence (17th century) has a fine pulpit, representing Jesus in the midst of the doctors. The population of the commune has increased from 11,960 in 1808 to 17,400 in 1876.

LOKMAN, a name famous in Arabian tradition. The Arabs distinguish two persons of this name. The older Lokman was an 'Adite, and is said to have built the famous dyke of Mu'rib. He not only escaped the destruction sent on his nation for their refusal to hear the prophet Hâd, but received the gift of a life as long as that of seven vultures, each of which is said to have lived eighty years. The other Lokman, called "Lokman the Sage," is mentioned in the Koran (xxx. 11). He is said to have been a Nubian slave, son of 'Ankâ, and to have lived in the time of David in the region of Elak and Midian (Masrûdy, l. 110), but the commentators on the Koran (Abu Sa'îd, ii. 336) make him son of Bâ'ura, the son of Job's sister or daughter. This form of the legend, and many of the stories told of him (D'Herbelot, s.v., but not those given by Nawawy, p. 526), show Jewish influence on the legend, and Derenbourg (*Fables de Lokman le sage*, 1850) has pointed out that Bâ'ura seems to be identical with Boor, and that Lokman corresponds to Balaam, the roots of both names meaning "to swallow," so that the one may be viewed as a translation of the other. In favour of this identification Derenbourg advances several important and probably conclusive arguments from Jewish tradition; but in view of the divergent accounts given of Lokman it may be questioned whether Jewish influence created or only modified the Arabian tradition. The grave of Lokman was shown on the east coast of the Lake of Tiberias, but also in Yemen and elsewhere (Yâkût, iii. 512; D'Herbelot, s.v.).

The name of Lokman is associated with numerous old verses, proverbs, and anecdotes of which Freytag, *Arabum Proverbia*, gives many examples. The fables which pass under his name, and were first printed by Erpenius (Leyden, 1616), are not mentioned by any Arabic writer. They appear to be of Christiana origin, and are mainly derived, though not closely copied, from those of Synopsus and Aesop. They existed in the 13th century (Derenbourg, *ut supra*). The editions are numerous, the book having been much used as an elementary Arabic reading-book. Those of Rodiger (2d ed. 1838, with glossary) and Derenbourg (1850) claim special mention.

LOLLARDS, THOMAS, were the English followers of John Wicliffe, and were the adherents of a religious movement which was widespread in the end of the 14th and begin-

ning of the 15th centuries, and which to some extent maintained itself on to the Reformation. The name is of uncertain origin: it has been traced to a certain Walter Lollard, but he was probably a mythical personage, some derive it from *lollum*, tares, quoting Chaucer (*C. T.*, Shipman's Prologue)—

"This Lollere here wol prechen us somwhat . . .
He wolde seuen some difficulte
Or sprengen oxide in ours clene corn."

but the most generally received explanation derives the words from *lollen* or *lullen*, to sing softly. The word is much older than its English use; there were Lollards in the Netherlands as early as the beginning of the 14th century, who were akin to the Fratricelli, Baghards, and other sectaries of the recussant Franciscan type. The earliest official use of the name in England occurs in 1387 in a mandate of the bishop of Worcester against five "poor preachers," *nomine seu ritu Lollardorum confederatos*. It is probable that the name was given to the followers of Wicliffe because they resembled those offshoots from the great Franciscan movement which had disowned the pope's authority and separated themselves from the medieval church. The 14th century, so full of varied religious life, made it manifest that the two different ideas of a life of separation from the world which in earlier times had lived on side by side within the medieval church were irreconcilable. The church chose to abide by the idea of Hildebrand and to reject that of Francis of Assisi, and the revolt of Ockham and the Franciscans, of the Baghards and other spiritual fraternities, of Wicliffe and the Lollards, were all protests against that decision. Hildebrand's object was to make church government or polity in all respects distinct from civil government—no civil ruler to touch churchman or church possession for trial or punishment, taxation or confiscation, and, in the hands of his successors who followed out his principles, the church became transformed into an empire in rivalry with the kingdoms, and of somewhat the same kind, only that its territories were scattered over the face of Europe in diocesan domains, convent lands, or priests' glebes, its taxes were the tithes, its nobles the prelates. Francis of Assisi had another ideal. Christians, he thought, could separate themselves from the world, in imitation of Christ, by giving up property, and home, and country, and going about doing good and living on the alms of the people. For a time these two ways of separation from the world lived on side by side in the church, but they were really irreconcilable; Hildebrand's church required power to enforce her claims, and money, land, position, were all sources of power. Church rulers favoured the friars when they found means of evading their vows of absolute poverty, and gradually there came to be facing each other in the 14th century a great political Christendom, whose rulers were statesmen, with aims and policy of a worldly ambitious type, and a religious Christendom, full of the ideas of separation from the world by self-sacrifice and of participation in the benefits of Christ's work by an ascetic imitation, which separated itself from political Christianity and called it anti-Christ. Wicliffe's whole life was spent in the struggle, and he bequeathed his work to his followers the Lollards. The main practical thought with Wicliffe was that the church, if true to her divine mission, must aid men to live that life of evangelical poverty by which they could be separate from the world and imitate Christ, and if the church ceased to be true to her mission she ceased to be a church. Wicliffe was a metaphysician and a theologian, and had to invent a metaphysical theory—the theory of *Dominium*—to enable him to transfer, in a way satisfactory to himself, the powers and privileges of the church to his company of poor Christians; but his

¹ Tabery, i. 240; Abul, H. A., 20; Dumfry, ii. 384. The tradition has various forms. Masûdy, iii. 366, 375, gives Lokman only the age of one vulture. Further details are given by Cassan de Perceval, *Revue*. The vultures of Lokman, especially the seventh, whose name was Lobad, are often referred to in Arabic poetry and proverbs.

followers, who were not troubled with need of theories, were content to allege that a church which held large landed possessions, collected tithes greedily, and took money from starving peasants for baptizing, burying, and praying, could not be the church of Christ and his apostles, who in poverty went about doing good.

Lollard was most flourishing and most dangerous to the ecclesiastical organization of England during the ten years after Wickliffe's death. It had spread so rapidly and grown so popular that a hostile chronicler could say that almost every second man was a Lollard. Wickliffe left three intimate disciples.—Nicolas Hereford, a doctor of theology of Oxford, who had helped his master to translate the Bible into English; John Ashton, also a fellow of an Oxford college; and John Purvey, Wickliffe's colleague at Lutterworth, and a co-translator of the Bible. With these were associated more or less intimately, in the first age of Lollardy, John Parker, the strange ascetic William Smith, the restless fanatic Swynderly, Richard Waytstract, and Crome, and there must have been a large number of preachers who itinerated through England preaching the doctrines of their master. Wickliffe had organized in Lutterworth an association for sending the gospel through all England, a company of poor preachers somewhat after the Wesleyan method of modern times. "To be poor without mendicancy, to unite the flexible unity, the swift obedience of an order, with free and constant mingling among the poor, such was the ideal of Wickliffe's 'poor priests'" (cf. Shirley, *Fuse. Zis*, p. 21), and, although proscribed, these "poor preachers," with portions of their master's translation of the Bible in their hand to guide them, preached all over England wherever they could be heard without detection. The Oxford university and many nobles supported them. Lord Montacute, Lord Salisbury, Sir Thomas Latimer of Braybrooke, and several others had chaplains who were Lollardist preachers; whilst many merchants and burgesses assisted the work with money. The organization must have been strong in numbers, but only the names of those have come down to us who were seized for heresy, and it is only from the indictments of their accusers that their opinions can be gathered. The preachers were picturesque figures in long russet dress down to the heels, who, staff in hand, preached in the mother tongue to the people in churches and graveyards, in squares, streets, and houses, in gardens and pleasure grounds, and then talked privately with those who had been impressed. The Lollard literature was very widely circulated,—books by Wickliffe and Hereford and tracts and broadsides,—in spite of many edicts proscribing it. In 1395 the Lollards grew so strong that they petitioned parliament through Sir Thomas Latimer and Sir R. Stury to reform the church on Lollardist methods. It is said that the Lollard Conclusions printed by Canon Shirley (p. 360) contain the substance of this petition. If so, parliament was told that temporal possessions ruin the church and drive out the Christian graces of faith, hope, and charity; that the priesthood of the church in communion with Rome was not the priesthood Christ gave to his apostles; that the monk's vow of celibacy had for its consequence unnatural lust, and should not be imposed; that transubstantiation was a feigned miracle, and led people to idolatry; that prayers made over wine, bread, water, oil, salt, wax, incense, altars of stone, church walls, vestments, mitres, crosses, staves, were magical and should not be allowed; that kings should possess the *jus episcopale*, and bring good government into the church; that no special prayers should be made for the dead; that auricular confession made to the clergy, and declared to be necessary for salvation, was the root of clerical arrogance and the cause of indulgences and other abuses in pardoning sin; that all wars

were against the principles of the New Testament, and were but murdering and plundering the poor to win glory for kings; that the vows of chastity laid upon nuns led to child murder; that many of the trades practised in the commonwealth, such as those of goldsmiths and armourers, were unnecessary and led to luxury and waste. These Conclusions really contain the sum of Wickliffe teaching, and, if we add that the principal duty of priests is to preach, and that the worship of images and going on pilgrimages are sinful, they include almost all the heresies charged in the indictments against individual Lollards down to the middle of the 16th century. The king, who had hitherto seemed anxious to repress the action of the clergy against the Lollards, spoke strongly against the petition and its promoters, and Lollardy never again had the power in England which it wielded up to this year.

If the formal statements of Lollard creed are to be got from these Conclusions, the popular view of their controversy with the church may be gathered from the ballads preserved in the collection of *Political Poems and Songs relating to English History*, published in 1859 by Mr Thomas Wright for the Master of the Rolls series, and in the *Piers Ploughman* poems. *Piers Ploughman's Creed* (see LARGELAND) was probably written about 1394, when Lollardy was at its greatest strength; the ploughman of the *Creed* is a man gifted with sense enough to see through the tricks of the friars, and with such religious knowledge as can be got from the creed, and from Wickliffe's version of the Gospels. The poet gives us a "portrait of the fat friar with his double chin shaking about as big as a goose's egg, and the ploughman with his hood full of holes, his mittens made of patches, and his poor wife going barefoot on the ice so that her blood followed" (*Early English Text Society*, vol. xxx, pref., p. 18); and one can easily see why farmers and peasants turned from the friars to the poor preachers. The *Ploughman's Complaint* tells the same tale. It paints popes, cardinals, prelates, rectors, monks, and friars, who call themselves followers of Peter and keepers of the gates of heaven and hell, and pale poverty-stricken people, cold and landless, who have to pay the fat clergy for spiritual assistance, and asks if these are Peter's priests after all. "I trowe Peter took no money, for no sinners that he sold. . . . Peter was never so great a fole, to leave his key with such a losell."

In 1399 the Lancastrian Henry IV. overthrew the Plantagenet Richard II., and one of the most active partisans of the new monarch was Arundel, archbishop of Canterbury and the most determined opponent of Lollardy. It has been alleged that Henry won his help by promising to do his utmost to suppress the followers of Wyclif, and this much is certain, that when the house of Lancaster was firmly established upon the throne the infamous *Act De comburendo hereticos* was passed in 1400, and church and state combined to crush the Lollards. John Purvey was seized, William Sautre (Chartrist) was tried, condemned, and burned. The Lollards, far from daunted, abated no effort to make good their ground, and united a struggle for social and political liberty to the hatred felt by the peasants towards the Romish clergy. Jak Upland (John Countryman) took the place of Piers Ploughman, and upbraided the clergy, and especially the friars, for their wealth and luxury. Wickliffe had published the rule of St Francis, and had pointed out in a commentary upon the rule how far friars had departed from the maxims of their founder, and had persecuted the *Spirituales* (the Fratricelli, Beghards, Lollards of the Netherlands) for keeping them to the letter (cf. Matthews, *English Works of Wyclif hitherto unprinted*, Early Eng. Text Soc., vol. lxxiv., 1880). Jak Upland put all this into rude nervous English verse:—

"Fier, what chaunte is this
To fain that whose lyveth after youi order
Livelh most perfectly
And next folloeth the state of the Apostles
In povertie and penance
And yet the wisest and greatest clerkes of youi
Wond or seil or procure to the court of Rome,
... and to be assailed of the vow of povertie."

The archbishop, having the power of the state behind him, attacked that stronghold of Lollardy the university of Oxford. In 1406 a document appeared bearing to be the testimony of the university in favour of Wickliffe; its genuineness was disputed at the time, and when quoted by Huss at the council of Constance it was repudiated by the English delegates. The archbishop treated Oxford as if it had issued the document, and procured the issue of severe regulations in order to purge the university of heresy. In 1408 Arundel in convocation proposed and carried the famous *Constitutions Thoma Arundel* intended to put down Wickliffe preachers and teaching. They provided amongst other things that no one was to be allowed to preach without a bishop's licence, that preachers preaching to the laity were not to rebuke the sins of the clergy, and that Lollard books and the translation of the Bible were to be searched for and destroyed. He next attempted to purge the nobility of Lollardy. The earlier leaders had died, but there was still one distinguished Lollard, Sir John Oldcastle, in right of his wife Lord Cobham, "the good Lord Cobham" of the common people, who had been won to pious living by the poor preachers, and who openly professed the common Lollard doctrines. His chaplain, one of the interesting preachers, was seized, then his books and papers were taken and burnt in the king's presence, and later he was indicted for heresy. It is said that at first he recanted, but the abjuration, said to be his, may not be authentic. In the end he was burnt for an obstinate heretic. These persecutions were not greatly protested against; the wars of Henry V with France had awakened the martial spirit of the nation, and little sympathy was felt for men who had declared that all war was but the murder and plundering of poor people for the sake of kings. Mocking ballads were composed upon the martyr Oldcastle, and this dislike to warfare was one of the chief accusations made against him (comp. Wright's *Poetical Poems*, vol. ii. p. 244). But Arundel could not prevent the writing and distribution of Lollard books and pamphlets. Two appeared just about the time of the martyrdom of Oldcastle—*The Ploughman's Prayer* and *the Lanthorne of Light*. *The Ploughman's Prayer* declared that true worship consists in three things—in loving God, and dreading God, and trusting in God above all other things; and it showed how Lollards, pressed by persecution, became further separated from the religious life of the church. "Men maketh now great stonon houses full of glasson windowis, and clepeth thilke thine houses and churches. And they setten in these houses mawmets of stoockes and stones, to fore them they knelen privelien and apert, and maken thier prayers; and all this they say is thy worship. . . . For Lorde our believ is that thine house is man's soul."

The council of Constance (1414-1418) put an end to the papal schism, and also showed its determination to put down heresy by burning John Huss. When news of this reached England the clergy were incited to still more vigorous proceedings against Lollard preachers and books. From this time Lollardy appears banished from the fields and streets, and takes refuge in houses and places of concealment. There was no more wayside preaching, but instead there were *conventicula occulta* in houses, in peasants' huts, in sawpits, and in field ditches, where the Bible was read and exhortations were given, and so

Lollardy continued. In 1428 Archbishop Chichele confessed that the Lollards seemed so numerous as evai, and that their literary and preaching work went on as vigorously as before. It was found out also that many of the poorer rectors and parish priests, and a great many chaplains and curates, were in secret association with the Lollards, so much so that in many places processions were never made and worship on saints' days was abandoned. For the Lollards if not stamped out were hardened by persecution, and became fanatical in the statement of their doctrines. Thomas Bagley was accused of declaring that if in the sacrament a priest made bread into God, he made a God that can be eaten by rats and mice, that the Pharisees of the day, the monks, and the nuns, and the friars, and all other privileged persons recognised by the church were limbs of Satan, and that anacular confession to the priest was the will not of God but of the devil. And others held that any priest who took salary was excommunicate; and that boys could bless the bread as well as priests.

From England Lollardy passed into Scotland. Oxford infected St Andrews, and we find traces of more than one vigorous search made for Lollards among the teaching staff of the Scottish university, while the Lollards of Kyle in Ayrshire were claimed by Knox as the forerunners of the Scotch Reformation.

The opinions of the later Lollards can best be gathered from the learned and unfortunate Peock, who wrote his elaborate *Thesaur* against the "Bible-men," as he calls them. He summed up their doctrines under eleven heads: they condemn the having of images in the churches, the going on pilgrimages to the memorial or "mynde places" of the saints, the holding of lauded possessions by the clergy, the various ranks of the hierarchy, the framing of ecclesiastical laws and ordinances by papal and episcopal authority, the institution of religious orders, the evilness of ecclesiastical decorations, the carcerousness of the mass and the sacraments, the taking of oaths, and the maintaining that war and capital punishment are lawful. When these points are compared with the Lollard Conclusions of 1385, it is plain that Lollardy had not greatly altered its opinions after fifty-five years of persecution. All the articles of Peock's list, save that as to the sacraments, are to be found in the Conclusions; and, although many writers have held that Wickliffe's own views differed greatly from that have been called the "exaggerations of the later and more violent Lollards," all these views may be traced back to Wickliffe himself. Peock's idea was that all the statements which he was prepared to impugn came from three false opinions or "movings," viz., that no governance or ordinance is to be esteemed a law of God which is not founded on Scripture, that every humble minded Christian man or woman is able without "faul and defaut" to find out the true sense of Scripture, and that having done so he ought to listen to no arguments to the contrary; in elsewhere add a fourth (vol. i. p. 102), that if a man be not only meek but also keep God's law he shall have a true understanding of Scripture, even though "no man ellis teche him save God." These statements, especially the last, show us the connexion between the Lollards and those mystics of the 14th century, such as Tauler and Ruysbroeck, who accepted the teachings of Nicholas of Basel, and formed themselves into the association of the Friends of God.

The question remains—What was the connexion between the Lollard movement and the Reformation in England? Many writers make Lollardy the forerunner of Reformation teaching; others, like Mr. Gauden, relying on the facts that the persecution of the Lollards did not rouse the English nation in the way that the martyrdom of Huss excited the Bohemians and that Lollardy had almost faded out of sight in the beginning of the 16th century, admit only a casual connexion between the two awakenings. The problem is scarcely one which can be settled by counting the numbers of Lollards convicted at different periods from the beginning to the end of the 16th century, or by pointing to the enthusiasm or indifference of the mass of the English nation to Lollard doctrines. The English Reformation down to the middle of Elizabeth's reign was much more a political than a religious movement with the great proportion of English people. Lollardy in its most essential and invariable characteristics had much more in common with medieval religious revivals than with Reformation piety, and Lollard preaching must have had much more resemblance to that of Ockham and his recessant Franciscans than that of Luther, Calvin, or Peter Martyr. But Lollardy did one thing for England which other medieval revivals did not do for the lands in which they

arose; it made the Bible familiar to the people in their mother tongue, and this must have been a positive preparation for the English Reformation of no ordinary power. May not the great peculiarity of the English Reformation on its religious side, the repeated attempts to give a good version of the Bible from the original tongue into English, by Tyndale, Coverdale, Taverner, Crammer, the Geneva refugees, and Parker, with the revisions and combinations of these various translations, on to our present authorized version, have come from the fact that Lollard Biblemen, as Peacock calls them, had made a good English Bible a necessity for an English reformation of religion?

Literature—*Lectiones Joannis ev. Martij*, 2d vol. 1675, Shirley, *Patres Latini Zuanovum*, Master of the Rolls Series, 1858, Rebingron's edition of Peacock's *Repositor of our most Manly of the Clergy*, 2 vols., Master of the Rolls Series, 1860, Matthew, *The English Works of John Wycliffe*, Early English Text Society, 1880; Wright, *Political Poems and Songs*, Master of the Rolls Series, 2 vols., 1843; J. Gellender and J. Spalding, *Studies in English History*, 1881, *Pope's Book of Hours*; Eddis's *donat non laudamus*, 9, 1871. (T. M. L.)

LOMBARD, PETER (c. 1100–1160), bishop of Paris, better known as *Magister Sententiarum*, the son of obscure parents, was born about the beginning of the 12th century, at Novara (then reckoned as belonging to Lombardy). After receiving his education in jurisprudence and the liberal arts at Bologna, he removed to France, bearing a recommendation to Bernard of Clairvaux, who first placed him under Lotolf at Rheims, and afterwards sent him to Paris with letters to Ghilduin, the abbot of St Victor. His diligence and talents soon brought him into notice, and ultimately obtained for him a theological chair, which he held for a number of years; during this period he is said to have been the first to introduce theological degrees. On June 29, 1159, he succeeded his former pupil, Philip, brother of Louis VII., in the bishopric of Paris, but did not long survive the promotion; according to the most trustworthy of the meagre accounts we have of his life, he died on July 30 of the following year.

His famous theological handbook, *Sententiarum Libri Quatuor*, is, as the title implies, primarily a collection of "sententiae petrum,"¹ These are arranged (professedly on the basis of the aphorism of Augustine, Lombard's favourite authority, that "omnis doctrina vel rerum est vel signorum") into four books, of which the first treats of God, the second of the creature, the third of the incarnation, the work of redemption, and the virtues, and the fourth of the seven sacraments and eschatology. It soon attained immense popularity, ultimately becoming the text-book in almost every theological school, and giving rise to endless commentaries. A charge of heresy ("ultranianism") was indeed raised against Lombard for a particular view which he seemed not remotely to have indicated regarding Christ's human nature, but neither at the synod of Tours, where the question was first broached in 1168, nor at the subsequent Lateran synod in 1179, does a condemnation seem to have been obtained. In 1890 the theological professors of Paris agreed in the rejection of sixteen propositions taken from Lombard, but their decision was far from obtaining universal currency.

Besides the *Sententiae*, Lombard wrote numerous commentaries (e.g., on the Psalms, Canticles, Job, the Gospel Harmony, and the Pauline Epistles), sermons and letters, which still exist in MS. The *Glossae seu Commentaria in Prædicatorum Doctorum*, first published at Paris in 1838, and the *Collectanea in omnes D. Pauli Epistolae* (Paris, 1838) have been reprinted by Migne.

LOMBARDS. The history of the Lombards falls into three divisions:—(1) The period before the invasion in 568 A.D.; (2) the Lombard kingdom in Italy between 568 and 774; (3) the period of their incorporation with the Italian population, and the history of Lombardy and its cities as one of the great provinces of Italy—(a) from the restoration of the empire under Charles the Great (800) to the peace of Constance with Frederick Barbarossa (1183), and (b) from the declaration of independence to the time of the tyrannies and, afterwards, of the French, Spanish, and Austrian rule.

1. The name *Lombard* is the Italianized form of the national name of a Teutonic tribe, *Langobardi*, itself an Italian arrangement, based on a supposed etymology of the Teutonic *Langbard*, *Langobardi*, the form used when they are first named by Roman writers—Velleius and Tacitus. The etymology which made the name mean *Longbeard* is too obvious not to have suggested itself to Italians, and

perhaps to themselves (see Zeuss, 95, 109); it is accepted by their first native chronicler, Paul the Deacon, who wrote in the time of Charles the Great. But the name has also been derived from the region where they are first heard of. On the left bank of the Elbe, "where Bordo or Bord still signifies a fertile plain by the side of a river," a district near Magdeburg is still called the *Langbe Börde*; and lower down the Elbe, on the same side, about Lüneburg, the *Bardengau*, with its *Bardewik*, is still found; it is here that Velleius, who accompanied Theodoric in his campaign in this part of Germany, and who first mentions the name, places them. As late as the age of their Italian settlement the Lombards are called *Bardi* in poetical epiphs, though this may be for the convenience of metre.

Their own legends bring the tribe as worshippers of Odin from Scandinavia to the German shore of the Baltic, under the name of *Wendii*, a name which was given to them in a loose way as late as the 12th century (e.g., by Ordericus Vitalis; cf. Zeuss, 57). By the Roman and Greek writers of the first two centuries of our era they are spoken of as occupying, with more or less extension at different times, the region which is now Hanover and the Altmark of Prussia. To the Romans they appeared a remarkable tribe:—"gens etiam Germana feritate ferocior," says Velleius, who had fought against them under Theodoric; and Tacitus describes them as a race which, though few in numbers, more than held their own among numerous powerful neighbours by their daring and love of war. In the quarrels of the tribes they appear to have extended their borders; in Ptolemy's account of Germany, in the 2d century, they fill a large space among the races of the north-west and north. But from the 2d century the name disappears, till it is found again at the end of the 6th century as that of a half Christian tribe on the northern banks of the Danube. How they got there, and what relation these Langobards bore to those who lived in the 1st and 2d centuries on the west bank of the Elbe, we learn little from the vague stories preserved by their traditions; but they are described (B. G., ii. 14, 15) by Procopius, a contemporary, as subject to one of the most ferocious of the tribes on the Danube, the Heruli, also a Teutonic tribe, by whose oppression they were driven in despair to a resistance, which ended in the utter defeat and overthrow of their tyrants. We know nothing of the way in which Christianity was introduced among them, probably only among some of their noble families; but they were Arians like their neighbours and predecessors in Italy, the Goths, and like them they brought with them into Italy a hierarchy of bishops, priests, and deacons; but, while the Gothic Bible of Ulfilas is partially preserved, whatever religious literature the Langobards had in the shape of versions of the Scriptures or liturgical forms has utterly perished. They were among the Teutonic tribes which were generally on good terms with the empire, and were encouraged by it in their wars with their more barbarous neighbours. After defeating the Heruli and destroying their tribal organization, the Langobards attacked the Gepides with equal success, scattering the tribe or incorporating its survivors in their own host. They thus became the most formidable of the Teutonic tribes of the Danube. They had alliances with the distant Saxons, probably a kindred stock, and with the Huns and the Avars of the Danube. Their kings belonged to a royal line, and made marriages with the kings of the Franks and the other German nations. Their wars led them westwards, and for forty years they are said to have occupied Pannonia, the region between the Danube and the valleys of the Drave and Sava. Thus following the line of movement of the Goths, they resolved at last to strike for

¹ Except in the Anglo-Saxon *Treveler's Song*, of probably between 875–455; see Guest's *English Rhythms*, 2, 77, 88, 87.

the great prize which the Goths had won and lost. Through the eastern passes, and the border land of Friuli, they invaded Italy. It is said that they were invited by Narses, the conqueror of the Goths, in revenge for his ill treatment by the masters whom he had served.

2. In 568 Alboin, king of the Langobards, with the women and children of the tribe and all their possessions, with Saxon allies, with the subject tribe of the Gepidae, and a mixed host of other barbarians, descended into Italy by the great plain at the head of the Adriatic. There was little resistance to them. The war which had ended in the downfall of the Goths had exhausted Italy; it was followed by famine and pestilence; and the Government at Constantinople, away in the East, made but faint efforts to retain the province which Belisarius and Narses had recovered for it. Except in a few fortified places, such as Ticinum or Pavia, the Italians did not venture to encounter the new invaders, and, though Alboin was not without generosity, the Lombards, wherever resisted, justified the opinion of their ferocity by the savage cruelty of the invasion. In 572, according to the tragic tale of the Lombard chronicler, a tale which recalls the story of Candacius in Herodotus, Alboin, the fierce conqueror, fell a victim to the revenge of his wife Rosamond, the daughter of the king of the Gepidae, whose skull Alboin had turned into a drinking cup, out of which he forced Rosamond to drink; but the Langobards had already shown themselves in ravaging bands all over Italy, and in the north had begun to take possession. Military chiefs, whom, after the Latin writers, we call "dukes," corresponding to the German "Herzog," were placed, or placed themselves, first in the border cities, like Friuli and Trent, which commanded the north-eastern passes, and then in other principal places in Italy; and this arrangement became characteristic of the Lombard settlement. The principal seat of the settlement was the rich plain watered by the Po and its affluents, which was in future to receive its name from them; but their power extended across the Apennines into Liguria and Tuscan, and then southwards to the outlying dukedoms of Spoleto and Benevento. The invaders failed to secure any maritime ports such as Genoa, Pisa, Naples, Salerno, Ravenna, or any territory that was conveniently commanded from the sea. Pavia, or, as it was called, Ticinum, the one place which had obstinately resisted Alboin, became the seat of their kings, as it had been one of the seats of the Gothic kingdom.

After the short and cruel reign of Cleph, the successor of Alboin, the Lombards (as we may begin for convenience sake to call them) tried for ten years the experiment of a national confederacy of their dukes, without any king at their head. It was the rule of some thirty-five or thirty-six petty tyrants, under whose oppression and private wars even the invaders suffered, while the Italians were remorselessly trodden under foot. With anarchy among themselves and so precarious a hold on the country, hated by the Italian population and by their natural leaders the Catholic clergy, threatened also by an alliance of the Greek empire with their natural and persistent rivals the Franks beyond the Alps, they resolved to sacrifice their turbulent independence to the usual necessities of the Teutonic invaders which led to the election of a king. In 584 they chose Authari, the grandson of Alboin, and endowed the royal domain with a half of their possessions. From this time till the fall of the Lombard power before the arms of their rivals the Franks under Charles the Great, the kingly rule continued. Authari, "the Long-haired," with his Roman title of Flavius, marks the change from the warring of an invading host to the permanent representative of the unity and law of the nation, and the increased power of the crown, by the possession of a great

domain, to enforce its will. The independence of the dukes was surrendered to the king. The dukedoms in the neighbourhood of the seat of power were gradually absorbed, and their holders transformed into royal officers. Those of the northern marches, Trent and Friuli, with the important dukedom of Tivoli, retained longer the kind of independence which marchlands usually give where invasion is to be feared. The great dukedom of Benevento in the south, with its neighbour Spoleto, threatened at one time to be a separate principality, and even to the last resisted, with varying success, according to the personal characters of its dukes, the full claims of the royal authority at Pavia.

The kingdom of the Lombards lasted more than two hundred years, from Alboin (568) to the fall of Desiderius (774),—much longer than the preceding Teutonic kingdom of Theodoric and the Goths. But it differed from the other Teutonic conquests in Gaul, in Britain, in Spain. It was never complete in point of territory: there were always two, and almost to the last three, capitals—the Lombard one, Pavia, the Latin one, Rome, the Greek one, Ravenna; and the Lombards never could get access to the sea. And it never was complete over the subject race, it profoundly affected the Italians of the north, in its turn it was entirely transformed by contact with them, but the Lombards never overcame the natural repulsion of the two races, and never amalgamated with the Italians till their power as a ruling race was crushed by the victory given to the Roman element by the restored empire of the Franks. The Langobards, German in their faults and in their strength, but coarser, at least at first, than the Germans whom the Italians had known, the Goths of Theodoric and Totila, found themselves continually in the presence of a subject population very different from anything which the other Teutonic conquerors met with among the provincials.—Like them, exhausted, dispirited, unwelcome, but with the remains and memory of a great civilisation round them, intelligent, subtle, sensitive, feeling themselves infinitely superior in experience and knowledge to the rough barbarians whom they could not fight, and capable of hatred such as only cultivated races can nourish. The Lombards who came into Italy with the most cruel incidents of conquest, and who, when they had occupied the lands and cities of Upper Italy, still went on sending forth furious bands to plunder and destroy where they did not care to stay, never were able to overcome the mingled fear and scorn and loathing of the Italians. They adapted themselves very quickly indeed to many Italian fashions. Within thirty years of the invasion, Authari took the fancy of decking himself with the imperial title of Flavius, even while his hands were leading Italian captives in leash like dogs under the walls of Rome, and under the eyes of Pope Gregory; and it was retained by his successor. They soon became Catholics; and then in all the usages of religion, in church building, in founding monasteries, in their veneration for relics, they vied with Italians. Authari's queen, Theodelinda, solemnly placed the Lombard nation under the patronage of St John the Baptist, and at Monza she built in his honour the first Lombard church, and the royal palace near it. King Liutprand (713-744) bought the relics of St Augustine for a large sum to be placed in his church at Pavia. Their Teutonic speech disappeared; except in names and a few technical words all traces of it are lost. But to the last they had the unpardonable crime of being a ruling barbarian race or caste in Italy. To the end they are "nefastissimi," execrable, loathsome, filthy. So wrote Gregory the Great when they first appeared. So wrote Pope Stephen IV, at the end of their rule, when stirring up the kings of the Franks to destroy them. Authari's short reign (584-591) was one of renewed effort for con-

quest. It brought the Langobards face to face, not merely with the emperors at Constantinople, but with the first of the great statesmen popes, Gregory the Great (590-604). But Lombard conquest was bungling and wasteful. It was ever ready to lapse into mere plunder and warfare; and when they had spoiled a city they proceeded to tear down its walls and raze it to the ground. But Authari's chief connexion with the fortunes of his people was an important, though an accidental one. The Lombard chronicler tells us a romantic tale of the way in which Authari sought his bride from Garibald, duke of the Bavarians, how he went incognito in the embassy to judge of her attractions, and how she recognized her disguised suitor. The bride was the Christian Theodelinda, and she became to the Langobards what Bertha was to the Anglo-Saxons, and Clothilda to the Franks. She became the mediator between the Lombards and the Catholic Church. Authari, who had brought her to Italy, died shortly after his marriage. But Theodelinda had so won on the Lombard chiefs that they bid her as queen choose the one among them whom she would have for her husband and for king. She chose Agilulf, duke of Turin (592-615). He was not a true Langobard, but a Thuringian. It was the beginning of peace between the Lombards and the Catholic clergy. Agilulf could not abandon his traditional Arianism, and he was a very uneasy neighbour, not only to the Greek exarch, but to Rome itself. But he was favourably disposed both to peace and to the Catholic Church. Gregory interfered to prevent a national conspiracy against the Langobards, like that of St Brice's day in England against the Danes, or that later uprising against the French, the Sicilian Vespers. He was right both in point of humanity and of policy. The Arian and Catholic bishops went on for a time side by side; but the Lombard kings and clergy rapidly yielded to the religious influences around them, even while the national antipathies continued unabated and vehement. Gregory, who despaired of any serious effort on the part of the Greek emperors to expel the Lombards, endeavoured to promote peace between the Italians and Agilulf; and, in spite of the feeble hostility of the exarchs of Ravenna, the pope and the king of the Lombards became the two real powers in the north and centre of Italy. Agilulf was followed, after two unimportant reigns, by his son-in-law, the husband of Theodelinda's daughter, King Rothari (636-652), the Lombard legislator, still an Arian though he favoured the Catholics. He was the first of their kings who did for the Lombards what was done by all the Teutonic conquerors as soon as they felt themselves a nation on Roman soil; he collected their customs under the name of laws,—and he did this, not in their own Teutonic dialect, but in Latin. The use of Latin implies the use of Latin scribes or notaries, and implies that the laws were a notice to the Italians of the usages and rules of their conquerors, which, so far as they applied, were to be not merely the personal law of the Lombards, but the law of the land, and binding on Lombards and Romans alike. But such rude legislation could not provide for all questions arising even in the shattered and decayed state of Roman civilization. It is probable that among themselves the Italians kept to their old usages and legal precedents where they were not overridden by the conquerors' law, and by degrees a good many of the Roman civil arrangements made their way into the Lombard code, while all ecclesiastical ones, and they were a large class, were untouched by it.

The precise nature of the relations, legal and political, of the Lombards, as a conquering race, or a military caste, to the Italians is still a subject of controversy, owing to the prevailing mixture of clearness and obscurity in the documents of the time. There must have been, of course, much change of property; but appearances are conflicting as to the terms on which land generally was held by

the old possessors or the new comers, and as to the relative legal position of the two. Savigny held that, making allowance for the anomalies and usurpation of conquest, the Roman population held the bulk of the land as they had held it before, and were governed by an uninterrupted and acknowledged exercise of Roman law in their old municipal organization. Later inquirers, Leo, Troya, and more recently Hugel, have found that the supposition does not tally with a whole series of facts, which point to a Lombard territorial law ignoring completely any parallel Roman and personal law, to a great restriction of full civil rights among the Romans, analogous to the condition of the rayah under the Turks, and to a reduction of the Roman occupiers to a class of half-free "aldii," holding immovable tenancies under lords of superior race and privileges, and subject to the sacrifice either of the third part of their holdings or the third part of the produce. Probably something like this, with exceptions and anomalies, represents the state of things, at least at first, but it must be remembered that regular and consistent arrangements were very unlikely to have been thought of early in such a conquest as that of the Lombards, that the Romans suffered probably rather from the insolence of barbarians than from the rules of a constitutional settlement, and that a conquered race always and naturally exaggerates its own humiliations and grievances, and in this case has the chief telling of the story. It might also be expected that the tribal customs of Teutonic conquerors would be more modified in Italy than elsewhere, by the deeply-rooted traditions and customs of the old Roman rule. The Lombards were rough and harsh, and the Italians never ceased to hate them; but we know by experience how two portions of a population, possessed of equal civil rights can hate one another, where they differ in blood and history. The Roman losses, both of property and rights, were likely to be great at first, how far they continued permanent during the two centuries of the Lombard kingdom, or how far the legal distinctions between Rome and Lombard gradually passed into desuetude, is a further question. The legislation of the Lombard kings, in form a territorial and not a personal law, shows no signs of a disposition either to depress or to favour the Romans, but only the purpose to maintain, in a rough fashion, strict order and discipline impartially among all their subjects.

From Rothari (ob. 652) to Liutprand (712-744) the Lombard kings, succeeding one another in the irregular fashion of the time, sometimes by descent, sometimes by election, sometimes by conspiracy and violence, strove fitfully to enlarge their boundaries, and contended with the aristocracy of dukes inherent in the original organization of the nation, an element which, though much weakened, always embarrassed the power of the crown, and checked the unity of the nation. Their old enemies the Franks on the west, and the Slavs or Huns, ever ready to break in on the north-east, and sometimes called in by mutinous and traitorous dukes of Friuli and Trent, were constant and serious dangers. By the popes, who represented Italian interests, they were always looked upon with dislike and jealousy, even when they had become zealous Catholics, the founders of churches and monasteries; with the Greek empire there was chronic war. From time to time they made raids into the unsubdued parts of Italy, and added a city or two to their dominions. But there was no sustained effort for the complete subjugation of Italy till Liutprand, the most powerful of the line. He tried it, and failed. He broke up the independence of the great southern duchies, Benevento and Spoleto. For a time, in the heat of the dispute about images, he won the pope to his side against the Greeks. For a time, but only for a time, he deprived the Greeks of Ravenna. Aistulf, his successor, carried on the same policy. He even threatened Rome itself, and claimed a capitation tax. But the popes, thoroughly irritated and alarmed, and hopeless of aid from the East, turned to the family which was rising into power among the Franks of the West, the mayors of the palace of Austrasia. Pope Gregory III. applied in vain to Charles Martel. But with his successors Pippin and Charles the popes were more successful. In return for the transfer by the pope of the Frank crown from the decayed line of Clovis to his own, Pippin crossed the Alps, defeated Aistulf, and gave to the pope the lands which Aistulf had torn from the empire, Ravenna and the Pentapolis (754-756). But the angry quarrels still went on between the popes and

the Lombards. The Lombards were still to the Italians a "foul and horrid" race. At length, invited by Pope Adrian I, Pippin's son Charles once more descended into Italy. As the Lombard kingdom began, so it ended, with a siege of Pavia. Desiderius, the last king, became Charles's prisoner (774), and the Lombard power perished. Charles, with the title of king of the Franks and Lombards, became master of Italy, and in 800 the pope, who had crowned Pippin king of the Franks, claimed to bestow the Roman empire, and crowned his greater son emperor of the Romans (800).

3 To Italy the overthrow of the Lombard kings was the loss of its last chance of independence and unity. To the Lombards the conquest was the destruction of their legal and social supremacy. Henceforth they were equally with the Italians the subjects of the French king. Charles, the Carolingian king, expressly recognised the Roman law, and allowed all who would be counted Romans to "profess" it. Latin influences were not strong enough to extinguish the Lombard name and destroy altogether the recollections and habits of the Lombard rule. Lombard law was still recognized, and survived in the schools of Pavia. Lombardy remained the name of the finest province of Italy, and indeed for a time was the name for Italy itself. But what was specially Lombard could not stand in the long run against the Italian atmosphere which surrounded it, with its countless and subtle forces, social, political, and religious. Generation after generation passed more and more into real Italians. Antipathies, indeed, survived, and even in the 16th century called each other Roman or Langobard as terms of reproach. But the altered name of Lombard also denoted henceforth some of the proudest of Italians; and, though the Lombard speech had utterly perished, their most common names still kept up the remembrance that their fathers had come from beyond the Alps.

But the establishment of the Frank kingdom, and still more the re-establishment of the Christian empire as the source of law and jurisdiction in Christendom, had momentous influence on the history of the Italianised Lombards. The empire was the counterweight to the local tyrannies into which the local authorities established by the empire itself, the feudal powers, judicial and military, necessary for the purposes of government, invariably tended to degenerate. When they became intolerable, from the empire were sought the exemptions, privileges, immunities from that local authority, which, autocratic and anarchical as they were in theory, yet in fact were the foundations of all the liberties of the Middle Ages in the Swiss cantons, in the free towns of Germany and the Low Countries, in the Lombard cities of Italy. Italy was and ever has been a land of cities, and, ever since the downfall of Rome and the decay of the municipal system, the bishops of the cities had really been at the head of the peaceful and industrial part of their population, and were a natural refuge for the oppressed, and sometimes for the mischievous and the evil doers, from the military and civil power of the duke or count or judge, too often a rule of cruelty or fraud. Under the Carolingian empire, a vast system grew up in the North Italian cities of episcopal "immunities," by which a city with its surrounding district was removed, more or less completely, from the jurisdiction of the ordinary authority, military or civil, and placed under that of the bishop. These "immunities" led to the temporal sovereignty of the bishops; under it the spirit of liberty grew more readily than under the military chief. Municipal organization, never quite forgotten, naturally revived under new forms, and with its "consuls" at the head of the citizens, with its "arts" and "crafts" and "guilds," grew up secure under the shadow of the

church. In due time the city populations, free from the feudal yoke, and safe within the walls which in many instances the bishops had built for them, became impatient also of the bishop's government. The cities which the bishops had made thus independent of the dukes and counts next sought to be free from the bishops; in due time they too gained their charters of privilege and liberty. Left to take care of themselves, islands in a sea of turbulence, they grew in the sense of self-reliance and independence; they grew also to be aggressive, quarrelsome, and ambitious. Thus, by the 11th century, the Lombard cities had become "communes," communalities, republics, managing their own affairs, and ready for attack or defence. Milan had recovered its greatness, ecclesiastically as well as politically, it scarcely bowed to Rome, and it aspired to the position of a sovereign city, mistress over its neighbours. At length, in the 12th century, the inevitable conflict came between the republicanism of the Lombard cities and the German feudalism which still claimed their allegiance in the name of the empire. Leagues and counter-leagues were formed; and a confederacy of cities, with Milan at its head, challenged the strength of Germany under one of its sternest emperors, Frederick Barbarossa. The struggle was terrible. At first Frederick was victorious; Milan, except its churches, was utterly destroyed; everything that marked municipal independence was abolished in the "rebel" cities; and they had to receive an imperial magistrate instead of their own (1158-62). But the Lombard league was again formed. Milan was rebuilt, with the help even of its jealous rivals, and at Legnano (1176) Frederick was utterly defeated. The Lombard cities had regained their independence; and at the peace of Constance (1183) Frederick found himself compelled to confirm it.

From the peace of Constance the history of the Lombards is merely part of the history of Italy. Their cities were the ordinary form of most Italian cities. They quarrelled and fought with one another. They took opposite sides in the great strife of the time between pope and emperor, and were Guelph and Ghibelline by old tradition, or as one or other faction prevailed in them. They swayed backwards and forwards between the power of the people and the power of the few, but democracy and oligarchy passed sooner or later into the hands of a master who wielded his lordship under various titles, and generally at last into the hands of a family. Then, in the larger political struggles and changes of Europe, they were incorporated into a kingdom, or principality, or duchy, carved out to suit the interest of a foreigner, or to make a heritage for the nephew of a pope. But in two ways especially the energetic race which grew out of the fusion of Langobards and Italians between the 9th and the 12th centuries has left the memory of itself. In England, at least, the enterprising traders and bankers who found their way to the West, from the 13th to the 16th centuries, though they certainly did not all come from Lombardy, bore the name of Lombards. In the next place, the Lombards, or the Italian builders whom they employed or followed, the "masters of Cosmo," of whom so much is said in the early Lombard laws, introduced a manner of building, stately, solemn, and elastic, to which their name has been attached, and which gives a character of its own to some of the most interesting churches in Italy. (R. W. C.)

LOMBOK (called *Tanah Sasek* by the natives, and *Salaparan* or *Salaparang* by the Balinese, Lombok being properly the name only of a village on the north-east side), an island of the East Indian Archipelago, belonging to the Lesser Sunda group, and separated from Bali by the Strait of Lombok, from Sumbawa by the Strait of Alas. It stretches from about 116° 44' to 118° 40' E. long, and from 8° 12' to 9° 1' S. lat., and its area is estimated at 2080 square miles. Rising out of the sea with bold and often precipitous coasts, Lombok is mountainous towards the south, and in the north-east contains one of the principal volcanic summits of the whole archipelago—Rindjani or Peak of Lombok, 8688 feet according to Hornbough's measurement, 13,379 according to Melville de Carnbee, and 11,834 according to Smits. There is no active crater in

the island, but in 1815 it suffered severely from the eruption of Tombora on the neighbouring island of Sumbawa. Of the numerous streams by which it is watered none are navigable except by small boats; among the mountain lakes Segara Anak, lying some 9000 feet above the sea, is noteworthy in point of size. The best harbour is Ampanan (8° 34' 15" S. lat., 116° 3' 40" E. long.) on the west coast, often visited by European and American vessels; that of Labuhan Tring farther south is also good, but less frequented. Forest-clad mountains and stretches of thorny jungle alternating with rich alluvial plains, cultivated like gardens under an ancient and elaborate system of irrigation, make the scenery of Lombok exceedingly attractive; and to the naturalist it is of particular interest as the frontier island of the Australian region, with its cockatoos and megapods or mound-builders, its peculiar bee-eaters and ground thrushes. Rice is the principal export; ponies, skins, ducks' eggs and other eggs, and edible nests, are also sent from the island. The rajah of Lombok (who has his capital at Mataram, a large village on the west coast, and his country seat at Gunung Sari) is tributary to the sultan of Bali and Lombok; he has possession of the whole island, which was formerly divided into the four states of Karang-Asam Lombok on the west side, Mataram in the north-west, Pagarawan in the south-west, and Pagutan in the east. Balinese supremacy dates from the conquest by Agong Dahuran in the beginning of the present century; the union under a single rajah dates from 1839. The population is variously estimated. The *Woordenboek van Ned. Ind.* (1869) gives about 405,000 souls; Dehm and Wagner conjecture 100,000 in 1880. The greater proportion are Sasaks, as the Mohammedanized native stock are called; but the dominant Balinese, who still retain their Buddhist creed, may amount to about a twentieth of the whole.

See Zollinger, in *Tijdschrift voor Ned. Ind.*, June, i. J. P. Fryx, in the *Tijdschr. v. Ind. land- en volkenkunde*, ix (8d series), Melville de Cernabé, in *Moniteur des Indes*, 1847; W. R. van Hoovel, *Reis over Java*, &c.; Wallace, *Malay Archipelago*.

LOMONOSOFF, MIKHAIL VASILIEVICH (1711-1765), was born in the year 1711, in the village of Denisovka (which in later times has had its name changed in honour of the poet), situated on an island not far from Kholmogor, in the government of Archangel. His father, a fisherman, took the boy as soon as he was ten years of age to assist him in the labours of his calling, but his eagerness for knowledge was unbounded. The few books accessible to him he almost learned by heart; and, seeing that there was no chance of his stock of knowledge being enlarged under the arctic skies of his native place, he resolved to betake himself to Moscow in the best way he could. An opportunity occurred when he was seventeen years of age, and by the intervention of friends he obtained admission into the Zaikonospasski school. There his progress was very rapid, especially in Latin, and in 1734 he was sent from Moscow together with other promising students to St Petersburg. There again his proficiency, especially in physical science, was remarked by all, and he was one of the young Russians chosen to complete their education in foreign countries. He accordingly commenced the study of metallurgy at Marburg; but, not content with his work under the professors, he now began to write poetry, imitating German authors, among whom he is said to have especially admired Günther. His *Ode on the Taking of Khotin from the Turks* was composed in 1739, and attracted a great deal of attention at St Petersburg. During his residence in Germany Lomonosoff married a native of the country, and found it difficult to maintain his increasing family on the scanty allowance granted to him by the St Petersburg Academy, which, moreover, was

irregularly sent. His circumstances became embarrassed, and he resolved to leave the country secretly, and to return home. On his arrival in Russia, after an adventure with a Prussian recruiting officer which at one time threatened serious consequences, he rapidly rose to distinction, and was made professor of chemistry in the university of St Petersburg, he ultimately became rector, and in 1764 secretary of state. He died in 1765.

The most valuable of the works of Lomonosoff are those relating to physical science, and he wrote upon many branches of it. His everywhere shows himself a man of the most varied learning. He compiled a Russian grammar, which long enjoyed popularity, and did much to improve the rhythm of Russian verse. Many of his poems are good, but they do not constitute his chief claim to be remembered. The school upon which he formed himself as a poet was a bad one. We must remember that these were the days of falsely-conceived classicism, and the French taste upon which all the literature of Europe was moulded. His great merit is that he belongs to the glorious band of patriots, which includes such men among Slavs as Dostoi Orlovich, Baich, and Piusius Trubetzkoy, — men whose object was to elevate and give dignity to their country, — earnest toilers in the field of national education.

LOMZA, or LOMŻA, a government of Russian Poland, is bounded on the N. by Prussia and the Polish government of Suwalki, on the E. by the Russian government of Grodno, on the S. by the Polish governments of Siedlec and Warsaw, and on the W. by that of Plock. It covers an area of 4670 square miles, or $\frac{1}{2}$ per cent. of all Poland. It is mostly flat or undulating, with a few tracts in the north and south-west, where the deeply-cut valleys give a hilly aspect to the country. Extensive marshes overspread it, especially on the banks of the Nareff, and in the east there are also good forests. Lomza is traversed by the Nareff, which flows from east to south-west, joining the Bóg in the south-western corner of the government. The Bóg flows along the southern border, joining the Vistula 20 miles below its junction with the Nareff. The inhabitants numbered 501,385 in 1872, the Poles constituting 76 per cent. of the population (or 35 per cent. when the Poles who are mixed with Lithuanians are included), the Jews 14½ per cent., and the Germans 2 per cent. Of this population 402,148 belonged in 1870 to the Catholic Church, 10,354 to the Protestant, and 1817 to the Greek and United Churches. In 1878 394,570 were peasants, while only 76,950 belonged to the citizen class, and 11,470 to the nobility (*szlachta*). In 1877 45 per cent. of the total area, or 1,366,000 acres, were under crops. Stock raising is carried on to some extent (197,900 cattle, 283,700 sheep, and 68,705 horses). The wood trade is an important branch of industry, but manufactures are very imperfectly developed, the total production in 1873 having been only some £110,000, or 1·5 per cent. of the total for Poland. Lomza produces some wooden wares, spirits, tobacco, and sugar. There is only one railway (between Grodno and Warsaw); the Bóg is navigable, but only wood is floated down the Nareff. The province is divided into eight districts, of which the chief towns are Lomza (13,860), Pultusk (7950), and Ostrolenka (6900) on the Nareff, Masowicz (2750), Ostrow (6300), Maków (6600), Kolno (4800), and Szczeczyn (4750). Tykocin (6400) and Nasielsk (6250), although not district towns, have lately acquired some importance.

LOMZA, capital of the above province, on the Nareff, 80 miles north-east from Warsaw, and 30 miles north from the Chizheff station of the railway between Warsaw and Grodno, had a population in 1872 of 13,860.

Lomza is an old town, one of its churches having been erected before the year 1000. In the 16th century it was carried on a bridge with Lithuania and Prussia. It was well fortified and had two citadels, but nevertheless had often to suffer from the invasions of Germans and Tartars, and in the 17th century it was twice plundered by the Cossacks of the Ukraine. In 1796 it fell under the dominion of Prussia, and after the peace of Tilsit it came under Russian rule.

L O N D O N

Plates
IX, X.

LONDON, the metropolis of England, and the chief town of the British empire, is situated on both banks of the river Thames, about 60 miles from its mouth, St Paul's Cathedral being in $51^{\circ} 30' 45''$ N. lat and $0^{\circ} 8' 48''$ W. long. This old City of London is wholly included in the county of Middlesex, but the town beyond the City limits extends into portions of three other counties—namely, Surrey and Kent on the south, and Essex on the east. The area and population of the various governmental divisions of London are given below (pp 821, 822).

Geology

STR.—A great part of London is built on sands and gravels belonging to the Drift period, marking the ancient bed of a much larger river than the present Thames. This formation, resting immediately on the London Clay, extends along both banks of the present river, with an average breadth of about 2 miles; but in some parts there is immediately adjoining the banks a considerable breadth of alluvial deposits, or occasionally of artificially constructed embankments. On the north bank the alluvial soil comprehends the greater part of Westminster, on the south bank it stretches east from Lambeth Bridge, gradually widening to a breadth of about half a mile, and from Southwark to Deptford occupying a still wider area. The sands and gravels again occur at Greenwich Hospital, but are succeeded by the Greenwich and Woolwich marshes. The Isle of Dogs opposite Greenwich is constructed wholly of artificial embankments, and at one time the area it now occupies formed part of the mouth of the Lea, along whose banks the alluvial formation runs northwards between Bow and Stratford to Stoke Newington, widening to a considerable area at the marshes of West Ham and Plaistow. At Farnham, Battersea Park, Chapside, Victoria Park, and to the south of Stoke Newington, there are considerable areas occupied by brick earth. The London Clay crops to the surface throughout the whole of north-west London, with the exception of a small portion to the south of Regent's Park, which is encroached upon by the sands and gravels, and the summits of Hampstead and Highgate, which are occupied by the silicious sands of the Bagshot series. In west London the Clay extends south to Kensington Gardens, and in north London it occupies part of Islington and the district north of Highbury and Stoke Newington. South of the Thames it encroaches regularly on Wandsworth, Clapham, Camberwell, and Deptford, and comprehends nearly all the district round Sydenham. The Lower Tertiaries are represented by the Thanet sands at Greenwich and in the neighbourhood of Deptford, by the Woolwich and Reading beds, which occur at Camberwell, Dulwich, and Lewisham, and by the Blackheath beds, which are best seen at Blackheath. Chalk, the basement rock of the London basin, and the source of the water supply for the deep wells, only crops to the surface in the neighbourhood of Greenwich.

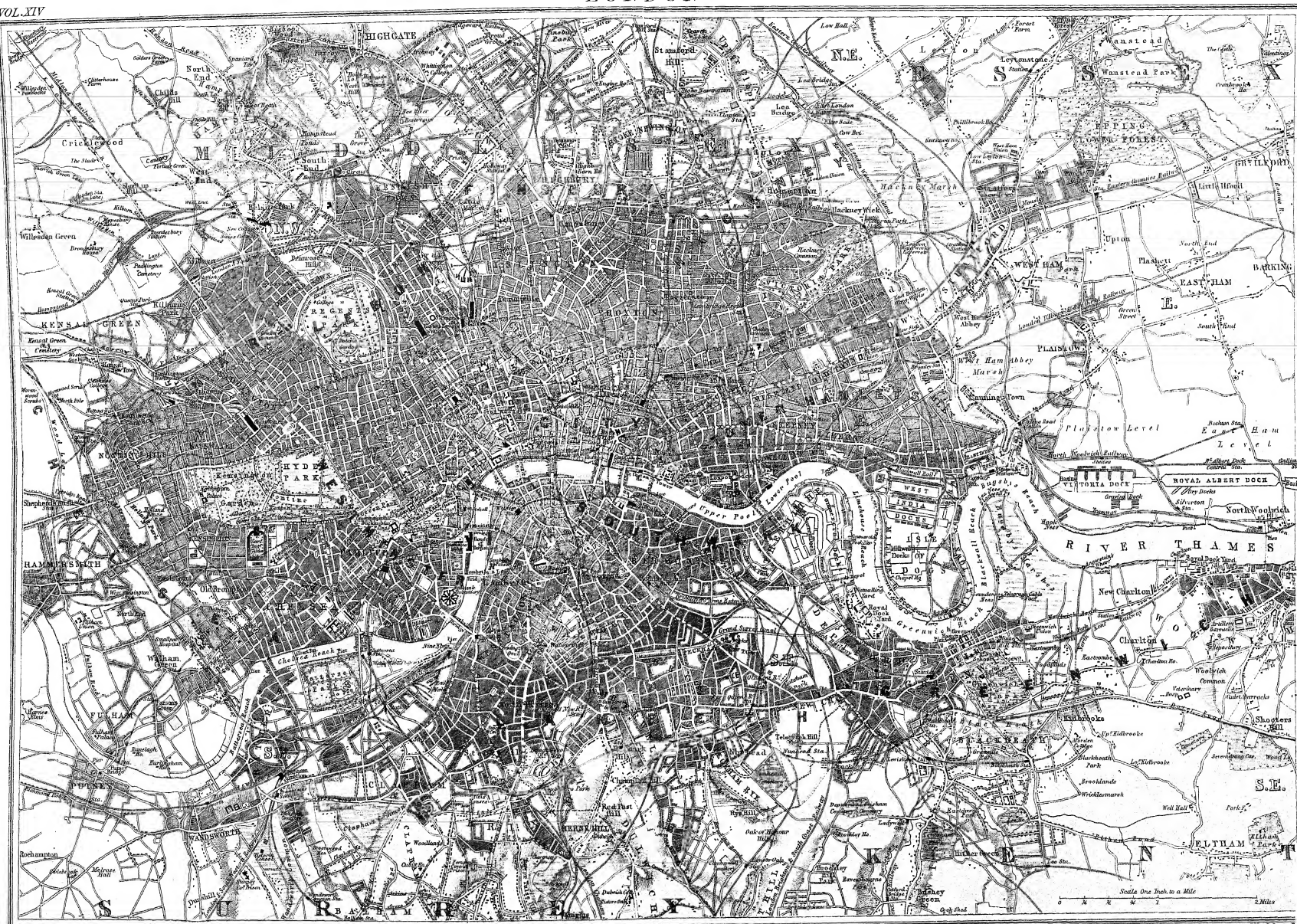
Surface

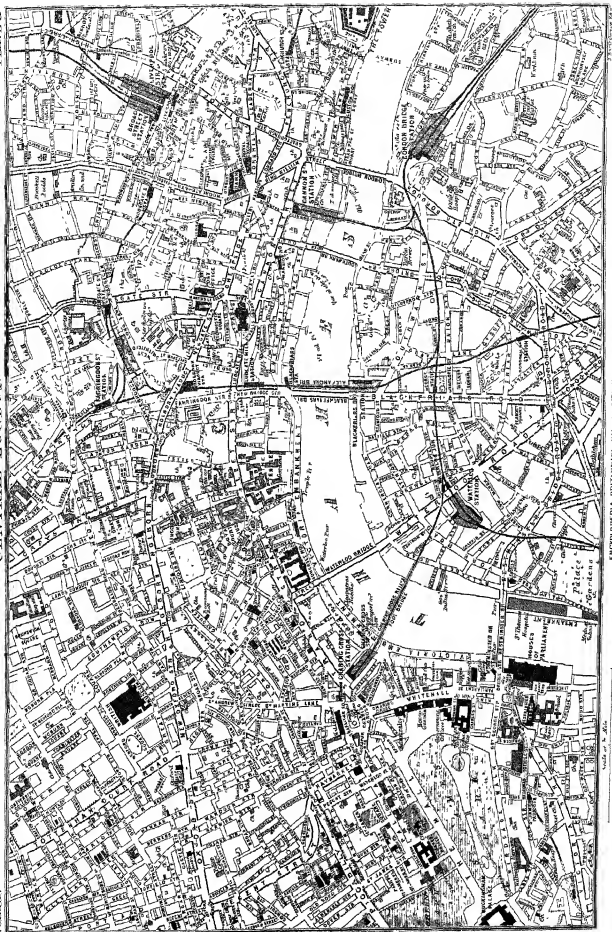
The original surface of the soil of London has been much altered in the course of generations, the depth of made earth being often very great. At one period the Thames flowed straight from Lambeth to Limehouse, and the greater part of the district now stretching south and east of the river to the range of heights in the neighbourhood of Sydenham and Greenwich was occupied by marshes or shallow lagoons. North of the Thames the greater part of London is built on several ranges of small eminences lying between the river and the northern heights of Hampstead (430 feet), Highgate, and Hornsey. The original city clustered round the eminence now crowned by St Paul's, and formerly intersected by the ravine of the Walbrook.

To the north and east it was bounded by an extensive fen, from which Finsbury takes its name. To the west was the Fleet river, which flowed from Hampstead in a southeasterly direction to King's Cross, and then more southerly to Clerkenwell, where on account of the steepness of its banks it received the name of Holbourne or Hollowburn. It was navigable to King's Cross, and for a long period formed a convenient and well-protected harbour for the city. A more extended elevation, included in the district now occupied by the Inns of Court, Bloomsbury, and Soho, was bounded on the west by the Tyburn, which rose near the Swiss Cottage and, after an easterly course till reaching the present Regent's Park, flowed southwards nearly in the line of Marylebone Lane and Bond Street. Tyburn Hill was bounded on the west by the Westbourne; and to the south and west an extensive range of low ground, now included in Westminster, Pimlico, Chelsea, and Kensington, was in early times for the most part covered by water. Westwards the low ground is bounded by Notting Hill, whence an elevated region lying between the smaller eminences and the "northern heights," and including Primrose Hill, runs in a north-westerly direction to Camden Town, Islington, and Highbury. The hilly regions in the neighbourhood of Kensington and Notting Hill formed part of an extensive forest, and St John's Wood was originally a dense thicket.

GOVERNMENT AND ADMINISTRATION.—At first the *Admna* municipal constitution of London was loose and disjointed *history.*

in its form, resembling that of the shire rather than the town, but even from the time of Henry I. the independence of its jurisdiction was complete, and the citizens, besides the right of inheritance and tenure not then possessed by the rest of England, enjoyed exemption from the Danegeld and from similar obligations. By the 13th century the later form of the municipality was already shaped in its main features, although at this stage residence in the borough and not membership in a trade guild was the basis of citizenship. This in some respects premature development of municipal functions has always given to London a peculiar and unique position in respect of municipal government. Its charters, which in early times served as the model for charters to new incorporations, have defied the attacks of reform. The system of government was more heterogeneous and complicated than that of other English towns. London is practically a borough by prescription, and its special rights and privileges have made those who possess them distrustful of change. The mere extent of the new city surrounding the old, and the rapidity of its growth, have also tended to postpone the attempt to grapple with the problem of its government. Until 1855, when the Metropolitan Board of Works was formed, the whole administration of the metropolis was of a mediæval character. The City was governed by old charters, confirmed but not interpreted by a special Act of William and Mary, and the various parishes of the rest of the metropolis had each its own peculiar system of administration, regulated by local Acts which differed widely in different localities. No direct change of vital importance was made in the constitution and functions of the City corporation by the Metropolitan Local Management Act of 1855, but the very existence of the Metropolitan Board implied a certain limitation of its authority, and the additional functions conferred by successive Acts on the Metropolitan Board have in some degree circumscribed its influence. As modified by the Act of 1855, the government of London within what is known as the metropolitan area consists of the City Corporation, the Metropolitan Board of Works, and thirty-eight





vestries and district boards; while various authorities, to be afterwards mentioned, exercise jurisdiction in special matters over the whole area of the metropolis or in separate localities.

The City of London, which is a county in itself, and with which the borough of Southwark is assimilated, is governed by a lord mayor, twenty-six aldermen, and two hundred and six common councilmen, forming a Court of Common Council. This court has a certain independent power to enact regulations for the government of the City, is entrusted with the management of the finances and the estates of the corporation, elects most of the officials, and controls the police. The City elects a sheriff of Middlesex as well as a sheriff of London; and the lord mayor is elected by the trade guilds in common hall from among the aldermen who have served as sheriffs. He is lord lieutenant within the City, the dispenser of its hospitality, the chairman of the courts of the corporation, and holds certain other offices, the dignity of which is now almost entirely nominal. The aldermen, who hold office for life, are chosen by the several wards, each ward electing one. Since 1867 the power of election has been enjoyed by all possessing the household and lodger franchise. The Court of Aldermen has the power of appointment to certain offices, exercises judicial functions in regard to licensing and in disputes connected with the ward elections, has some power of disposal over the City cash, and possesses magisterial control over the City, each alderman being a judge and magistrate for the whole City, and by virtue of his office exercising the functions of a justice of the peace. The common councillors were chosen originally in the reign of Edward I. as assistants to the aldermen, and in 1384 were constituted a standing committee to regulate the affairs of the City, each ward choosing four, six, or eight, according to its size. A gradual increase in their number took place until 1840, when it was fixed at two hundred and six.

From the time of Richard II. the election was vested in freemen householders, but it is now regulated by the Act of 1867. The Court of Common Hall, formerly the popular assembly or ancient *folk-mote*, is now composed of the lord mayor, four aldermen, and the liverymen of the city guilds, and nominates yearly two aldermen, who must previously have been sheriffs, for the Court of Aldermen to select one for the office of lord mayor. The sheriffs are themselves chosen by the Court of Common Hall, which also appoints the chamberlain, the bridge masters, and the city auditors.

The fragmentary and indirect participation in the government of London at present exercised by the livery companies represents the remnants of an influence which was paramount from the time of Edward III., when enactments were passed which made admission to the freedom of the city dependent on membership in a trade or mystery. Originally established to afford mutual aid to members of their "craft," the guilds of London gradually assumed a certain control over their trade or manufacture, and by the payment of large sums of money obtained various monopolies, with the power to make by-laws for the regulation of their craft. From gifts for charitable purposes, and from entrance money and fines, many of the guilds, on account of the rise in the value of property, have amassed enormous wealth. Within the limits of the City alone the gross annual rental of the land possessed by them is over £500,000, and it is believed that the land they possess outside its limits is of equal value. At one time their number was over one hundred, but they now number seventy-six, and some represent trades which are extinct. Twelve so-called "great companies" claim precedence over the others, but of these some are not so wealthy as a few of the less highly privileged. The "livery" or dress of the companies, first formally adopted

in the reign of Edward III., was ultimately worn only by a higher grade of the members called liverymen. The extension of London beyond the City limits and changes in trade maxims and in social life have now left them little more than the shadow of their former authority over trade and manufacture, but a few, such as the fishmongers, the stationers, the goldsmiths, and the apothecaries, still discharge certain functions in the regulation of their several crafts. Besides administering their charities, many of the companies contribute largely to benevolent objects of pressing need, and some take an interest in promoting technical instruction, and in various matters relating to their special trade or manufacture; but the business of most of them is now chiefly of a ceremonial kind. The halls of the companies number thirty-five, and many of them are of interest either from their architectural merits, their antiquarian associations, or the portraits or other objects they contain. Their annual assessed value is over £60,000. The hereditary connexion of the companies with the corporation, their large ownership of property in the City, and their control over so many charities still enable them to exercise a very great influence in municipal affairs.

The following list (Table I.) gives details regarding the twelve great companies, and six other companies which may be ranked next to them in importance—

Name	Date	Situation of Hall	Parishes of Freedom	Livery Admission
			£ s. d.	£ s. d.
<i>Great Companies</i>				
Barbers	1295	Chancery	4 11 0	38 10 0
Drapers	1304	Throgmorton Street	106 0 0	26 6 0
Goldsmiths	1307	Upper Thames Street	112 15 0	51 15 0
Goldsmiths	1327	Foster Lane	1 10 0	58 7 0
Skinner	1327	Dowgate Hill	94 0 0	80 8 0
Mercantile Tailors	1408	Thames Embankment	54 0 0	20 0 0
Haberdashers	1449	Gratham Street	110 1 8	45 0 0
Salters	1480	St. Martin's Lane	110 1 8	45 0 0
Ironmongers	1484	Foreburch Street	110 1 8	45 0 0
Vintners	1488	Upper Thames Street	110 1 8	45 0 0
Clockmakers	1580	Minding Lane	110 1 8	45 0 0
<i>Other Companies</i>				
Apothecaries	1615	Water Lane	105 0 0	28 0 0
Armourers	1659	Colman Street	118 25 0	28 9 8
Barbers	1659	Monkwell Street	60 0 0	40 8 8
Goldsmiths	1659	Gratham Street	60 0 0	40 8 8
Salters	1659	Chancery	60 0 0	40 8 8
Stationers	1659	Lodgate Hall	38 0 0	70 0 0

The corporation of the City of London still retains certain exceptional prerogatives. The lord mayor's court still exercises civil jurisdiction, the two courts of the sheriffs' compter survive in the City of London court, and the lord mayor exercises the functions of judge in the central criminal court, which superseded the court of oyer and terminer in 1834, and extends beyond the radius of the Metropolitan area. The corporation possesses the sole right to establish markets within 7 miles of the City; it enjoys a messuage of grain, partially commuted in 1872 to a fixed duty chargeable by weight, and applied to the preservation of Epping Forest and other open spaces; and it leases coal and wine duties, continued by various Acts, for defrayment of the cost of public improvements. Most of the work of the corporation is performed by committees; and "commissioners of sewers," under Act of Parliament, have charge of the cleaning, lighting, and paving of the streets.

A large portion of the City income is derived from rents, which City have increased from £24,458 in 1692 to £16,192 in 1785, £45,969 accounts in 1826, and £17,781 in 1851. In 1692 the City markets were farmed for £3100, the profits being about £2600; in 1785 their revenue was £15,681, and the profit £2621; in 1826 these were respectively £33,668 and £69,271; and in 1851 they were £159,816 and £20,611. The total revenue of the City in 1692 was £11,955, in 1785 £59,866, and in 1851 £294,688, not including the public and trust accounts, which are regulated by various Acts of Parliament. They include the Bridge-House estate account, the sewers rate, the Metropolitan Board of Works sewers rate, the police rate, the ward rate, and the duties on coal, wine, and grain. The total charge of the government establishment in 1692 was £2847, and in 1851 it was £51,855, not including £7556 spent in pensions of

Special
prerogatives
of the City
corporation

officials. In 1692 the lord mayor received an annual sum of £100 for his care of the market, and an annual fee of £80 out of the chamber. He has now an annual salary of £10,000, and in addition to this his personal expenses in 1881 amounted to £4438. The salaries of the recorder, the chamberlain, the common sergeant, the town-clerk, and some other officers have risen in a somewhat arbitrary proportion. The City in 1692 spent nothing on special acts of hospitality or on the promotion of literature, science, or art, while its contribution to the poor rates was only £66. It now spends several thousands annually on the reception of eminent persons, while to the London almonshouses it in 1881 contributed £1894, to general charitable purposes £3179, for education £3894, for technical instruction £2900, for the Guildhall library and museum £5898, and for music £3037. The debt of the corporation, which is solely connected with the construction of improvements and public markets, was on December 31, 1881, £5,456,150, the money spent for these purposes since 1769 being nearly £10,000,000. The rateable value of the City and liberties has since 1801 increased sevenfold, having risen from £507,572 to £3,585,484.

Corporation
buildings.

The Guildhall, rebuilt by Dance in 1789, contains the greater part of the walls of the old building of 1411, which was damaged by the fire of 1666, and also the crypt divided into three aisles by clustered columns of marble supporting a groined roof richly adorned with carvings. The principal front was restored in 1867 in the Gothic style. In addition to the great hall used for state banquets and receptions, the building contains the common council chamber, the aldermen's room, and several courts of justice. Adjoining the Guildhall is the free library of the corporation, and a museum of antiquities relating to the City. The Mansion House at the east end of the Poultry, erected in 1740 from the designs of Dance, is the official residence of the lord mayor. In addition to the justice room and various reception rooms, it contains the Egyptian hall, in which certain special banquets of the lord mayor are held.

Metropolitan
Board.

By the Metropolitan Local Management Act of 1855, the metropolis was divided into thirty-nine vestries or district boards, which elect the forty-five members who form the Metropolitan Board of Works, the city of London electing three members, each of the six great parishes of Islington, Marylebone, St Pancras, Lambeth, St George's (Hanover Square), and Shoreditch two members, and the other districts one each or one in combination. The board was originally established for the formation and maintenance of main sewers, but later Acts have made it the administrative authority of the metropolis in a great variety of other matters, including the construction of main thoroughfares, the carrying out of great metropolitan improvements, the formation of new streets, the construction and maintenance of parks, the preservation of commons and open spaces, the maintenance of the fire brigade, and the administration of certain enactments specially applicable to the metropolitan area. The total sum raised by the board for application to its various purposes since 1856 to 31st December 1881 was £28,689,749, and its net liability on the 31st December 1881 was £13,437,940. The capital required for the execution of great works is raised by the issue of stock bearing interest at the rate of 3½ and 3 per cent, which has the same facilities of transfer as the Government stocks, and is redeemable in sixty years from creation. The rate per pound levied by the board has varied very greatly, being 2.09d. in 1856, and as high as 6.99d. in 1867, while for 1883 it is estimated at 8.2d. The total net charge in 1880 was £662,213, and for 1882 it is estimated at £718,822. The rateable annual value of property in the metropolis has risen from £11,283,663 in 1856 to £27,386,086 in 1882.

Vestries.

The vestries and district boards are entrusted with the management of local sewers, the lighting, paving, and cleaning of their own thoroughfares, and the removal of nuisances. For paving, except in the old main thoroughfares, they have power to charge adjoining properties, and in several districts a small income is obtained from

realized property. The total amount of money advanced to them on loan by the Board of Works up to 31st November 1881 was £3,631,769, of which £3,297,480 was redeemable by 1929, and £334,338 by 1941.

The School Board of London has in regard to education other a rating and legislative authority over a district corresponding with that of the Metropolitan Board of Works. The metropolitan police force outside the City limits and within a radius of 12 miles of Charing Cross is under the control of the Home Secretary. The Tower of London is governed by the constable of the Tower, assisted by fifty magistrates, and the borough of Westminster is still under the nominal care of the dean and burgesses. The Metropolitan Asylums Board, the Burial Board, the Thames Conservancy Board, and the Lea Conservancy Board constitute the principal other direct governing authorities having relation to London, but the water and gas companies enjoy monopolies which imply a certain degree of irresponsible authority, and a right of taxation not sufficiently defined and limited. Within an area less than the district of the Board of Works there are ten parliamentary boroughs, which return in all twenty-two members, the City returning four members, and Southwark (from 1296), Westminster (1847), Marylebone (1832), Finsbury (1832), Tower Hamlets (1832), Greenwich (1832, extended in 1869), Lambeth (1832), Hackney, (1868), and Chelsea (1868) two each. London University (1868) returns one member.

GROWTH AND POPULATION.—For some centuries after Growth.

the Conquest there are almost no data for an estimate of the extent and population of London, but a great impulse was given to its increase by the settlement of Normans and the opening up of intercourse with the Continent. The statement of Fitzstephen that it furnished, in the reign of Stephen, 60,000 men-at-arms and 20,000 knights cannot be accepted as applying only to the City. Peter of Blois, under Henry II., only estimated its numbers at 40,000, although he may possibly have referred only to adults (*Opera*, ed. Giles, vol. ii. p. 85). In any case, previous to the great plague of 1349 it must have numbered at least 90,000, for in that year, according to Stow, as many as 50,000 persons were buried in the cemetery of Spitalrook, specially consecrated for the purpose. There were severe ravages from the same cause in 1361 and 1389, and the calculation of Chalmers (*Comparative Estimate of Great Britain*, 1802), founded on the Subsidy Rolls of 1377, shows a population of only 34,971; but the emperor Manuel II., who visited it in 1400, states that it was to be preferred to every city of the West for population, opulence, and luxury (Macpherson, *Annals of Commerce*, vol. i. p. 611). Notwithstanding the regulations of Elizabeth for checking its growth, London had by the end of the century advanced considerably beyond its old boundaries. Giovanni Botero, writing about 1590, classes it with Naples, Lisbon, Prague, and Ghent as possessing about 160,000 inhabitants more or less, while Paris was said to possess over 400,000 inhabitants. The "Bills of Mortality," which were begun in 1592, were in 1604 extended to St Bartholomew the Great, Bridewell Precinct, and Trinity in the Minories, which were partly within the City liberties, and to St Clements Danes, St Giles-in-the-Fields, St James (Clerkenwell), St Catherine (Tower), St Leonard (Shoreditch), St Mary in Whitechapel, St Martin-in-the-Fields, and St Mary Magdalen (Bermondsey). St Mary at the Savoy was added in 1606, and Westminster in 1626. The parishes of Hackney, Islington, Lambeth, Newington, Rotherhithe, and Stepney, which were included in 1636, were, according to Grant (*Observations on the Bills of Mortality*, 1676), still country villages in 1672, and indeed occupied an isolated position up to the middle of the 18th century. The result of the census of the

city taken in 1631 is given by Graunt as 130,178, but the sum of his details is 130,268. By 1661 he reckoned it to have increased to 179,000. He also concluded that the population within the limits of the "Bills of Mortality" was 460,000, and that from the beginning of the century it had increased from 2 to 5. The population of London and its suburbs, excluding Westminster and the distant parishes, he placed at 384,000, or about a fourth less than Paris. Notwithstanding the plague of 1665 and the fire of 1666, London towards the close of the 17th century increased with great rapidity. Evelyn, writing in 1684, states that it had nearly doubled within his own recollection. Sir William Petty, in his *Essay on Political Arithmetic*, estimated the population in 1683, including that of Westminster and Southwark, at 696,000, but Gregory King, in his *Observations on the State of England*, first published by Chalmers, allowing $\frac{1}{3}$ persons to every house, makes it in 1694, within the limits of the "Bills of Mortality," only 530,000. From about this period London superseded Paris as the largest city in Europe. During the first half of the 18th century its progress was fluctuating, but on the peace of 1763 a great impulse was given to its prosperity, and after 1780 a rapid rate of progress commenced, which still shows no signs of diminution. Until 1756 there was sufficient space for the Mayfair east of Hyde Park, but by the end of the century the aristocracy had nearly all migrated west from Covent Garden and Soho. Islington was still almost disjoined from the metropolis, but the great eastern suburbs had become so consolidated as almost to absorb even Hoxton, Bethnal Green, and Stepney. The first census of 1801 included St Pancras, Marylebone, Paddington, Kensington, and Chelsea, but Chelsea was still a solitary suburban retreat, Kensington was little more than "the old court suburb," Paddington and Westbourne were rural hamlets, and Marylebone and St Pancras had less than one-fourth of their present population. The populous city surrounding Regent's Park had scarcely any existence before 1820, but by 1830 it as well as Somers Town had become absorbed in the metropolis, especially by additions in the neighbourhood of St Pancras church and London university. Eastwards the most rapid extension had been in the direction of Greenwich, which was now united with Lambeth by a continuous line of houses. Belgravia in the south-west, and Tyburnia to the north of Hyde Park are chiefly the product of the next twenty years. Since that period the suburban districts have in all directions become almost consolidated, and beyond the present limits

of the registrar-general fringes of houses, extending in some instances outside even the 12 miles circuit from Charing Cross, connect the metropolis with populous towns which a few years ago were solitary hamlets. Within the last twenty years the rate of increase of the outer ring of this greater London has been 126·8 per cent, while that of London proper has been only 36·0, its outer ring showing an increase of 63·8 per cent, but its central area a decrease of 13·2,—the decrease in the City being 54·3, in the Strand 30·5, St Giles 16·3, Holborn 9·5, Westminster 11·9, St George's (Hanover Square) and Marylebone 4·1, and in the eastern central districts of Whitechapel, St George-in-the-East, and Shore-ditch 9·3, 3·8, and 2·2 respectively. In these latter districts the decrease has been occasioned chiefly by improvements, but in the central business districts it is almost entirely the result of the substitution of business premises for dwelling-houses. The day census of the City taken in 1866 shows that the number of persons employed daily within its limits was 170,133, and that of 1881 gives a day population of 261,061, while the night population in 1871 was 74,897 and in 1881 only 50,526. The rapidity of the growth of London is largely due to the peculiar development of its trade and commerce, and is also closely connected with the interest excited by politics and the meetings of parliament. The bonds of connexion between London and England thus pulsate daily with a manifold vitality. London is the emporium of England, the centre of its great monetary transactions, the home of its science, literature, and art, and the yearly resort of its aristocratic and landed proprietor classes. Since the beginning of the century its rate of increase has exceeded that of England generally.

The proportion of inhabitants born outside its limits amounts to Nation-one-third of its entire population. The number of the natives of European states is in excess of those born in Scotland, and that of the natives of Ireland is about double, while the natives of the counties of England and Wales amount to more than a million. Inhabited by descent may be estimated at about 360,000 persons, Scots 120,000, foreigners 200,000, viz. Austrians, Germans, and Americans together 48,000, Europeans 166,000 (Germans 60,000, French 80,000, Dutch 16,000, Poles 12,000, Italians 7,500, Swiss 5,000). The number of Jews is about 40,000. The special foreign district of London is that of Soho; another foreign district lies in the neighbourhood of Ratcliff Highway, near St George Street. The lower-class Jews inhabit the neighbourhood of Houndsditch and Aldgate. The Italian street musicians and vendors of ice form a small colony near Hatton Garden.

Table II shows the percentage of the population of London to Tables of the rest of England, the numbers before 1801 being only approximate; Table III. the areas, houses, and population of London in round.

TABLE II.

	1800.	1800.	1850.	1870.	1881.	1881.	1881.	1881.	1881.
Population	80,000	180,000	360,000	480,000	600,000	654,085	1,227,000	1,879,365	2,895,985
Percentage to England	3·40	8·27	6·58	9·16	10·90	12·52	19·32	21·58	33·19

TABLE III.

	Area ¹ in Acres	1861.			1871.			1881.			
		Inhabited Houses	Popula- tion	Persons to an Acre	Inhabited Houses	Popula- tion	Males.	Females.	Inhabited Houses	Popula- tion	Persons to an Acre
London Police District, "Greater London", Registration London,	441,287	484,350	5,222,120	7	325,794	3,884,941	1,619,839	2,265,102	646,810	4,704,813	11
London under the Board of Works and School Board,	71,303	300,451	2,608,589	37	417,707	1,940,161	1,030,161	909,744	408,982	2,816,071	61
Parliamentary Borough District— City of London	71,480	880,048	2,813,802	37	416,648	3,304,887	1,638,819	1,706,068	408,982	3,882,441	62
Borough of Chelsea	7,098	12,296	112,603	168	8,206	54,937	31,420	23,518	5,438	50,498	76
" Islington	6,147	44,368	399,844	65	7,243	30,920	119,216	55,934	63,282	306,616	62
" Greenwich	5,841	109,603	808,488	138	61,218	469,044	229,090	239,954	103,130	628,480	109
" Hackney	4,700	48,299	482,999	102	56,078	190,001	88,680	101,321	34,043	204,631	24
" Lambeth	5,848	122,603	1,171,420	100	67,149	377,429	195,085	182,344	68,968	445,388	77
" Marylebone	4,088	46,299	468,299	80	64,961	270,048	177,189	202,859	39,322	498,957	98
" Southwark	4,088	46,000	468,000	80	63,290	477,822	311,710	166,112	55,668	498,811	99
" Ten Town Hamlets	4,087	108,688	1,086,888	97	56,656	298,735	154,020	144,715	27,397	326,188	111
" Westminster	2,568	26,480	266,356	59	20,394	346,006	216,839	129,167	61,123	325,832	70
Total of Parliamentary Borough District	46,841	894,318	2,660,353	25	807,865	3,000,071	1,470,378	1,500,098	432,264	1,492,500	75

¹ Exclusive of areas under Thames.

various governmental divisions; and Table IV, the population of the several registration districts at different periods from 1801.

Streets.

STREETS, BRIDGES, &c.—By the non-adoption of Wren's plans the opportunity afforded through the great fire was for ever lost of constructing a model capital, and within the City limits the streets are still in many cases confused and intricate. The total absence of plan in the construction of the nucleus of London has doubtless tended to aggravate the confusion outside the old boundaries. The growth of the immense new outer city was, moreover, for centuries totally unregulated by the control of any central authority. The principal lines of streets formed along the old public highways are insufficient as main lines of communication for the increased population, and the absence of direct connexion between important points causes traffic to be enormously impeded. The longest line of street communication in London is that which is formed by the junction of the lines of the Edgeware and Uxbridge Roads at the Marble Arch, whence it extends eastward by Oxford Street, Holborn, Newgate Street, Chapside and other important City streets, Whitechapel Road, and Mile End Road to Bow. At Chapside a branch from it runs westward by Fleet Street, the Strand, Haymarket, Piccadilly, and Knightsbridge to Kensington. Much of the effect of the fine architecture of the City streets is totally lost from promiscuous crowding, and the main connecting streets between the City and the West End display, at certain parts, much meanness and incongruity. Regent Street, the most fashionable thoroughfare of London, possesses ample width, and the splendour of its shops to some extent atones for the plain monotony of its regular architecture. In Oxford Street, which ranks next to it in importance, many buildings of a more ornamental character have lately been erected. Piccadilly, the eastern half of which is occupied chiefly by shops, and the western by dwelling houses and clubs, is a medley of every species of architecture, but is to some extent effective from the variety of its contrasts, and its outlook to the Green Park.

Travellers Square, with its fountain, its Nelson column, its statues, and its wide expanse, has an airy and pleasant effect, but the huge erections which surround it are a very miscellaneous group, and few of them are worthy of the site. The clubs and hotels in Pall Mall and its neighbourhood represent every variety of Grecian and Italian architecture. The private houses in the more fashionable regions are not remarkable for external beauty, but in summer time flowers and foliage give the West End squares and terraces a bright and pleasant aspect. A special characteristic of London is the enormous space covered by the suburban cottages and villas of the middle classes. Close to the most fashionable regions there are many mean back streets tenanted by workmen, but the principal territories of the working classes are comprehended in the dense and dreary districts east and south-east of the City. The improvements lately carried out in the City and other central districts, and the substitution of business premises for dwelling houses, have compelled large numbers of these classes to live at a long distance from their work, and also caused undue crowding in the less remote regions. The running of workmen's trains from the suburbs and the efforts of various private building associations and of the Metropolitan Board, guided by the Artisan and Labourers' Dwellings Improvement Act, have only partially mitigated these evils.

Since 1785 the greater part of London within the City Street limits has been rebuilt, and its streets have been much improved. The principal improvements being the reconstruction of the lines from London Bridge to Finsbury Pavement, and from Blackfriars Bridge to Farringdon Road, both intersecting the City from north to south; the rebuilding of Bartholomew Lane, Lothbury, Threadneedle Street, and Cannon Street from King William Street to St Paul's; and the construction, in conjunction with the Metropolitan Board, of the Holborn Viaduct and of Queen Victoria Street from Blackfriars Bridge to the Mansion House. The Metropolitan Board now exercises a certain

TABLE IV

	Area in Acres.	1801		1841		1851		1871		1881	
		Population	Persons to an Acre	Population	Persons to an Acre	Population	Persons to an Acre	Population	Persons to an Acre	Population	Persons to an Acre
City of London within the walls	880	98,230	112	144,226	164	144,400	164	212,002	241	212,002	241
City of London within and without the walls	608	128,002	210	128,002	210	128,002	210	128,002	210	128,002	210
London City and Westminster	5,207	281,441	54	340,805	65	340,805	65	340,805	65	340,805	65
London City, Westminster, and Southwark	5,518	348,170	63	445,961	81	445,961	81	445,961	81	445,961	81
London within the old "Bills"	31,657	716,283	23	1,338,346	42	1,777,453	56	2,947,029	93	2,947,029	93
St. James's, St. Giles, St. Martin's	15	15,000	1,000	15,000	1,000	15,000	1,000	15,000	1,000	15,000	1,000
Regent Street	1,190	8,600	7	8,600	7	8,600	7	8,600	7	8,600	7
St. Marylebone	1,400	42,000	30	42,000	30	42,000	30	42,000	30	42,000	30
Finsbury	1,261	1,261	1	1,261	1	1,261	1	1,261	1	1,261	1
St. Pancras	2,672	91,772	34	120,768	45	120,768	45	120,768	45	120,768	45
Limits of Registrar-General, 1801	10,002	864,008	87	1,718,468	172	2,307,732	231	3,616,420	362	3,616,420	362
Hammerhead	2,267	4,000	2	18,400	8	18,400	8	18,400	8	18,400	8
Fulham	1,716	4,000	2	18,400	8	18,400	8	18,400	8	18,400	8
St. Mary, Stoke Newington	638	2,400	4	4,000	7	4,000	7	4,000	7	4,000	7
St. Mary, Strand-on-the-Bow	603	2,100	3	4,200	7	4,200	7	4,200	7	4,200	7
Brentford	1,078	1,000	1	1,000	1	1,000	1	1,000	1	1,000	1
Uxbridge	4,600	2,000	4	8,000	2	8,000	2	8,000	2	8,000	2
Greenwich district	1,174	11,500	10	18,100	15	18,100	15	18,100	15	18,100	15
St. Nicholas, Deptford	111	6,000	54	6,000	54	6,000	54	6,000	54	6,000	54
St. Nicholas, Deptford	1,741	14,800	8	20,500	12	20,500	12	20,500	12	20,500	12
St. Nicholas, Deptford	1,190	8,000	7	20,768	18	20,768	18	20,768	18	20,768	18
Limits of Registrar-General, 1850-51	44,816	928,316	21	1,873,942	42	2,668,728	59	3,007,838	67	3,007,838	67
Clapham	1,137	4,000	3	12,100	11	12,100	11	12,100	11	12,100	11
Baker Street	2,308	2,308	1	6,617	3	19,000	8	24,010	10	177,248	40
Wandsworth	5,420	4,400	8	7,414	14	18,340	34	18,340	34	26,036	51
Fulham	2,266	2,266	1	1,000	4	1,000	4	1,000	4	1,000	4
Tooting	866	1,100	1	2,340	3	2,340	3	2,340	3	2,340	3
Streatham	5,614	2,307	4	8,994	2	8,994	2	8,994	2	8,994	2
Limits of Registrar-General, 1864-65	68,264	946,464	14	1,913,220	28	2,712,120	39	3,120,880	46	3,120,880	46
Hampton	4,000	4,000	1	10,000	2	10,000	2	10,000	2	10,000	2
Charlton-upon-Woolwich	1,288	747	6	2,400	2	2,400	2	2,400	2	2,400	2
Finchley	2,308	1,100	2	2,418	1	2,418	1	2,418	1	2,418	1
Levensham, Eitham, Lee, Lewisham villages, Sydenham	73,185	6,145	8	17,648	2	17,648	2	17,648	2	17,648	2
Police on duty, 1841				8,000							
London within Tables of Mortality, 1851	76,909	989,860	13	1,840,417	24	2,800,960	36	3,204,900	42	3,204,900	42

control over the formation of new streets, but its powers are hampered by previous circumstances and by various restrictions. The principal new thoroughfares opened up by the board, besides Queen Victoria Street and the Holborn Viaduct, are Garsick Street, Covent Garden (1861), Southwark Street (1864), Northumberland Avenue (1876), and Theobald's Road and Clerkenwell Road, begun in 1873 to connect Oxford Street and Old Street. They have also effected extensive improvements in the neighbourhood of Whitechapel, Shoreditch, Park Lane, and Kensington. The more important schemes in contemplation are a new street from Tottenham Court Road to Charing Cross, another from Oxford Street to Piccadilly Circus, the widening of Coventry Street, of Gray's Inn Road, and of Tooley Street, and alterations of a less extensive character at Kentish Town, Hackney, and Camberwell. A scheme has been put forth by Government to relieve the pressure at Hyde Park Corner. Altogether up to 31st December 1881 the board have expended in street improvements £6,531,856, of which probably one-third will be defrayed by sales of property. In addition to this over £4,000,000 have been spent on the Thames Embankment and Queen Victoria Street, and the board have contributed about £296,077 to defray local improvements by district boards and vestries, as well as £1,360,500 for artisans' dwellings.

Thames
Embank-
ment.

The Thames Embankment, with its marine wall of large granite blocks facing the river, supports on the north side a spacious thoroughfare which forms one of the finest promenades in London. The total cost of the various portions of the embankment was over £3,000,000, the greater part of which is being defrayed by the coal and wine duties levied by the City corporation. By the construction (1864-70) of that portion known as the Victoria Embankment, stretching from Blackfriars Bridge to Westminster, about 37 acres of land have been reclaimed, of which 19 are occupied by carriage and footways, 7½ have been conveyed to adjoining proprietors, and about 8 have been formed into ornamental grounds. The Albert Embankment (1865-68), stretching on the south side of the river from Westminster Bridge to Vauxhall Bridge, includes about 9 acres, which are now chiefly occupied by St Thomas's Hospital. The Chelsea Embankment (1871-74), which is the extension of one previously constructed between Vauxhall Bridge and Chelsea Hospital, involved the reclamation of about 9½ acres of ground, now occupied partly by a roadway 70 feet wide, and partly by a flower garden.

Bridges.

There are twelve bridges, other than railway bridges, over the Thames within the metropolitan area, the most easterly being London Bridge and the most westerly Hammersmith Bridge. Three of these, London Bridge, Southwark Bridge, and Blackfriars Bridge, are within the City area. New London Bridge, a noble structure by Rennie, was opened in 1831, having cost £1,458,511. As populous and busy commercial districts extend for several miles to the east of it on both sides of the Thames, it is not only totally inadequate for the requirements of traffic, but is also removed beyond many convenient lines of communication. On this latter account the proposal to widen it—in itself a very unsatisfactory plan—has met with almost no support; but a bill promoted by the Metropolitan Board for erecting a high level bridge at the Tower failed also to commend itself to a committee of the House of Commons. Until 1769, when the Blackfriars Bridge was erected, London Bridge stood alone. Old Blackfriars Bridge was replaced in 1899 by the present one of five iron arches resting on granite, erected from the designs of Page at a cost of £230,000. Southwark Bridge, designed by Rennie, 1815-19, consists of three iron arches of great elegance resting on stone piers, and cost £280,000. Partly from

the unsuitability of its approaches, it has not proved of very much service.

The number of passengers and vehicles passing over the London and Blackfriars Bridges in a single day of 1833 is given in the July number of the *Monthly Review* for that year, and in 1881 similar information was obtained, in regard to the three bridges, for the traffic in the direction of the City. Multiplying these figures by two, we find that the foot passengers crossing London Bridge in 1833 numbered 48,440, while in 1881 they were 157,585, and that the number of vehicles had increased from 6183 to 21,466; the over Blackfriars Bridge the passengers had increased from 6108 to 87,134, and the vehicles from 4047 to 14,534, while 80,090 passengers and 3560 vehicles passed over Southwark Bridge, the increase in the number of passengers over the three bridges being thus 194,401, and of vehicles 26,831. At the earlier date Southwark Bridge was practically unused, but in 1856 the toll was abolished, and the bridge purchased by the corporation for £214,363. The Metropolitan Toll Bridges Act of 1877 required the Metropolitan Board to extinguish the tolls on all the Thames bridges and the bridge over Deptford Creek, and thereafter to repair and maintain them, the county authorities of Middlesex and Surrey paying each £1200 a year towards their maintenance. The bridges treated by the Act were the Charing Cross foot-bridge, for which £93,640 was paid to the South-Eastern Railway, Waterloo Bridge (1811-17), designed by Rennie in a style similar to London Bridge, constructed at a cost of £1,000,000, and purchased for £175,000; Lambeth Bridge (1802), built of iron at a cost of £240,000, and purchased for £26,049; Vauxhall Bridge (1811-16), similar in form to Southwark Bridge, erected for over £200,000, and purchased for £255,320; Chelsea Suspension Bridge (1858), designed by Page, erected by the Government for £23,000, purchased for £75,000; the Albert Suspension Bridge (1878) and Battersea Bridge, an old wooden structure, both purchased for £300,000; Wandsworth Bridge for £59,761; Putney Bridge (1728), a picturesque old timber structure, for £53,000, and Hammersmith Bridge for £112,550. Battersea and Putney bridges are about to be re-erected, and Deptford Creek Bridge is to be widened and improved at a cost of £180,000. The total amount of money spent by the board in connexion with bridges up to 18th December 1881 was £1,479,697. The amount to be paid by the board for their maintenance in 1882 is estimated at £26,502. The river is crossed by many railway bridges, and the Thames tunnel, begun in 1825 and completed in 1841 at a cost of £468,000, for the purpose of traffic, was purchased in 1856 by the Great Eastern Company, and is now used as a railway tunnel. A subway under the Thames from Tower Hill to Tooley Street was constructed in 1869 at a cost of £16,000. The communication in the neighbourhood of the river is greatly facilitated by the frequent passenger steamers.

The cleaning, watering, and paving of the streets are more satisfactory than might be expected from the fact that each district townships depends solely on its own local authority. Several Acts for paving of streets have been passed in the 14th century, and in the 15th century for the streets outside the City. In 1614 the custom began to pave the margins of the streets before their doors, but the middle of the streets were laid with large pebbles very unevenly. In 1661 the money obtained from hackney coach licences, 25 for each annually, was applied to keeping them in repair. The use of squared granite blocks, with raised footways, was introduced by Acts of Parliament for Westminster in 1761, and for London generally in 1766. Within the last twenty years asphalt and wooden pavement have been largely substituted for granite in the principal thoroughfares.

Hackney coaches are first mentioned in 1625, when they were conveyed at night, and numbered altogether only 30. In 1659 their number was limited to 300, in 1682 to 400, in 1694 to 700, in 1715 to 800, in 1771 to 1000, and in 1799 to 1200. In 1833 the restriction of their number was abolished. The number of cab drivers in 1671 was 10,048, and of cabs 7813, of which 616 were hackneys and 4528 four-wheelers, in 1831 the number of drivers was 12,930, and of cabs 9552, of which 6805 were hackneys and only 3547 four-wheelers. Omnibuses were first introduced in 1829. Many of the principal streets are too crowded for trams, but in South London trams are more used than omnibuses, and there are also several routes in the northern and eastern districts. The Metropolitan and Metropolitan District Railway lines, which run partly underground, and form almost a complete belt round the "inner circle" of London, with several branches interesting it, and others communicating with various suburban lines, have proved invaluable in relieving the throng of vehicles on the streets, and in affording rapid communication between important points; but the railway system in and around London has suffered greatly in directness from the absence of a complete plan embracing proper connecting links between the lines of the several districts, and the small number of passengers on the Metropolitan Railway is now about 60 millions. The Regent, Grand Junction, and several other canals, besides connecting London with the internal navigation of

England, supply a means of transport for heavy goods between various districts of the metropolis.

Postal districts.—London is divided into eight postal districts, viz., Eastern Central (E.C.), Western Central (W.C.), Northern (N.), North-Western (N.W.), Western (W.), South-Western (S.W.), South-Eastern (S.E.), and Eastern (E.). In the E.C. district there are twelve deliveries of letters daily, in the town portions of the other districts, which extend to about 5 miles from the General Post-Office, eleven deliveries, and in the suburban portions six deliveries.

OPEN SPACES.—London owes the possession of its finest parks rather to accident than to intention. Eastwards and northwards no effort was made to preserve any part of the "delightful plain of meadow land interspersed with flowing streams" mentioned by Fitzstephen, or of the "immense forest of densely wooded thickets," or of the "common fields" in the great fen, notwithstanding the riot of the citizens in the reign of Henry VIII. against the invasion of their rights by enclosure. Westward, however, the inroads of the builder were interrupted by the royal parks, which, lying adjacent to each other, cover an area of about 900 acres. St James's Park, 80 acres, transformed from a swamp into a deer park, bowling green, and tennis court by Henry VIII., extended and laid out as a pleasure ground by Charles II., and rearranged by Nash (1827-29), possesses beautiful combinations of water and foliage. Green Park, 70 acres, lying between St James's Park and Piccadilly, is unadorned except by rows of trees and by patterns of flowers bordering Piccadilly. Hyde Park, 350 acres, stretches westward from the district of Mayfair to Kensington Gardens. Originally forming part of the manor of Hyde, which was attached to Westminster Abbey, Hyde Park at the dissolution of the monasteries was taken possession of by Henry VIII. In 1652 the park, which then included a large portion of the ground now joined to Kensington Gardens and extended to 621 acres, was sold for £17,068, 6s. 8d., but in 1680 it was rebought by the Crown, having some time before this become the great " rendezvous of fashion and beauty." It possesses nine principal gateways, of which that at Hyde Park Corner on the south-east and the Marble Arch on the north-east present the most striking features. The former, designed by Decimus Burton and erected in 1828 at a cost of £17,000, consists of three imposing arches adorned with reliefs copied from the Elgin marbles. The Marble Arch, originally intended as a monument to Nelson, was first erected at a cost of £80,000 in front of Buckingham Palace, and was placed in its present position in 1861. With its fine expanse of grass, its bright flower beds and clumps of shrubbery, its noble old trees, its beautiful ornamental lake the Serpentine, its broad avenues crowded with equipages, its Rotten Row alive with equestrians, its walks lined with thousands of loungers of very various nationalities, professions, and grades of social position, Hyde Park in the height of the season presents a scene which in the brilliancy of its *tout ensemble* and its peculiarly mingled contrasts can probably be paralleled nowhere else. In the 17th and 18th centuries Hyde Park was a favourite meeting place for duellists, and in the present century has been frequently the scene of great political gatherings. To the west are Kensington Gardens, 360 acres, originally attached to Kensington Palace, and enlarged in the reign of George II. by the addition of nearly 300 acres taken from Hyde Park. They are more thickly planted than the "Park," and also contain an avenue of rare plants and shrubs, and several walks lined with flowering trees. Regent's Park in the north-west, 470 acres, occupying the site of Marylebone Park, which in the time of Elizabeth was used as a hunting ground, owes its preservation to the intention of George III. to erect within it a royal palace. It contains the gardens of the Zoological Society and of the Royal Botanic Society, as well as the grounds of a few private

villas. The northern half of the park is in summer devoted to cricket; in the south-east corner there is a flower garden of rather antique design; and in the south-west a portion bounded on the north by an artificial lake is let to private householders. To the north of Regent's Park there are other about 12 acres of open ground surrounding Primrose Hill, 230 feet, commanding an extensive view of London. Battersea Park, 180 acres, formed (1853-58) at a cost of £312,890, on the south side of the Thames, besides a fine promenade along the banks of the river, several walks and carriage drives bordered with parterres, and a wide expanse for cricket and other amusements, contains a subterranean garden, which during August and September possesses much of the witchery of an ideal fairy-land. East London, after the enclosure of Finsbury Fields, had no special recreation ground until the opening of Victoria Park, which was sanctioned by an Act of Parliament in 1842, and was in 1872 increased to about 300 acres. Finsbury Park, 115 acres, formed by the Metropolitan Board of Works from the grounds of Hornsey Wood House at a cost of £112,000; Southwark Park, Rotherhithe, 63 acres, formed at a cost of £111,000; West Ham Park in the extreme east, partly purchased by the City corporation, Greenwich Park (see GREENWICH); and the gardens on the Thames Embankment, with various squares and semi-private gardens, sum up the other ornamental open spaces of London.

The Metropolitan Board, under various Acts of Parlia- Public ment, have secured the exclusive right of the public in several commons and open spaces, which with the parks under their care comprise together an area of 1698 acres, giving with the royal parks and Battersea Park, Victoria Park, and West Ham Park a total of over 3000 acres, or about a twentieth-fifth part of the whole metropolitan area. The principal public commons are Hampstead Heath, a wildilly region now encroached on by buildings on all sides except the north and north-west, commanding fine views both of London and the country, and, with its clear bracing air and its unkempt and rugged beauty, breaking on the vision with all the effect of a sudden surprise, Bickhath Common, 267 acres, a bare sandy expanse to the south of Greenwich Park, containing a good golfing course, Clapham Common, 220 acres; Wormwood Scrubs, 194 acres; the Tooting Commons, 207 acres; and Plumstead Common, 110 acres. The total sum expended by the Board of Works in the purchase, preservation, and adornment of parks and open spaces up to 31st December 1881 was £436,760. All the parks and open spaces already mentioned are included in the Metropolitan Board district, but outside this area there is in the neighbourhood of London a large number of unencultivated spaces to which the public have various rights, some of them of an obscure and undefined character. A return made to the House of Commons in 1865 gives the area of public commons within radii of 25 miles and of 15 miles of the metropolis, the area of those within the smaller circuit being 13,301 acres. Of Epping Forest 5600 acres have been secured to the public by the corporation of the City, and in 1871 an Act was passed for the preservation of Putney Heath and Wimbledon Common, but Hounslow Heath, of old the favourite resort of highwaymen, and at one time over 4000 acres in extent, is now nearly all under cultivation. Richmond Park, the grounds of Hampton Court Palace, the gardens at Kew, the fine surroundings of the Crystal and Alexandra Palaces, the cricket grounds at the Oval and Lord's, may practically be also reckoned among the public parks of London. In addition to this the river Thames itself supplies facilities for recreation which are safe from the inroads of the builder; and all round the metropolis there are numerous footpaths through the open fields.

WATER SUPPLY.—For two centuries after the Conquest,

Water
supply

London obtained a sufficient supply of pure water partly from the rivers or streams which passed through it and partly from wells sunk into the sands above the chalk. Holywell, Clerk's Well (Clerkenwell), and St Clement's Well (near St Clement's Inn) are mentioned by Fitzstephen as those "of most note." In 1236 the magistrates purchased from Gilbert Sandford the liberty to convey the waters of the Tyburn from Faddington in leaden pipes to the city, and a great conduit of lead castled with stone was begun in West Cheap in 1285. Various other conduits were built in the 14th and 15th centuries, some for the water of the Thames, from which also the inhabitants were supplied by the city company of water bearers, who brought it in leathern panniers along on horses. In 1583 a great step in advance was taken by Peter Moris, a Dutchman, the real originator of the Thames water companies, who erected a "forrier" on an arch of London Bridge to convey the Thames water into the houses in the east end of the city as far as Gracechurch Street; in 1594 another was erected near Broken Wharf for West Cheap, Fleet Street, and the district round St Paul's, and in 1610 a third at Aldersgate without the gate. Moris, who obtained the lease of one arch of London Bridge for five hundred years at a rental of 10s. per annum, and two years later the use of another arch, erected for his purpose very ingenious machinery; and the works continued until 1701 in the possession of the family, who after amassing large wealth sold the lease to a company for £30,000. They ultimately occupied four arches, and continued till 1822, when the supply was purchased by the Southwark Company for £10,000. In 1806 an Act was passed for supplying the northern districts from springs near Ware in Hert. This enterprise was in 1609 undertaken by Hugh Myddelton, who, when his funds became exhausted in 1612, received the necessary money from James I. on condition of his sharing in the profits. With this assistance the reservoirs at Clerkenwell supplied by the New River were opened in 1613. In 1630 a scheme to bring water to London and Westminster from Hoddenden in Hert was promoted by aid of a lottery licensed by Charles I. on condition that the

promoters should pay £4000 per annum into the king's treasury. Styrpe, writing in 1720, mentions that "there is not a street in London but water runs through it in pipes conveyed underground, and from those pipes there is scarce a house whose rent is £15 or £20 per annum but hath the convenience of water brought into it," while "for the smaller tenements there is generally a cock or pump convenient to the inhabitants." In 1721 the Chelsea Water Company began to supply water from the Thames to Westminster and the parts adjacent, and in 1783 the supply of south London was supplemented by the erection of the Lambeth water-works opposite Charing Cross. The Vauxhall Company was established at Vauxhall Bridge in 1805, the West Middlesex near Hammer-smith in 1806, the East London on the River Lea at Bow in the same year, the Kent on the Ravensbourne at Deptford in 1810, the Grand Junction at the Grand Junction Canal in 1811, and the Southwark at London Bridge in 1822. For several years before the interference of parliament the companies had agreed to restrict themselves to separate localities. The Acts of 1847 required the companies to provide pure and wholesome water for the use of the inhabitants in the districts supplied by them, and also to provide water for general use. An Act passed in 1852 compelled the removal of the companies beyond the tidal limits of the Thames, contained regulations as to rates, enforced thorough filtration, and endeavoured to make provision for a constant supply. The rates, which differ in the various companies, were in some respects amended by the Act of 1871, but, as it fails to guard against claims for back dividends, no sufficient guarantee is provided against the raising of the rates. These are charged chiefly on the value of the houses, but the Acts do not distinguish with sufficient clearness between the gross annual value and the rental. A proposal in 1880 to purchase the rights of the companies, whose capital was then a little over £12,000,000, for £24,180,000, failed to commend itself to a committee of the House of Commons.

Their accounts being made up at different periods, it is impossible to give comparative returns for the companies, the following are the figures (Table V), as best they can be stated, for two years—

	Ordinary Capital	Piety and Loss Capital	Total Capital	Total Expenditure	Income	Working Expenses	Dividends
1871-2	£7,000,000	£2,000,000	£9,000,000	£10,107,710	£992,010	£250,950	£700,250
1880-1	8,000,000	3,448,961	11,448,961	11,612,669	1,502,784	619,500	921,985
Increase	1,000,000	928,961	2,448,961	9,474,879	510,774	368,550	152,229

Within ten years the increase of capital has thus been about 24 per cent., or 2½ per cent. per annum, the increase of the income 64 per cent., or 6½ per cent. per annum, and of the expenses 87 per cent., or 8½ per cent. per annum. Thus, while in 1871 there was a capital of 10 millions, gaining 6 per cent. profit, in 1881 there was a capital of 12½ millions producing 7½ per cent. Within the last two years the value of the property has been increasing at a more rapid rate, and probably at the rate of £1,250,000 per annum; but, as on account of the proposals to buy up the rights of the companies they have at present special reasons for curtailing expenses and delaying the carrying out of all but essential improvements, it is impossible to know how much of the increase is temporary and artificial.

According to Dr Frankland the water of the Thames and the Lea, notwithstanding the most efficient possible filtration, are, on account of sewage pollution, becoming less and less fit for domestic use, about one-half of the water at present supplied being already grossly polluted, and a very large proportion of the remainder occasionally polluted. He therefore recommends that the supply of water

for domestic use should be taken from the springs of the basin before they reach the river. At the present rate of the increase of London the supply required will, however, within forty years exceed that which may be obtainable in the whole Thames basin in times of summer drought, such as may occur in any year, and thus in a future not far distant a means of storage must be provided, or a new source of supply discovered, involving an outlay which would at least double the rates on the present rental. The Kent Company, which obtains its supply from the chalk wells, is the only one possessing wholly unpolluted sources, but the New River Company also obtains about one-tenth of its supply from springs, the remainder being obtained from the Lea. The East London Company obtains its supplies from the Lea and Thames, and the other companies from the Thames alone. The following table (VI.) gives certain particulars:—

Authorized Daily Supply from Thames.	Other Sources.	Average Supply from Thames.	Other Sources.	No. of Houses on Constant Supply.	Estimated Population Supplied.	Subsidiary Storage.		Filtered Storage.		Miles of Main in the Metropolis.	Miles of Main in the County of Chancery.
						Area.	Capacity.	Area.	Capacity.		
10,000,000	Not Estimated.	58,000,000	75,000,000	612,000	120,000	4,000,000	4,000,000	4,000,000	4,000,000	3,707	740

Oil
methods
of
lighting

LIGHTING.—From 1416 the citizens of London were under an obligation to hang out candles between certain hours on dark nights for the illumination of the streets; and in 1691 a special Act of Parliament was passed to enforce the custom. The corporation in 1684 granted a licence to Edward Heming, the inventor of oil lamps, for the sole supply of the public lights for twenty-one years, but the duty was then once more assigned to the individual citizens. A second agreement with contractors not proving satisfactory, the corporation in 1736 obtained from parliament permission to erect lights where they thought proper, and to levy a rate, which in that year yielded £15,000. Gas-lighting was in 1807 introduced in Pall Mall by the erection of a small apparatus to supply the lamps on the one side of the street, the other being still lighted with oil. In 1810 the Gas Light and Coke Company received a charter permitting it to supply gas to any persons within "the cities of London and Westminster, and the borough of Southwark," and as the result of their enterprise Westminster Bridge in 1818 was lighted with gas, and in 1814 the whole of the streets of St Margaret's parish. The City of London Gas Company was formed in 1817, and soon afterwards other seven companies. After several years' wasteful competition the companies came to an agreement in 1857 to restrict themselves to separate localities. This led to the Metropolitan Gas Act of 1860, the only effectual provisions of which were those in reference to the quality of the gas. The City of London Gas Act of 1868, limiting the price of gas within the City to 3s. 9d. per 1000 feet, except in certain cases, was the only other measure of a restrictive character passed before 1876, and previous to this the companies, by amalgamation, and through the favourable terms on which they were allowed to increase their capital and to raise new shares, had economically increased the value of their dividends. The Act of 1876, from the provisions of which the London Gas Company is exempt, adopted a sliding scale of dividends, one half of the profits, after a 10 per cent dividend had been paid, going to the shareholders, the other being applied to reduction in the price of the gas, it being also provided that the price should not be more than 3s. 9d., and that when additions were made to the capital the shares should be put up to auction. The experimental introduction of the electric light by the commissioners of sewers of the City, and by the Metropolitan Board (for the Thames Embankment and some of the bridges), has led the gas companies to provide better lights in some of the more important streets.

The following table (VII.) will show that the prosperity of the companies¹ has not been affected by the legislation of 1876, and as yet has not materially suffered from the threatened competition of electric lighting:—

	Total Gas Companies, Year ending December 31, 1880	Total, Year ending December 31, 1874.	Increase or Decrease— from 1874 to 1880.
Amount of capital authorized ..	12,000,719	10,469,900	+1,530,819
Paid up capital ..	10,786,761	8,887,280	+1,899,481
Capital remaining to be paid up ..	1,213,958	1,582,620	-368,662
Reserve fund ..	3,867,277	2,006,067	+1,861,210
Total capital remaining to be borrowed ..	1,701,806	229,484	+1,472,322
Amount of capital on which 10 per cent. is paid ..	1,007,720	1,266,800	-259,080
Total income ..	9,388,428	8,705,108	+683,320
Total expenditure ..	2,794,583	3,077,598	-283,015
Total gas sales ..	8,012,444	5,627,510	+2,384,934
Consumption for public lighting ..	327,571	298,397	+29,174
Coal carbonized ..	1,008,544	1,444,000	-435,456
Gas sold for private lights ..	17,015,060	12,666,809	+4,348,251
Gas sold for public lamps ..	1,234,438	1,074,228	+160,210
Public lamps ..	60,548	64,119	-3,571

¹ By amalgamation the companies have now been reduced to four.—Gas Light and Coke Company, paid up capital £7,615,000; South Metropolitan Gas Company, £1,881,860; Commercial Gas Company, £476,845; London Gas Company, £762,123.

The gas
com-
panies.

FIRE EXTINCTION.—Until 1893 the duty of extinguishing fires rested in the hands of the fire insurance companies, which in 1833 then formed in support of one brigade for the whole of London, but only fire kept a comparatively small establishment, in the central districts of the metropolis. The other districts were protected by small hand-engines kept up by the parochial authorities according to the 14 Geo. III. c. 78. Since the staff of the fire insurance companies was placed under the care of the Metropolitan Board, the number of stations has been increased from 17 to 53, with 4 floating stations, while 11 movable stations have also been provided, the number of engines has been increased from 11 steam and 27 manual to 3 floating engines, 38 steam land engines, and 115 manual; and the number of men has been increased from 130 to 536, in addition to 68 coachmen and pilots. The board has also undertaken the duty of protecting life from fire, which previous to 1867 was discharged by a society supported by voluntary subscription, and they at present maintain 187 fire-escapes, which are stationed during the night in the most prominent parts of the metropolis. The total receipts of the brigade in 1880 was £91,645, and the expenses £63,180, of which £66,021 was defrayed by the board, £10,000 was paid by the treasury, and £21,464 was contributed by the insurance companies, at the rate of £36 for every £100,000 insured; and then, in 1881 the expenses were over £100,000, of which over £60,000 was defrayed by rates. The number of persons endangered by fire during 1881 was 164, of whom 114 were saved and 40 lost their lives. The following table (VIII.) gives a classification of fires since 1874:—

	Number of Fires			Percentage	
	Persons	Slight	Total.	Persons	Slight
1874	254	2149	1973	10	90
1875	168	1801	1969	11	90
1876	106	1466	1572	11	90
1877	230	1974	2204	10	90
1878	170	1489	1659	10	90
1879	120	1450	1570	9	91
1880	69	1700	1769	9	91
1881	107	1994	2101	8	92

SANITARY ARRANGEMENTS.—Until 1831 no provision had been made for the construction of underground main sewers, notwithstanding that in 1290 the exhalations from the Fleet overcame the incense burnt at the altars in the neighbouring churches, and that in 1307 the river, on account of the accumulation of filth, had become inaccessible for ships. The Act of Henry III. in 1251, which provided for the appointment of a commission of sewers, was renewed in 1548 by Edward VI., and extended in its application by James I. in 1607; and subsequently separate commissions were granted as the population extended to other districts. The most important work of the old commission of sewers was the bridging over of the Fleet in 1637. In 1841 this sewer, which drained an area of over 400 acres, was widened at a cost of about £47,000, and at its mouth an iron culvert was provided which carried its discharge into the middle of the Thames. Other main sewers were constructed, but the bridging of them over was carried out slowly and in a very imperfect manner. In early times the nuisances were carried away by the scavengers and the sewage received into wells, which when full were pumped into the kennels of the streets. Until 1848 the discharge of house sewage into the main drainage was forbidden, and the construction of cesspools enforced, the majority of which were unprovided with overflow drains, but after 1810 there was considerable improvement in connexion with the introduction of better arrangements for a supply of water. Under the auspices of the Metropolitan Commission of Sewers, created by the Act of 1843, a more satisfactory system of local drainage was enforced; but its action in regard to the main sewage discharge was so dilatory that the pressure of public opinion led to the Metropolitan Local Management Act of 1865 providing for the creation of the Metropolitan Board of Works, in which was vested the care of the main sewers, and to which was entrusted the construction of works for their discharge at a distance from London regarded as sufficient to prevent the pollution of the river. Works were commenced in 1869, and completed in 1865 at a cost of £4,807,000, pro-

Metropo-
Board.

viding three lines of intercepting sewers on the north side of the river, which convey the discharge 11 miles below London Bridge, and two lines on the south side, which convey their discharge 4 miles farther down. These works comprise 80 miles of main intercepting sewers, in addition to four pumping stations to raise the sewage from the lower levels. The total length of the main street sewers entrusted to the board was about 168 miles, one-fifth of which consisted of offensive open sewers, while many of the others were of most defective design or out of repair. The total cost of repairing these sewers, and connecting them with the new main drainage system, was estimated at £800,000, and works to the value of £750,000 have been executed. The sum expended on main drainage and main sewers up to 31st December 1881 was £5,684,470. The opinion seems to be increasing that the present method of getting rid of the sewage of London is idically wrong, and undoubtedly the sewage discharge may reach proportions which may absolutely demand a new supplemental schema. For the four years ending 1878 the average daily sewage discharge was 124 millions of gallons, in 1878 it was 157½ millions, and it is now estimated at 180 millions.

THAMES CONSERVANCY. The conservancy of the Thames was in 1857 transferred from the corporation to a body of twelve, nominated by various authorities, and presided over by the lord mayor; and in 1867 the conservancy of the upper reaches from Staines to Cucklade was vested in a board, of which the conservators of the lower reaches formed the majority. Under the auspices of these two boards not only has the navigation of the river been very much improved, but very stringent care has been exercised to prevent its unnecessary pollution. In 1868 the Len was also placed under the control of a conservancy board. The expenses of the boards are defrayed by tonnage dues, tolls, pier dues, fines, and licences, and contributions from the canal and water companies.

Street sanitation. The sanitary condition of the streets and houses is under the care of vestries and district boards, but great variety exists in regard to the efficiency with which the work is performed.

Cemeteries. An Act passed in 1846 provides for the prohibition of interment in any of the cemeteries within the metropolitan area by order in council, and forbids the construction of new burial grounds within 2 miles of the metropolis except on the approval of the secretary of state. The power of constructing cemeteries for such several districts is granted to the vestries, who may borrow money for the purpose from the Public Works Loan Commissioners, and are required to appoint a board for their management. The commissioners of sewers for the City of London are the burial board for the City parishes. The secretary of state has the power to issue regulations in regard to the construction of cemeteries and the arrangements connected with interment. Among the more important suburban cemeteries are Kensal Green (in which many eminent persons have been interred), Brompton, Hampstead, Highgate, Abney Park, Nunhead, and Norwood.

Climate. **HEALTH.**—Apart from the deleterious influence of smoke and defective sanitary arrangements, London must be

regarded as exceptionally healthy. Although subject occasionally to rapid alternations of temperature, the climate is generally mild and according to the seasons equable, with an early spring and a long autumn. The following table (IX.) gives a summary of Greenwich meteorology for thirty-two years, 1849-80.—

Weekly Movement of Air in Miles.	Yearly Fall of Rain in Inches.	Mean Dryness of Atmosphere.	Mean Temperature for the Year.	Mean Temperature for Quarters ending in—			
1811	54.8	89.9	45.8	March	June	Sept.	Dec.
	54.8	89.9	45.8	59.7	59.4	54.1	

In 1306, when the population did not exceed 50,000, Smoke the citizens of London petitioned Edward I. to prohibit the use of sea coal, and he passed a law making the burning of it a capital offence. John Evelyn, in *Fumifugium*, written in 1661, complains that on account of the increase of coal smoke the gardens no longer bear fruit, and instances various cases in which the smoke had been prejudicial to health, but the influence of smoke in increasing fogs and intensifying their evils seems not to have been appreciable. The smoke producing area has since then increased from about 3 square miles to over 100 square miles, and the average daily consumption of coals in domestic fireplaces has mounted to about 27,000 tons, or in winter probably to 40,000 tons, which in certain states of the atmosphere produces a cloud of smoke resting for days over the central districts of the town, and shutting out the sun, even when it does not descend in foggy weather as a thick, impenetrable, and partly poisonous mass of darkness. During the fog of 1879-80 asthma increased 220 per cent. and bronchitis 331 per cent., and in the week ending February 13, 1882, the death-rate, owing to the dense fogs, rose from 27.1 in the previous week to 35.3, diseases of the respiratory organs rising to 994, the corrected weekly average of this class of diseases being 430. The evil is mainly due to the smoke of domestic fireplaces.

The death-rate of London has steadily declined since the beginning of the century, when it was first exceeded by the birth-rate. A record of the births and deaths of London entitled "Bills of Mortality" was made by the parish clerks in the plague year of 1593, and from 1603 was continued even after the returns had begun to be published by the registrar-general. Though they only included the births of persons baptized according to the forms of the Church of England, and the deaths of persons buried in consecrated ground within the parishes included in the "Bills," and were in many cases very carelessly compiled, they place it beyond doubt that even in years when London was exempt from the plague the rate of mortality required a large immigration from the country to take the place of those who died in London. Previous to 1593 the great plague years were 1349, 1361, and 1369.

The following table (X.) shows the number of births and deaths in the great plague years of the seventeenth century, and the average annual number for every decade in the 18th century.—

Years.	Total Deaths.	Deaths from Plague.	Births.	Excess of Deaths.	Average 10 Years ending—	Deaths.	Births.	Excess of Deaths.	Average 10 Years ending—	Deaths.	Births.	Excess of Deaths.
1609	17,864	10,889	4,081	13,822	1710	21,461	18,028	3,433	1790	22,001	17,106	4,895
1610	42,043	34,288	4,758	37,532	1720	22,809	17,111	5,698	1770	24,948	19,784	5,164
1611	64,286	56,417	6,781	57,636	1730	24,208	18,268	5,940	1780	22,521	18,268	4,253
1612	28,880	10,400	6,232	22,648	1740	20,422	18,889	1,533	1790	22,001	21,477	524
1613	67,206	38,396	6,247	60,859	1750	24,467	22,806	1,661	1800	24,372	22,608	1,764

The average mortality of London in 1881 was 21.8 per 1000, or 1.1 less than that of the twenty other large towns of England, while the rate for England was only 20.4. It is to be remembered that London contains a comparatively small proportion of working class population. Its sanitary condition is still very far in advance of that of Paris, where at present the death-rate is about 180 for 100 in London. The registrar-general calculates that according to the density of London its normal death-rate should be much lower than

it is, but, besides the fact that mortality is influenced by other causes than sanitary arrangements, the extended area augments the evil results of density, and the lesser density in some districts cannot counterbalance the excessive crowding of others. Table XI. gives the annual rate of mortality per 1000 persons living for various periods, and Table XII. the number of births and of deaths from the principal zymotic diseases and from all causes.—

	Cattle				Sheep				Pigs			
	Foreign Supply			Total	Foreign Supply			Total	Foreign Supply			Total
	Home Supply Metro- politan Cattle Market	Home Supply Metro- politan Cattle Market	Foreign Cattle Market		Home Supply Metro- politan Cattle Market	Home Supply Metro- politan Cattle Market	Foreign Cattle Market					
									Total	Total	Total	
1870	102,811	109,447	212,258	372,276	1,132,138	484,865	1,617,003	444,885	1,236,748	6,560	5,270	11,250
1871	146,775	122,078	268,853	536,927	1,031,249	592,580	1,623,829	587,200	1,254,000	7,209	760	7,969
1872	178,995	70,593	249,588	589,108	868,305	129,803	998,108	668,305	1,000,906	8,979	40	9,019
1873	281,815	120,000	401,815	801,815	1,041,000	7,705	1,048,705	7,705	1,000,000	7,705	384	3,084
1874	186,069	179,093	365,162	734,355	114,006,444	1,044,000	1,055,444	1,055,444	1,044,000	8,979	82	9,061
1875	174,441	136,000	310,441	620,882	107,020	88,400	195,420	88,400	1,044,000	8,979	82	9,061
1876	190,000	110,000	300,000	600,000	107,020	88,400	195,420	88,400	1,044,000	8,979	82	9,061
1877	197,584	41,486	239,070	478,146	107,020	88,400	195,420	88,400	1,044,000	8,979	82	9,061
1878	174,000	107,170	281,170	562,340	107,020	88,400	195,420	88,400	1,044,000	8,979	82	9,061
1879	200,000	44,000	244,000	488,000	107,020	88,400	195,420	88,400	1,044,000	8,979	82	9,061
1880	170,250	107,170	277,420	554,840	107,020	88,400	195,420	88,400	1,044,000	8,979	82	9,061

Central
meat
market

The Central London meat market, opened in Smithfield in 1868 at a cost of about £250,000, to supersede Newgate market, is built in the Italian Renaissance style, with towers at the four corners, and occupies about 3 acres, its length being 625 feet and its breadth 240. Below the market area there is a railway terminus. To the west of the meat market another one-third its size was opened in 1875 for poultry and provisions. From 1869 to 1876 the toll received from the meat market increased from £14,280 to £18,275, or 281 per cent, and with the addition of the poultry and provisions market it had increased in 1880 to £21,310, or 71 per cent. The total amount of meat sold in the market in 1879 was 215,614 tons; in 1880 the total amount was 221,446 tons, of which 107,926 tons were country-killed, 80,905 town-killed, 7381 foreign, and 22,830 American, the amount of American meat in 1876 being only 6515 tons. A large quantity of meat is conveyed to the butcher's direct without entering the market, and several butchers also buy their cattle and get them killed privately. As, moreover, the cattle markets and the meat market supply towns and villages beyond the metropolitan area, there is a double impossibility of forming from these sales a true estimate of the actual amount of butcher's meat consumed in London.

Leaden-
hall
meat
market.

Leadenhall, which according to Stow belonged in 1300 to Sir Hugh Neville, and had been used as a market before it came into the possession of the city in 1411, was enlarged in 1444 by an addition for a grain market in connection with the wool market, and its removal to its present site, the cloth market also following before 1503, and before 1553 the foreign butchers who formerly stood in the High Street off Lime Street had been ordered to take stalls in it. A great part of it in the time of Stow was used as a wool market, but afterwards it became the principal provision market in the city, and, in 1600, to Fennell, the Spanish ambassador, that Charles II. felt that he believed there was more meat sold in that market than in all the kingdom of Spain. The Leadenhall underwent improvements in 1718 and 1814; and in 1881 a new structure of elegant design, with an area of 26,900 square feet, and erected at a cost of £26,000, was opened as a market for fowls and game, the principal commodities sold at Leadenhall for many years.

Billings-
gate

Billingsgate, the great fish market of the metropolis, was from an early period a harbour for small ships and boats, and in the time of Stow had almost superseded its great rival Quenchinbo, which was in the possession of the Crown. As it grew in importance fish stalls were erected in its neighbourhood, but the original market for fish was in Fish Street, and Friday Street, Chesapeake, which received its name from being inhabited by fishermen who served Friday's market, is mentioned as early as 1303. The Act of 1699, which made Billingsgate a "free market for fish," to some extent interfered with the ancient control of the fishermen, although the custom of selling fish there had been introduced long previously. Until 1846 Billingsgate was a mere assemblage of wooden sheds. The building erected in that year was succeeded by another in 1877, with an area of 39,000 feet instead of 20,000; but on account of the deficiency of its communications and the defective layout accommodation and arrangements, the market is totally inadequate. Among several abortive efforts to establish other markets for fish was Columbia market, which was completed in 1869 by the Barons Burdett Courts for over £200,000, and presented as a fish market to the City, but failed to attract attention. The City authorities have the intention to utilize the vegetable market in course of erection at Smithfield as a fish market, and a scheme is also being promoted for a fish market in the parish of St Paul, Shadwell. A fish and vegetable market has been established by the Great Eastern Railway Company at Canning Town. The quantity of fish brought to London by rail is not given by the statistics commencing prior to 1868, but in 1846 the quantity brought by water alone was 106,739 tons. In 1868 the total brought by water and rail was 192,004, in 1870 it was 117,192, in 1875 only 94,649, but since 1877, when the new market was opened, it has gradually increased from 107,168 to 130,629, or nearly 2000 tons less than in 1866, and scarcely 15,000 more than were brought in 1846 by water alone. There has of

late years been a more rapid increase in the quantity of water home fish, but the amount brought by rail is at present about two-thirds of the whole. Thus, with a population which since 1861 has increased by two-fifths, the fish supply has practically remained stagnant while, owing to delay in consequence of increased pressure of traffic, the fish often deteriorate so as to be unfit for human food.

Covent Garden market, for vegetables, fruit, and flowers, which Covent occupies the site of a convent garden belonging to Westminster Abbey, seems to have been used as a market very early in the 17th century, and it received a considerable impulse from the discontinuance of Stocks market on account of the building of the Mansion House and also of Honey Lane market, which in 1823 was succeeded by the City of London school, while since the removal of Hungerford market to make way for Charing Cross station it has remained the only vegetable and flower market of importance in the metropolis, although vegetables of a cheap kind are sold at the Borough and Spitalfields markets, watercresses at Farringham market, which superseded the Fleet vegetable market in 1824, and potatoes at the station of the Great Northern Railway. Until 1823 Covent Garden market consisted of an unsightly array of sheds. The present building, erected by the Duke of Bedford, though lately much improved, is quite inadequate for its requirements, while the arrangements for the disposal of mud and refuse are very reprehensible.

Tattersall's, Knightbridge, established by Richard Tattersall in Tattersall's, one of the principal markets in London for riding and milch, carriage horses, and may be regarded as the headquarters of the turf.

One of the principal difficulties connected with the establishment of new markets in London lies in the inconvenient railway arrangements, which render it impossible to obtain a site that shall have easy access to the metropolis and direct communication with the several districts of England and with the Continent. The poorer classes obtain a considerable supply of vegetables and other provisions from costermongers' mangers, and itinerant vendors, who either occupy stands in special localities, especially in the East End, and in High Street (Brixton), Hampstead Road, Edgware Road, and York Road (Barnes Town), or hawk them through the streets. The capital possessed in 1882 by these vendors, who then numbered 41,040, was estimated at £40,000, their gross amount of annual trade at £3,700,000, and their annual gains at £900,000. Since that period their numbers, capital, trade, and gains have probably increased at least one-fourth.

COMMERCE AND INDUSTRY.—London, which was a port ^{London} ^{com-} ^{merce} of some consequence in the time of the Romans, is spoken of by Bede as the "mart of many nations resorting to it by sea and land." The Hanse merchants, protected by a clause of Magna Charta, began in the 13th century to frequent London in large numbers, and, after obtaining liberty in 1236 to land and store the wool imported by them, are supposed to have settled in the Steelyard about 1250, but as early as the 8th century they had begun to frequent Billingsgate, and in 978 King Ethelred had conferred certain privileges on them and on other traders. Probably by the time of Fitzstephen London had become the most renowned mart of the world, with the exception perhaps of Antwerp and Bruges. The foreign merchants received a special charter from Edward I. in 1303, and, notwithstanding occasional interference with their privileges, the Hanse traders, who had erected extensive factories and storehouses near their "Gildhall," gradually absorbed the greater portion of the foreign trade of London, until the incorporation of the Merchant Adventurers of England, in 1505, for trading in wool to the Netherlands. The trade with the Levant, which had

become of some importance in the 15th century, soon largely extended, and commercial intercourse was also opened up with Barbary, Guinea, and Brazil. After the abolition of the special privileges of the Steelyard merchants, the trade in wool was transferred almost entirely to the Merchant Adventurers, the annual export of English wool and drapery to Antwerp and Bruges in 1666 being estimated at over £2,000,000. The close of the 16th century was marked by the rapid extension of maritime discovery, and the spirit of enterprise was stimulated by the grant of monopolies to those companies which should first open up communication with undiscovered countries. One of the earliest and most successful of the great maritime companies was the *Rasasin*, incorporated in 1553, which, besides establishing an extensive commerce with the ports of Russia, had an overland trade with Persia. The foundation of the Royal Exchange by Gresham in 1566 marked an era in the commercial history of London; and the destruction of Antwerp by the duke of Parma in 1585 left it without a rival as the emporium of Europe. The settlement of many of the *Flinders* merchants in England gave a great impetus to the manufacture of silks, damasks, and other fine cloths, but from the time of the expulsion of the Steelyard merchants by Elizabeth in 1597 the development of the maritime trade of London was solely in the hands of English companies. The incorporation of the Turkey Company in 1579, of the East India Company in 1600, of the Virginia Company in 1606, and of the Hudson's Bay Company in 1670 must be regarded, not only as the most important events connected with the growth of the port in the 17th and 18th centuries, but as of prime consequence in relation to the social and political history of England.

Present

trade.

In the trade of London there is a large excess of imports over exports, arising from the fact that it is specially a mart, and is removed from proximity to any large manufacturing district. The value in 1880 of the total trade of Liverpool, £191,489,888, was nearly equal to that of London, which was £194,043,836, but the value of the imports of London exceeded those of Liverpool by nearly £34,000,000, while the exports of Liverpool exceeded those of London by about £31,000,000. London has almost a monopoly of the trade with the East Indies and China, and has thus become the chief emporium for tea, coffee, sugar, spices, and indigo, and for silks and Eastern manufactures. A great part of the overland trade of London with India has till quite recently been carried on via Southampton, which, and also Folkestone, Newhaven, and Dover, may be regarded as virtually ports of London. The value of the imports of Folkestone, Newhaven, and Dover in 1880 amounted together to £24,485,034, and their exports to only £4,433,244; the imports of Southampton were valued at £9,305,183, and its exports at £9,306,926. In the Mediterranean and Levant trade London has now a powerful rival in Liverpool. From European and Asiatic Turkey London imports corn, dried fruits, madder, and various other special products; from Greece currants and olive oil; from Italy olive oil, wine, sunscho, oranges, and lemons; from Spain wine and dried fruits; from Portugal and the Azores oranges and wine. Nearly the whole of the French trade with England is concentrated in London, the imports including all the special French manufactures, and large quantities of butter, eggs, vegetables, and corn. It is, however, largely carried on through the southern ports, the value of the imports of silk

to Folkestone in 1880 being £3,614,014, and those of London only £260,646, while the imports of eggs at Newhaven greatly exceed those of London, as do also the imports of butter and eggs at Southampton. London absorbs the greater part of the Baltic imports to England, especially timber, corn, cattle, wool, and provisions, the tonnage of the shipping that entered from Germany in 1881 being 654,741, from Belgium 249,181, from Sweden 418,997, from Norway 201,056, from the northern ports of Russia 401,076, and from Denmark 135,634. The tonnage that entered from the southern ports of Russia only amounted to 50,883, but much of this trade is carried on *via* Southampton. The chief imports from Russia are corn, tallow, timber, hemp, linseed, and wool. The fact that the staple manufacture of Lancashire is cotton has enabled Liverpool to gain a superiority over London in the United States trade, with the exception of imports of tobacco from Virginia; but the shipping that entered London from the Atlantic ports of the United States in 1881 had a burden of 670,079 tons, and from the Pacific ports of 3248 tons. From Central America London obtains its chief supply of the finer woods, and also jalap, sarsaparilla, indigo, coffee, and Peruvian bark, and from South America sugar, hides, indiarubber, coffee, diamonds, and various drugs. From Canada the port receives timber, corn, cattle, and provisions, from the Australian islands wool, oil, gold, copper, tin, provisions, and cattle; and it possesses more than half the trade of England with the West Indies, the principal imports being sugar and molasses, fruit, rum, coffee, cocoa, fine woods, pimento, and ginger.

On account of the burning of the records at the custom-house, and the absence of regular parliamentary returns, it is impossible to give a continuous summary of the progress of the shipping trade since 1810, and the following table (XV) gives the returns of the shipping trade engaged in the foreign and colonial trade in various years from 1685 to that date, and the yearly average for subsequent periods:—

	Entered Favourable		Clearer	
	Vessels	Tonnage	Vessels	Tonnage, &c
1683	..	117,887	..	191,009
1674	..	139,872	..	217,840
1730	..	211,183	..	344,208
1760	..	681,035	..	797,054
1800	..	776,022	..	619,823
1816	3,110	692,050	5,077	619,823
1810-40	4,410	801,431	5,081	681,001
1811-40	4,340	808,431	5,023	726,554
1801-40	5,058	1,047,550	4,670	926,914
1841-40	8,038	1,091,433	8,706	1,194,701
1841-40	10,009	2,077,380	7,240	920,142
1841-70	11,369	2,338,078	7,010	1,011,705
1871-80	11,465	2,152,296	6,018	6,027,018
1881	13,765	2,810,043	5,011	6,476,000

Since 1873 vessels with sails and masts have been included in the coasting trade, and therefore the figures after that date show trade much greater progress than has actually taken place. In 1750 the number employed was 6306, and in 1795 it was 11,065 of 1,176,400 tons. The following table (XVI.) gives details from 1855:—

	Entered		Clearer	
	Vessels	Tonnage	Vessels	Tonnage
1855	19,540	9,282,320	5,463	579,180
1860	19,868	2,164,021	8,818	1,077,064
1865	24,226	2,056,460	8,053	1,131,801
1870	23,708	2,586,872	8,159	1,338,002
1874	19,228	2,606,449	9,979	1,347,448
1881	26,113	4,326,460	15,073	1,453,716

The following table (XVII.) gives the number of vessels registered in the port of London in various years from 1701:—

	Sailing Vessels		Steam Vessels		Total.	
	Vessels	Tonnage	Vessels	Tonnage	Vessels	Tonnage
1701	845	..	..	..	845	..
1791	1,048	64,869	..	..	1,048	64,869
1800	1,081	67,616	..	..	1,081	67,616
1810	1,081	67,616	..	..	1,081	67,616
1820	1,081	67,616	..	..	1,081	67,616
1830	1,081	67,616	..	..	1,081	67,616
1840	1,081	67,616	..	..	1,081	67,616
1850	1,081	67,616	..	..	1,081	67,616
1860	1,081	67,616	..	..	1,081	67,616
1870	1,081	67,616	..	..	1,081	67,616
1880	1,081	67,616	..	..	1,081	67,616
1890	1,081	67,616	..	..	1,081	67,616
1900	1,081	67,616	..	..	1,081	67,616
1910	1,081	67,616	..	..	1,081	67,616

Values of exports and imports.

Deduced values of the exports from London have been made at various periods, and are now made annually in the statement of the value of the United Kingdom. Since 1840 the value has more than quadrupled, being in that year £11,536,087, from which it gradually rose almost without intermission till it was £20,232,118 in 1874, but from that year it declined till in 1879 it was £17,336,763. In 1880 it again rose to £22,600,920, considerably above the average of the four years 1876-79, which was £18,684,473, but as much

below the average of 1872-76, which was £27,144,450. No return of the value of the imports is given before 1872, when they were £134,174,141. The value for 1880, £141,442,907, exceeds that of any previous year, the next being that for 1877, £140,832,773, while the average for 1872-76 was £129,443,956, and for 1879-79 £139,434,773. The following table (XVIII.) gives details of the principal imports for 1880 and 1880, and also a comparison with the United Kingdom in regard to the same articles—

Principal Articles.	1880		1880	
	United Kingdom	Port of London.	United Kingdom	Port of London.
Animals, living	No. 77,010	84,079	No. 803,843	122,202
Alcohol and liquors	Rs. 226,310	287,793	Rs. 1,111	27,923
Cocoa	6,074,601	6,074,601	Do 20,111	20,710
Coffee	85,727,740	72,784,353	cents 1,646,411	1,367,287
Corn, wheat	615 1,600,116	1,185,000	do 67,201,124	12,638,258
Barley	2,112,831	484,410	do 1,170,280	1,102,388
Oats	2,226,453	1,644,091	do 12,810,792	6,073,081
Peas	314,291	64,750	do 2,345,812	256,477
Lentils	430,634	80,000	do 2,07,138	207,462
Indian corn	1,857,702	43,188	do 87,224,728	4,413,706
Wheat meal or flour	6,082,229	1,979,394	do 10,758,712	9,040,194
Fruits, currants	145,415	474,640	do 8,031,162	681,132
Lemons and oranges	1,154,410	131,111	do 8,658,790	1,471,785
Rubins	93,770	140,788	cents 301,380	228,311
Hides, tanned	Rs. 848,228	408,981	lb 1,241,738	742,645
Tanned	4,707,372	1,800,411	do 4,663,442	21,437,121
Manila	4,710	41,200	cents 11,829	2,791
Metals, copper and	97,407	8,802	do 134,670	2,781
Copper, port wrought and part unwrought	31,768	3,778	do 100,078	10,038
Iron, wrought	64,620	40,110	cents 899,967	381,727
Oil, tinned, bleached, and unwrought	17,023	1,234	tons 1,821	4,432
Palm oil	164,674	164,674	do 1,041,674	2,000,000
Olives oil	20,602	2,606	tons 29,400	5,007
Seed oil	12,295	1,022	do 1,674	2,078
Provisions, bacon and lard	130,108	119,590	cents 1,674,574	8,000,000
Beef, salted	307,369	119,590	do 1,017,900	230,125
Milk	173,000	13,646	do 49,917	120,014
Butter	480,112	47,442	do 2,103,005	10,042
Cheese	183,281	294,489	do 1,774,907	207,407
Eggs	808,477	244,145	gr 1,000	2,000,000
Spices, nut	7,010,672	5,171,624	cents 1,107,001	5,000,000
in nut	2,142,748	1,741,624	do 3,000,000	1,800,000
Ground	628,430	396,120	do 2,000,000	1,000,000
Sugar, unrefined	8,812,276	4,846,132	cents 17,001,031	6,000,000
in refined and unrefined	1,000,000	1,000,000	do 1,000,000	1,000,000
Molasses	140,000	86,172	do 1,000,000	1,000,000
Tin	89,216,112	63,710,120	lb 20,000,000	20,000,000
Tobacco	2,400,000	2,400,000	do 2,400,000	2,400,000
Cigars	2,771,208	1,400,324	do 3,000,000	3,000,000
Wine	12,674,001	11,173,729	do 17,933,448	10,000,000
Wine and spirits	1,774,190	7,261	do 1,774,190	1,774,190
Sauces or oils	1,662,600	411,004	do 4,112,448	1,800,000
Sauces	1,774,190	7,261	do 1,774,190	1,774,190
Wool, sheep and lambs	15,000,000	75,000,000	do 4,000,000	2,000,000
Alpaca and llama	2,884,100	2,884,100	do 2,884,100	2,884,100

Docks.

In the time of Stow, Billingsgate had begun to supersede Quenchin as the principal landing place of the port of London, but he also gives a list of other "common waterways," and mentions that there were besides "divers private wharfs and keys all along from the east to the west end of the city, where merchants of all nations had landing places, warehouses, cellars, and storages of their goods and merchandise." On account, however, of the attempts made to avoid the payment of customs by the use of private landing places, a royal proclamation of Elizabeth appointed certain quays to be used as general landing places and others for special purposes. After the great fire the limits of the port were declared to be the North Foreland and London Bridge, certain wharves named "legal quays" were appointed for the general trade, and others named "special wharves" were permitted to be used under certain conditions with the special leave of the commissioners. The frontage of the legal quays in 1796 was only 1419 feet, and of the special wharves about 8500 feet, and so small-made was the storage accommodation that it would not have sufficed even for the single article of sugar. After the proposal for the establishment of a set docks was made by the West India Company the system was very rapidly extended. The West India docks at the Isle of Dogs were opened in 1806, the London docks at Wapping in 1806, the East India docks at Whitehall in 1808, St Katherine's docks to the east of the Tower in 1828, the Victoria docks in 1850, and the Millwall docks at the Isle of Dogs in 1868. The West India Company was granted for twenty years a monopoly of the West India trade, the London Dock Company of the trade in wine, brandy, tobacco, and rice, and the East India Company of the East India and China trade, but in no case were the privileges of the companies renewed. The various docks have at different times undergone improvement and extension to meet modern necessities, the latest addition being the Albert extension of the Victoria dock, opened in 1880, which affords an additional water space of 70 acres, and is unsurpassed in the completeness of its arrangements by any other dock in the world. The St Katherine's, London, and Victoria and Albert docks are now held by one company, and the East and West India docks by another, who are adding to their accommodation by the construction of the Tilbury docks specially for ocean steamers. All the great merchandise docks are thus on the north side of the river,—

the Commercial docks, which date from 1696, and were reconstructed in 1807, and the Surrey docks (1813), on the south side of the river, being used almost exclusively for timber and grain. The position of St Katherine's docks renders it impossible to adapt them to modern requirements; and probably, on account of the increased use of large ocean steamers, all the older docks may soon be superseded as regards the bulk of the foreign trade. The water area of the docks on the north side of the river, which in 1861 was 272 acres, will soon be 465 acres. The Surrey and Commercial docks, which is very complicated in its construction, has a total area, including land and water, of 530 acres. The land and water area (in acres) of the several docks on the north side of the river of recent completion or in process of construction is as follows (Table XIX.)—

Docks.	London	St Katherine's	East and West India	Victoria	Albert	Millwall	Tilbury.	Total.
Water	40	10	120	375	88	70	440	
Land	18	18	210	610	200	400	1,473	
Total	58	28	330	985	288	470	1,913	

The bonded warehouse system was sanctioned in the port of London in 1808, and the exclusive enjoyment of the several parts of this house privilege gave it a great advantage over the other parts of the kingdom. The warehouses of the dock companies, each occupied with their special class of goods, embrace a large portion of the City area, but the rapidity with which goods now pass into consumption renders this kind of dock property almost very unprofitable, and it is probable that very soon many of the warehouses will be turned to other uses.

The Custom-House in Lower Thames Street was built by Leing, Custom 1814-17, but on account of the enlargement of the central part the house, present Corporation House, 480 feet in length, designed by Smith, was afterwards added. In the building there is a museum containing various old documents and specimens of articles seized by the custom-house authorities.

Trinity House, Tower Hill, a plain building with an ornamental Trinity facade, erected in 1798 from the design of Wyatt, is the seat of an House association of mariners which received a charter from Henry VIII.

in 1514, and gradually acquired the management of lighthouses and buoys not only on the Thames but on the whole English coast, along with the superintendence of naval arsenals and dockyards. Besides the corporation of the City it had the conservancy of the Thames, until those authorities were superseded by the Thames Conservancy Board. Its general rights and privileges have also been much curtailed since 1853, when it was put under the partial control of the Board of Trade, but it has still the sole charge of the erection and maintenance of lighthouses and buoys, the examination of pilots and of navigating lieutenants, and two of its elder brethren act as naval advisers in the High Court of Admiralty.

The City.

The power of that portion of London known as the City is largely due to its proximity to the port, but the rapid development of the trade of the port is closely connected with the increase of London outside the City limits, which is of course dependent on a great variety of causes. The uninterrupted extension of the business and financial transactions of the City, and the connection of these with the rapid increase of the surrounding population, is sufficiently evidenced by the fact that the rateable annual value of the City has risen from about £700 an acre in 1801 to about £5300 an acre in 1881, that the net profits under the commercial and mercantile schedule D for the combined boroughs of the metropolis (1870-80) amounted to £1,088,368, of which the profits for the City alone amounted to £285,424, a larger sum than that of the whole seventeen next largest cities and towns of the United Kingdom, and that the number of persons entering the City daily during the extreme hours of business has increased from 657,379 in 1866 to 789,640 in 1881.

Ex-

changes. The business centre of London is the Royal Exchange, which occupies a commanding position between Threadneedle Street and Cornhill, at the principal convergence of the City thoroughfares. The first building, erected 1667-70 by Sir Thomas Gresham and presented to the city, was destroyed by the great fire, and the second, opened in 1699 was also burnt in 1838. The present exchange (1839-44), designed by Tite and erected at a cost of £180,000, is a quadrangular structure with an imposing Corinthian portico at its principal entrance, and encloses a court surrounded by an ambulatory. It is in the middle of the court that the commercial transactions take place—the ground floor being occupied by shops and offices, and the principal floor by insurance companies and "Lloyd's rooms." The principal exchanges for special articles are the corn exchange in Mark Lane, where the privilege of a bar was originally granted by Edward I. to wool exchanges; Coleman Street, the second exchange adjoining the custom-house, erected in 1646 in the Italian style, and consisting of a rotunda surrounded by a dome, and the auction mart for landed property in Tokenhouse Yard. The metal market is a very important one; and this is also a very large congregation of precious metals and diamonds, the vendors in which are chiefly concentrated in the neighbourhood of the Mint.

The Mint.

The Royal Mint, Tower Hill, erected in 1805 on the site of the Cistercian abbey of St. Mary, is the only mint in England for the fabrication of gold and silver coins, but bronze coins are chiefly made at Birmingham, and gold coinage is now also manufactured at Sydney and Melbourne.

Banking.

The unique commercial position of London, and its intercourse with every quarter of the globe, have assisted to make it financially a more complete centre than it is commercially the metropolis of the world. The stock jobbers and brokers, who according to the City census of 1861 numbered 1832, and who have their offices chiefly in the courts and alleys adjoining the Bank of England and the Royal Exchange, are nearly all members of the stock exchange, for whom the present building in Capel Street was erected in 1801; but there is also an open stock exchange in Leadenhall. The great approximation to banking transactions in London appeared in the negotiations for loans between Rishelwell and the principal city merchants, but the general adoption of the system was due to the civil war, when the merchants, some of whom had already made use of the Royal Mint as a bank of deposit, and the landed proprietors, began to place their money for the sake of greater security in the hands of the goldsmiths. Some of the private banks now existing, such as Coutts's and Child's, date from the 17th century, and a new era in the financial history of London was inaugurated in 1694 by the foundation of the Bank of England, of which a full account is given in the article BANKING (vol. iii. p. 315 &c.). Until 1788 the business of the bank was carried on at Grocers' Hall. The present building, which covers about 4 acres, and was enlarged in 1776 and 1788 by Sir Robert Taylor and Sir John Soane, presents to the street a low triangular wall without windows, and almost entirely devoid of ornament except at the north-west corner, where we caught from the temple of the Sibyl at Tyrol. Until the establishment of the Bank of London and Westminster Bank in 1826, the Bank of England was the only joint-stock bank in London. The private and joint-stock banks which have offices in London now number over 150. The principal banks are members of the Clearing House near Lombard Street, where a daily clearing of drafts and cheques is effected. For the year ending April 30, 1882, the total amount of bills, cheques, &c., paid at the

Clearing House was £6,882,645,000, the largest sum paid in any of the fifteen years for which statistics have been collected, the amount for the first year ending 1868 being only £3,557,411,000. The extent of the commercial enterprise of London is strikingly indicated by the large number of companies, with their field of operations chiefly in foreign countries, which have been projected in the City or have in at their headquarters. The foreign operations of these companies are however sometimes only nominal, their real business being wholly confined to London itself.

The largest manufacturing industry in London is that of brewing. The number of common brewers in 1880 being 110, who made up of 9,955,177 bushels of malt, while of the 412,192 barrels of beer exported from the United Kingdom 236,206 were from London. To supply the breweries with water, wells now require to be sunk below the chalk to the greensand. According to Stow, the brewers in 1585 in London and Westminster, who then consumed "water to the friendly water of Thames," numbered 26, some of them being foreigners, who first introduced the art of cultivating hops. Among the oldest and most important of the breweries now existing is that of Barclay, Perkins, & Co., which covers an area of 12 acres, begun at one time to Johnson's friend Thames, and occupies the site of the Old Globe Theatre.

Silk-weaving, which received a special impulse from the settlement of foreign refugees at Spitalfields after the revocation of the edict of Nantes, has within the last fifty years been in a stagnant condition, owing chiefly to the rivalry of Lancashire. The majority of the other manufactures are centred on in the neighbourhood of the Thames. The ships built in London in 1881, which are principally yachts, numbered 64, but their total tonnage was only 2723. The principal shipbuilding yards are at the Isle of Dogs. Boat-building is extensively carried on at Chelsea and at several other places in the upper reaches of the river. There are large engineering-works at Lambeth and Millwall, potteries and glass-works at Lambeth, Whitefriars, and Southwark, tanneries at Brompton, chemical-works on the Lea, paper-works on the Wandale, and sugar bakeries at Whitechapel. The clothe-making shops are situated principally in the neighbourhood of Roper's Row, but there are several adjoining Tottenham Court Road and the Strand, where upholstery warehouses are very numerous. Linen making gives employment to a large number of women and children in the eastern districts. There are extensive hat-manufactures in Lambeth. The special manufactures in different parts of London are too numerous for mention. The principal layers of the metropolis are in Long Acre. A large trade in second-hand clothing is done by the Jews at Houndsditch, especially on Sunday morning, and on the same day of the week there are bird and fancy animal fairs at Church Street, behind Green, and at St Andrew's Street, Brompton, near the Seven Dials. The centre of the cloth-trade is in Tottenham Court Road, but the great majority of the cloth-makers have their premises in the neighbourhood of Covent Garden and still farther west. Fleet Street is largely occupied with the offices of the London and the provincial daily newspapers, but the office of the *Times* is in Printing-house Square. The weekly newspapers have their offices chiefly in streets running off the Strand.

PAUPERISM.—London since 1867 has been divided into thirty poor-law unions, which are governed by boards of guardians, for whose the most part elected annually by the householders and owners of property, the number of votes possessed by each owner or household varying from one vote, according to the value of the property. A proportion of the guardians in each union are so elected, or are nominated by the Local Government Board. The Act of 1867 authorized the establishment of outdoor pauper-relief in any union or parish; and in twenty-seven of the thirty unions of the metropolis there are now forty-seven of these dispensaries, the number of prescriptions made up in the year ending March 31, 1882, being 1,000,000. For the maintenance of lunatics and insane poor, patients suffering from contagious diseases, and of pauper children at school, and for the relief of casual paupers, a metropolitan common poor fund is provided, through the operation of which the cost of maintaining the poor is now equalized, to the extent of 42½ per cent. of the whole sum expended over the metropolitan area. The good results which have followed, both in lessening expenses and in diminishing pauperism, especially outdoor pauperism, form a strong argument for the complete equalization of the rates, and the creation of a united poor-law authority for the whole metropolis. The three unions which in 1860 contained more than an out of the poorer ones were Kensington (£227,705), St. George's (£235,586), and the City of London (£261,080); and the three unions most benefited were Holborn (£21,048), Bethnal Green (£19,536), and St. George's, Southwark (£23,066); but, as will be seen from Table XXI. below, great inequality still exists in the rating, and this rate is generally higher in the poorer districts. The poor-law union possesses one or more workhouses, but the accommodation is inadequate, and difficulty in dealing satisfactorily with applicants often follows. Several unions, by the powers granted them under the Act of 1867, have combined into districts to provide infirmaries for the sick and imbecile, there being now only three unions—

Beltham Green, Hampstead, and Letcham—whose sick are not treated in establishments under medical supervision. In addition to this, the several unions and parishes are combined into one metropolitan asylums district, with a managing body of sixty members, fifteen of whom are nominated by the Local Government Board. The total number of persons relieved in establishments belonging to the managers of the metropolitan asylums district since the first was opened in 1870 has been more than 1200 in insensible asylums, nearly 50,000 in hospitals for infectious diseases, and 187,000 in the "Exmouth" training ship, which was established in March 1875. The paupers' schools fall to be noted under another section (see below, p. 834). The amount of accommodation provided in the various establishments of the unions in July 1870 was 35,093 beds, and in December 1880 it was 53,332 beds. Table XX gives a summary of the poor rate returns for 1880, Table XXI. the rateable value of the different unions in 1871 and 1881, and the

average pauperism, the amount of adjusted relief, and the rate in the pound for relief in 1880; and Table XXII various particulars in reference to metropolitan pauperism for 1871 and 1880.

The annual income of the various charitable institutions in Charities. London is now over £4,000,000, of which at least three-fourths is spent in London. That of the endowed parochial charities of the City of London in 1885 was £34,500, which by 1881 had increased to £116,900, those of Westminster being in the same years £26,555 and £33,124. The income of the charities of the Livery Companies in 1869 was stated to be £49,027, and now the 1,023 charities belonging to the companies have an aggregate income of £188,829, representing a capital value of £24,456,758. The amount spent on education in £68,130, and on doles £108,468. In addition, the charities of the corporation probably possess an annual income of £30,000. The parliamentary commission appointed to inquire into the endowed parochial charities of the City of London and

TABLE XX.—Summary of Poor Rate Returns for 1880

From Poor Rates	Receipts		Expenditure								
	In Aid of Poor Rates	Total Receipts	Relief of the Poor					Unconnected with the Poor		Partly Connected with the Poor	Total
			In-Maintenance	Out-Maintenance	Asylums, Work-houses, &c.	Total *	Lav.	Police Rate	Other Purposes		
£1,255,437	£112,383	£1,367,820	£113,631	£113,631	£113,631	£113,631	£113,631	£113,631	£113,631	£113,631	£1,367,820

* Including £1878, the difference arising in adjusting the charge of relief

TABLE XXI.

Unions	Rateable Value, Year commenced 6th April 1871	Rateable Value, Year commenced 6th April 1881	Average Pauperism, 1880		Adjusted Relief to the Poor, 1880	Rate per £1 for Relief, 1880
			Indoor	Outdoor		
West District						
Kensington	933,790	1,046,157	1,370	540	97,244	1 1/2
Islington	283,784	344,844	708	780	31,444	1 1/2
Paddington	179,897	230,844	412	734	17,947	1 1/2
Chelsea	241,740	295,363	1,196	590	29,860	1 1/2
St George's	1,807,023	2,180,920	2,180	1,632	123,110	1 1/2
Clive of St Peter	Nil	Nil	Nil	Nil	Nil	1 1/2
Westminster	625,041	768,406	930	505	42,074	1 1/2
Total West District	4,979,844	6,516,582	7,325	5,374	377,066	1 1/2
North District						
St Marylebone	1,168,970	1,368,367	2,804	1,384	94,640	1 1/2
St Pancras	1,140,817	1,495,461	915	210	91,014	1 1/2
Hampstead	553,016	617,795	808	464	34,464	1 1/2
Islington	984,961	1,446,398	1,791	3,003	81,292	1 1/2
Hackney	578,804	965,540	2,268	2,000	56,052	1 1/2
Total North District	4,185,568	5,880,137	9,464	12,511	255,296	1 1/2
Central District						
St Giles's and St George's, Bloomsbury	307,102	326,418	1,142	766	31,061	1 1/2
Lincoln's Inn	Nil	12,000	Nil	Nil	Nil	1 1/2
Strand	553,006	700,441	886	469	45,470	1 1/2
Holborn	720,301	813,118	3,407	4,066	101,539	1 1/2
Chancery Lane	Nil	15,308	Nil	Nil	Nil	1 1/2
Gray's Inn	Nil	15,308	Nil	Nil	Nil	1 1/2
London, City of	2,981,775	3,903,006	2,069	2,238	285,777	1 1/2
The Temple	Nil	85,096	Nil	Nil	Nil	1 1/2
Total Central District	4,108,004	5,542,380	7,066	8,109	361,767	1 1/2
East District						
Shoreditch	440,800	580,411	1,201	1,455	46,377	1 1/2
Beltham Green	270,424	337,854	1,758	1,247	31,220	1 1/2
Whitechapel	416,809	570,584	2,840	438	51,241	1 1/2
St George's in the East	158,176	190,297	1,480	390	16,844	1 1/2
Stepney	264,169	318,429	1,099	848	30,338	1 1/2
Mill End, Old Town	285,049	385,444	1,236	867	32,555	1 1/2
Fitzroy	447,622	670,476	1,486	1,772	58,363	1 1/2
Total East District	2,182,005	2,832,136	9,965	5,489	241,235	1 1/2
South District						
St Saviour's	724,545	938,868	3,300	3,300	77,890	1 1/2
St Olave's	575,809	716,290	1,907	1,890	66,107	1 1/2
Leabrook	915,016	1,254,022	2,284	4,068	90,211	1 1/2
Wandsworth and Clapham	684,515	1,183,373	1,294	1,494	66,407	1 1/2
Camberwell	477,668	605,412	1,035	1,521	38,844	1 1/2
Greenwich	403,490	517,320	1,658	2,690	32,555	1 1/2
Woolwich	211,973	275,247	490	988	22,424	1 1/2
Lewisham	364,000	547,100	1,061	2,548	46,197	1 1/2
Total South District	4,800,008	6,490,904	18,941	28,885	488,095	1 1/2
Total of the Metropolitan Unions	18,795,987	27,409,808	48,981	60,935	1,617,427	1 1/2

TABLE XXII.

Prochnal Year	Total Relief to the Poor Adjusted	Rate per £1 on Rateable Value	In-Maintenance	Outdoor Relief	Ratio of Outdoor Relief to In.	Mean Number of Paupers		Total.	Ratio per 1000 of Population.
						Indoor.	Outdoor.		
1871	£ 1,141,138	1 1/2	484,308	419,999	48-6	35,789	136,554	168,388	47
1880	£ 1,217,973	1 1/2	513,738	165,622	27-9	46,361	20,653	66,914	27

Westminster in the report of 1880 divides them into two classes—those that are elementary and those that are ecclesiastical. In regard to the first, it states that it is impossible to effect a satisfactory combination or readjustment of them under existing circumstances, and, in regard to the second, that they are so far hindered by altered circumstances as to require reappropriation to new charitable use.

Police. CRIME.—The London police district, or "Greater London," is divided into two police jurisdictions, that of the metropolitan police, with an area of 440,918 acres, and that of the City police, with an area of 488 acres. The Metropolitan police force, which suppressed the night watch in 1850, owes its existence to a bill introduced by Sir Robert Peel, providing for the establishment of a Metropolitan police under the control of the executive government. In 1839 the old watch was abolished within the City limits and a City police force appointed, which, however, is entirely under the control of the common council. There are two police courts within the City district, viz., Guildhall and Mansion House; and thirteen within the Metropolitan district, viz., Bow Street, Clerkenwell, Great Marlborough Street, Marylebone, Westminster, Lambeth, Southwark, Thames (Steynes), Wapping Street, Woolwich, Greenwich, Hammer-smith, and Wandsworth. The headquarters of the Metropolitan police are at Scotland Yard. The expenses of the two City police courts in 1880 were £10,031, and those of the Metropolitan police courts were £269,005, of which £10,637 was defrayed by fines and forfeitures. The Metropolitan police have power to regulate the street traffic, to inspect and license cabs, omnibuses, and other public conveyances, to interfere in abating noxious nuisances, and to inspect common lodgings. From 6158 in 1861 the Metropolitan force had in 1880 increased to 10,948, or one to every 430 of the population, the City police force from 628 to 880, or one to every 61 of the population. The increase of the City police force is necessitated wholly by the in-

crease in the number of persons who daily frequent the City, for not only has the night population greatly diminished, but the resident criminal population has become almost extinct. The number of persons belonging to the criminal classes in the whole police district of the metropolis in 1880 was 2389, as one in 1932 of the population in 1881; the number of known thieves 1885, the number in England being 17,907, the number of indictable offences was 17,835 (of which 1187 occurred in the City), the number in England being 63,437; and the number of apprehensions 5261 (City 412), the number in England being 23,231. Of indictable offences 48 were murders, 6 attempted murders, 418 attempted assaults, 1160 larcinages, 8913 simple larcinages, 1745 larcinages from the person, and 867 witnesses of counterfeit coin, 47 bodies of persons found dead and unknown were photographed and not identified. The number of offences determined summarily within the area of the Metropolitan police district was 125,302, or 11 1/2 to every policeman, the proportion of indictable offences to every policeman being 8-70. The number of offences determined summarily within the City area was 5649, or only 70 to every policeman, while the proportion of indictable offences was only 78. The total expense of the Metropolitan police was £1,165,661, or about 11s 10 1/2 per man, £461,824 was contributed to the expense from public authorities, and £38,071 was received for special services. The expense of the City police, £90,662 in 1880, is defrayed wholly by rate, and the cost per man is about £109.

The following table (XXIII.) gives details regarding police and crime in the Metropolitan police district since 1871, to which it will be seen that, although compared with the increase of population the total number of apprehensions has diminished, there has of late years been a considerable increase in the number of larcinages, and that the amount of property lost by thieves has been increasing very seriously.—

Year.	Total Police Force.	Apprehensions and Convictions.					Felonies.					Persons Apprehended.				
		Persons Apprehended.	Convicted on Trial.	Summarily Convicted.	Number of Felonies.	Apprehensions for Felony.	First Loss.	Amount Recovered.	Proportion per 1000 Population.	Persons Apprehended.	Persons Apprehended for Felony.	Persons Apprehended.	Persons Apprehended for Felony.	Persons Apprehended.	Persons Apprehended for Felony.	Persons Apprehended.
1871	5,605	71,901	2,636	45,608	16,290	10,054	477,228	£10,294	1.111	6,312	2,119	2,119	2,119	2,119	2,119	2,119
1872	5,701	78,208	2,646	45,472	17,461	10,271	517,794	19,106	1.276	5,101	2,070	2,070	2,070	2,070	2,070	2,070
1873	5,885	80,827	2,610	45,452	17,412	10,567	4,469	20,857	1.419	4,784	2,076	2,076	2,076	2,076	2,076	2,076
1874	6,168	87,700	2,698	45,882	17,514	10,728	77,468	18,129	1.566	3,912	2,076	2,076	2,076	2,076	2,076	2,076
1875	10,627	122,026	2,548	47,712	17,083	10,678	90,998	30,412	1.882	1,721	2,076	2,076	2,076	2,076	2,076	2,076
1876	10,948	125,214	2,528	47,180	16,983	10,520	125,210	34,990	1.990	1,486	2,076	2,076	2,076	2,076	2,076	2,076
1877	10,441	107,989	2,571	46,834	16,381	10,662	119,610	21,180	1.967	1,567	2,076	2,076	2,076	2,076	2,076	2,076
1878	10,477	107,989	2,571	46,834	16,381	10,662	126,288	19,765	1.966	1,119	2,076	2,076	2,076	2,076	2,076	2,076
1879	10,711	111,581	2,584	46,704	16,381	10,662	101,758	21,401	1.979	1,119	2,076	2,076	2,076	2,076	2,076	2,076
1880	10,948	116,690	2,500	46,400	16,200	10,300	120,687	47,851	2.051	1,593	2,076	2,076	2,076	2,076	2,076	2,076

Prisons. The Newgate and Holloway prisons are in the hands of the Court of Aldermen. Newgate, rebuilt after the riots of 1780, is now no longer used for persons awaiting trial in the Central Court. The City prison, Holloway, which is the House of correction for City prisoners, was erected in 1861 at a cost of nearly £100,000. Brixton, which occupied the site of a royal palace, and was granted to the city as a house of correction by Edward VI., was discontinued in 1864, the old Fleet prison was abolished in 1844, its site being now occupied by the Memorial Hall of the Congregationalists; Horse-monger Lane prison was superseded by Wandsworth prison, and Marshalsea in Southwark, immortalized by Charles Dickens, had been discontinued long before he wrote. The house of detention for Middlesex is Clerkenwell, and its houses of correction are Coldbath Fields for male prisoners and Westminster for females. Wandsworth is the prison for Surrey. The convict prisons within the metropolitan area are Brixton, Millbank, Pentonville, Wormwood Scrubs, Woking, and Fulham.

Elementary schools. RETROACTION.—Until the constitution of a School Board for London in 1870, the only special organizations for providing education to the poor children in London were the British and Foreign School Society, founded in 1818, and the National Society, founded in 1811. Many of the parish schools became amalgamated with those of the National Society, but the united efforts of these societies, and also of the Church of England, of the different denominations, and of various prominent charitable institutions, failed so completely to meet the necessities of the rapidly increasing population, that in 1851 the total number of scholars attending public schools was only 167,998, and that in 1871 the returns of the voluntary schools showed that there was accommodation for only 262,265 children, or 89 per cent. of the estimated population of school age. By October 1881 the School Board had supplied accommodation for 286,094 children, which with that in voluntary schools gives a total number of places sufficient for 568,096 children. In addition to which schools are in the process of erection for upwards of 100,000 more. Up to August 1881, 8338 children were board sent to industrial schools at the instance of the board, and the board now possesses three industrial schools under its own management. The total number of children attending workhouses, separate, and parochial and district schools in 1880 was 35,223, the amount paid to teachers in these schools being £37,110. The total

expenditure of the School Board for the year ending 31st March 1881 was £1,236,360. The amount paid by the council and by the ratepayers in 1881-82 was £276,570, the rate in the pound being 6 1/2d, a rate that for 1880-81, which was 6 1/2d, but its actual productivity there may for some years be a slight increase. The average cost of the 5129 teachers in 1880 was £124. The gross cost per child has risen from £2, 4s. 9d. in 1874 to £2, 17s. 6d. in 1881, but this will probably be a considerable diminution when the schools become fully occupied throughout a whole year. The following table (XXIV.) gives a comparison of cost between the board schools and other schools of London and of England in 1880.—

School.	Income per Scholar.			Expenditure per Scholar.			Expenditure per Scholar.		
	Voluntary.	Voluntary.	Voluntary.	Voluntary.	Voluntary.	Voluntary.	Voluntary.	Voluntary.	Voluntary.
Voluntary Schools.	£ 4	s 4	d 4	£ 4	s 4	d 4	£ 4	s 4	d 4
London.	0 19	2 9	0 7	0 19	2 9	0 7	0 19	2 9	0 7
England.	0 10	9 9	0 7	0 10	9 9	0 7	0 10	9 9	0 7
Board Schools.	0 8	4	1 13	0 16	4	1 13	0 16	4	1 13
London.	0 8	4	1 13	0 16	4	1 13	0 16	4	1 13
England.	0 8	4	1 13	0 16	4	1 13	0 16	4	1 13

Fitzsimmons mentions that in his time the three principal churches (transgressed by ancient privilege and dignity ecclesiastical schools, and that other schools were permitted on sufferance. The churches schools, referred to are supposed by Stow to have been St Paul's Cathedral, St Paul's at Westminster, and St Saviour's, Bermonsey, in Southwark. The various other parishes and churches, which were afterwards founded, had each its school, though of less fame than the earlier ones. On account of the suppression of the alien priories and religious houses by Henry V., Henry VI. in 1445 founded grammar schools at St Martin's-le-Grand, St Mary-le-Bow, St Dunstons in the West, and St Anthony's, and in the following year others in St Andrew's, Holborn, All Saints, the Great St. Peter's, Cornhill, and in the hospital of St Thomas of Acon. The custom of school disputations mentioned by Fitzsimmons was continued till the time of Stow, who states that they were restrained on account of the quarrels between the boys of St Paul's and St Anthony's. In his time the principal schools "referring to these

exercises" were St Paul's, St Peter's (Westminster), St Thomas of Acon, and St Anthony's. The last-named, which commonly presented the best scholars, and at which Sir Thomas More, Lord Chancellor, Heath, and Archbishop Warham received their education, had, however, lately greatly decayed. Up to the time of the dissolution of the monasteries education in England had been in the hands of the religious houses, but, though many of the grammar schools in London were then disestablished, several were re-erected and re-endowed, and others were added in subsequent years. Of these schools there are now existing St Paul's, St Peter's (Westminster), Christ's Hospital (Blue Coat School), Merchant Taylors' School, Chateaufort, St Martin's School, and the City of London School.

St Paul's School, St Paul's Churchyard, was re-established in 1512 by Dean Colet, for the free education of one hundred and fifty-three poor children, and was endowed with lands whose original annual value was £128, 4s. 7½d., but which now yield nearly £3000 yearly. This board of governors consists of thirteen members chosen by the Mercers' Company and nine nominated by the universities. Vacancies on the foundation are filled up by competition, and the school fee for the scholars is £20. The course of study, which formerly was chiefly classical, is now specially designed to prepare for the various examinations. The site of the school will soon be changed to West Kensington, where grounds to the extent of 16 acres have been purchased.

St Peter's School, Westminster, re-endowed by Queen Elizabeth in 1565, provides for 40 quarter's scholars on the foundation, and the school is also situated by about 180 day pupils. Besides six minor exhibitions tunable at school, there are eight exhibitions to Oxford or Cambridge. The management of the school is regulated by the Public Schools' Act of 1868. The school, which is in the Dean's Yard, was formerly the dormitory of the monks of the abbey.

Christ's Hospital (Blue Coat School), Newgate Street, founded by Edward VI. in 1548 on the site of the monastery of Gyffryth, has an annual income of over £16,000, and the number of children on the foundation is about 1180, including 440 at the preparatory school at Heston, of whom 99 are girls. The school is under the management of a board of governors, of which any one may be admitted on payment of a donation of £500. The education is chiefly classical, but few boys are annually sent to the universities. The boys still retain their ancient dress, as well as several peculiar privileges.

Merchant Taylors' School, which was formerly situated in Suffolk Lane, but in 1578 removed to the Chancery, was founded by the Merchant Taylors' Company in 1541, and provides for the education of 500 boys annually on payment of 12 guineas in the lower school, and 15 guineas in the upper. The site of the present building was purchased in about 1590, and the new school-house cost £20,000. The home of the preparatory schools in connexion with this, as well as the chapel of the date 1512, the master's lodge, and the great chamber, the tower of which is a very fine specimen of Elizabethan work.

Chateaufort, formerly a Carthusian monastery and afterwards the seat of the Howards, was purchased by Sir Thomas Sutton, and in 1611 endowed as a school. On the foundation 85 pensioners are maintained at Chateaufort, and 60 scholars at the school at Godalming, where it was removed in 1872.

The Mercers' Grammar School, Collegiate Hill, Dorgate, was originally attached to the hospital of St Thomas of Acon, which was sold in 1628 to the Mercers' Company on condition that they maintained the school. Of the 180 scholars 25 are free.

For the City of London School, founded by the City corporation in 1846, at Milk Street, Chancery, to supply education to sons of respectable persons, a new building is in course of erection on the Thames embankment. There are preparatory schools in connexion with University College and King's College.

Higher
education.

The University of London, Burlington Gardens, instituted in 1826, and removed in 1869 to its present building in the Italian Renaissance style, is a rare examining body for conferring degrees. University College, Gower Street, founded in 1828 on undemocratical principles, has the reputation in connection with the examinations—including engineering and the fine arts—that are taught in universities, with the exception of theology, and is attended by over 1500 students. The buildings, the chief feature of which is the Caianthian portico at the main entrance surmounted by a dome, were enlarged by a wing in 1881, and contain a large library, and the Plaxman gallery, with original models by Plaxman. King's College, erected by Smirke in 1832, and forming the east wing of Somerset House, provides similar instruction to University College, but with the addition of theology, and in connection with the Church of England. At Gresham College, founded in 1572 by Sir Thomas Gresham, and removed to its present building in Beaufort Street in 1843, lectures are given on law, divinity, the sciences, music, and medicine. The lectures of the London Society for the Extension of University Teaching have been instrumental in stimulating to some degree general interest in literary and scientific subjects, and in 1861 were attended by 3080 persons. The legal lectures in

connexion with the Inns of Court are noticed in the article INNS or COURT, vol. xii. p. 65.

SCIENCE.—The great medical schools owe their fame and success in part to the attraction which London presents to eminent physicians and schools of surgeons, and to the existence of extensive medical and surgical hospitals, which afford unequalled opportunities for the study of diseases. In addition to the university of London, the Royal College of Physicians, founded by Langens, physician to Henry VII. and Henry VIII., is an examining body for diplomas in medicine, and the Royal College of Surgeons, which originated in the lively company of Barber-Surgeons, formed by the incorporation of the surgeons with the barbers in 1640, has similar authority in regard to the practice of surgery. The College of Physicians, originally located in the private house of Langens on Knight-Rider Street, and afterwards in a building designed by Wren in Warwick Lane, removed to its present site in Trafalgar Square in 1826, where a Greco-Ionian structure was erected from the designs of Smirke at a cost of £30,000. The College of Surgeons, Langens's Inn Fields, erected 1835-37 from the designs of Barry at a cost of £40,000, contains the Hunterian Museum, purchased by parliament in 1789 (see HUNTER, vol. xii. p. 389), an extensive library, and a lecture theatre. Until the time of John Hunter the medical and surgical education obtainable in London was of a very unsystematic character, chiefly of a private nature, the provision made for dissection being often of the meagreest kind, while the lectures on anatomy and surgery were both undervalued in a course of six weeks. Hunter's lectures, not delivered in 1774, was a very influential effort in the development of the medical and surgical schools connected with the hospitals, but their most rapid progress has been during the present century. A full description both of these hospitals and of the hospitals for special diseases will be found in THOMAS DE GRANT, vol. viii. p. 238, and the article HOSPITAL, vol. xii. p. 301, &c. Other among the chief scientific schools of London may be mentioned scientific the Royal School of Mines, Jernyn Street; the Normal School of Science, South Kensington; the Royal Veterinary College, Camden Town; the Royal Naval College, Greenwich; the Royal Naval School, New Cross; the Royal Military Academy, Woolwich; and the School of Naval Engineering at the Crystal Palace. The Guilds of London Institute, for the advancement of technical education, has lately founded colleges at Finsbury and South Kensington. The foundation stone of the South Kensington Institute was laid in 1862, and the building will be opened in 1884, the cost being £75,000, making a total with the Fine Arts College of £100,000, in addition to £25,000 for fittings. The amount contributed by the Library Companies to the endowment is £25,000.

The most influential of the scientific societies is the Royal Society, Scientific incorporated by Charles II. in 1663. Originally located near Sotheby's, Gresham College, Canoe Court, it was removed in 1760 to Somerset House, and since 1857 it has occupied rooms in the Strand, Piccadilly. In 1864 old Burlington House, built by Richard Boyle, earl of Burlington, was purchased by the Government for £140,000, and in 1872 a new building in the Renaissance style was erected for the various societies formerly accommodated in Somerset House, viz., the Chemical Society, the Geological Society (founded 1807, incorporated 1850), the Society of Antiquaries (1707, 1761), the Royal Astronomical Society (1820, 1831), and the Linnean Society (1788, 1802). The Royal Geographical Society (1830, 1856), occupying a commodious building in Savile Row, has within the last forty years taken a leading part in promoting geographical discovery. The Royal Asiatic Society (1823) is in Albemarle Street. The Royal Institution of Great Britain, in the same street, established in 1799 chiefly for the promotion of research in connexion with the experimental sciences, possesses a large library, a mineralogical museum, a chemical and a physical laboratory, and a foundation for a course of lectures. The Society of Arts, in Pall Mall, Adelphi, established in 1754 and incorporated in 1817, for the encouragement of arts, manufactures, and commerce, offers rewards for new inventions and discoveries, and grants certificates and prizes for proficiency in commercial knowledge, the industrial arts, musical theory, and domestic economy. Among other scientific societies the principal are the Society of Meteorology, the Anthropological, the Entomological, the Numismatic, the Zoological, the Botanical, the Horticultural, the Institute of Civil Engineers, and the Royal Institute of British Architects. The Zoological Society, instituted in 1826, rented in 1868 a portion of Regent's Park, where their established gardens which now contain some of the finest collections of live specimens in the world. The gardens of the Botanical Society, which occupy 18 acres of Regent's Park, are not of a strictly scientific character, being used chiefly for promenade, and flower shows, and are to be distinguished from the Government gardens at Kew, where the arboretum and New (p. 1). The Horticultural Society, founded in 1864, possesses large fruit and flower gardens at Chiswick, and in 1861 entered upon a lease of 23 acres of ground, formerly occupied by the Exhibition of 1861, which they laid out at a cost of £50,000, and where they now hold their flower shows and fairs.

Of museums, London possesses two on a scale of unexampled

Scientific museums. The British Museum and the South Kensington Museum. The geological collections of the British Museum are still at Bloomsbury, but the departments of geology, mineralogy, and botany were removed in 1881 to a new building in Cromwell Road, South Kensington, called the British Museum of Natural History. The British Museum at Bloomsbury, and the South Kensington Museum, which are usually connected with art than science, are noticed under the section Art. The Museum of Practical Geology, Jernyn Street, occupies a building in the Italian Palazzo style, erected in 1850 by Pannethouse at a cost of £30,000. It was founded in 1835 in connexion with the geological survey of the United Kingdom, and is especially rich in collections illustrative of the application of the minerals and metals to the useful arts. In the Patent Office Museum at South Kensington there are many of the original examples of the greatest mechanical inventions of modern times; and the United Service Museum, Whitehall, possesses relics and models illustrating both of the art of war and of the great naval and military achievements of England.

The drama. DRAMA.—According to Fitzstephen, London, "instead of shovels upon theatres and comical pastimes," possessed in his time "holy plays and representations of miracles"; and Sawmarche tells us in 1591 a play by the parish clerk continued three days together, and "that another in the year 1409 lasted eight days, and was "of matter from the creation of the world." In the 16th century the secular began to supersede the sacred drama, the progress in London under Elizabeth and James I. will be touched on below (pp. 246 *et seq.*) after the Restoration, the "king's servants" who had previously occupied the Globe and Blackfriars played first at the Bull Bull, then in Vere Street, Clare Market, and in 1638 removed to the Theatre Royal in Drury Lane. For De Witt's company, known as the "dike over York's," the Lincoln's Inn theatre was built on an improved plan in 1603, and there for the first time women actors were introduced. The two companies received each special patents in the same year. Before 1672, when Drury Lane theatre was burned, De Witt had removed to a new house built by Wren in Dorset Gardens, and had taken of by a by-product as "like Nero's voice slurring all with gold"; and, as the new Drury Lane was far less magnificent in its arrangements, it generally had the worst of the costly competition in which they engaged until the union of the patents in 1682. In 1686 a licence was granted to a new theatre in Lincoln's Inn Fields, and in 1706 Haymarket theatre was opened, chiefly for Italian opera. The Dorset Gardens theatre was demolished in 1709. In 1738 the Lincoln's Inn theatre was removed to Covent Garden. The Act of 1737, which forbade the granting of new licences, gave to the patent houses a monopoly of the legitimate drama till 1743; but in the earlier houses, such as "The Little Haymarket" (erected in 1720), the Goodman's Fields theatre (1737), Sadler's Wells (1764), the Lyceum (1766), the Adelphi (about 1800), the Princess's (1880), the Strand (1831), and St James's (built by Ibrahim, 1836), the law was evaded by the performance of miscellaneous entertainments. The most striking feature in the dramatic entertainments of London is their variety; the old dramatic traditions of England, so closely associated with Drury Lane and Covent Garden, now exercise their influence rather in Germany than in London. London at present possesses about thirty theatres, and the plays of the older dramatists are revived only occasionally, chiefly at Drury Lane, the Lyceum, and the Princess's. Melodrama and the domestic drama were large support, but many theatres rely chiefly on comedy, farce, or operaboules.

Musical perform- ances. MUSIC.—In 1573 the celebrated career of English opens in London was first maintained by the performance at Dorset Garden of *Pygmalion*, followed by *The Tropic* and a little later *The Prophet* and *King Arthur*. For some time after the opening of the Haymarket theatre, Italian opera were varied by performances of English opera and the spoken drama, but the increasing success of the new entertainment soon led to its exclusive establishment. Since 1847 Italian opera has also been established at Covent Garden. English opera has lately been successfully revived by Carl Rosa, and Italian opera is also threatened with formidable rivalry by the performance on a scale of unexampled grandeur of Wagner's operas in Germany, chiefly at Drury Lane, the Lyceum, and the Princess's. The Academy of Ancient Concerts, established in 1710, had the honour in 1732 of introducing to the world that special development of Handel's genius, the oratorio, which still excites a wider and deeper interest in England than any other form of musical composition. The Ancient Concert Society did not find a worthy successor in its special sphere till the establishment of the Sacred Harmonic Society in 1821, which has since its annual series of performances, formerly in Exeter Hall and lately in St James's Hall, has organized great triennial festivals at the Crystal Palace. Oratorio performances on a larger scale than those of the Sacred Harmonic are now given at the Royal Albert Hall, but the nature of the building renders them less successful artistically. The Philharmonic Society has since its commencement in 1813 held a leading position in the performance of

great instrumental works, which previous to this had been commenced at subscription concerts conducted by private enterprises, but the orchestral performances at the Crystal Palace are of equal excellence, and of late years the Richter and Halle concertos have excited a larger amount of general interest. The Monday and Saturday popular concerts for chamber music have been the usual means of introducing to London audiences instrumental performances of European fame. By the formation of Henry Leslie's choir in 1855, the standard of refinement and taste in unaccompanied patting has been improved throughout England, and besides reviving general interest in glass and madrigals, it has been the successful means of giving currency to the "modern pat song." The choir, after the suspension of its performances since 1880, was revived in 1882; and there are also in London several local choirs which have attained nearly equal perfection in similar performances. The Bach Society devotes itself to the study and performance of the unaccompanied music of Bach and the other composers. The earliest renderings of the great classical compositions are associated rooms with the Hanover Square concerts, converted into a club house some years ago, and in a less degree with Wall's rooms, built in 1705, which are now used almost solely for balls and public meetings. The only concert-room in London of a convenient size for important performances is St James's Hall, Regent Street and Piccadilly, for since the purchase of Exeter Hall, associated with the "May meetings," by the Young Men's Christian Association, its use is prohibited even to the Sacred Harmonic Society, and the Royal Albert Hall is much too large for the proper reduction of the choir effects of choral, orchestral, or solo performance. This elliptical building in the Italian Renaissance style, erected from the designs of Captain Fowler, was completed in 1871 at a cost of £200,000, and has accommodation for an audience of about 9000 and an orchestra of 1000. The Crystal and Alexandra Palaces, though they present the additional attractions of fine grounds, of scientific and art exhibitions, and of various forms of outdoor amusement, have their claims to suit in a great measure on their theatrical and musical performances, and, besides the large central halls for promenades, possess various concert-rooms. The Crystal Palace, Sydenham, which has a total surface of 1008 feet, and a width at the nave of 313 feet, and at the central transepts of 384 feet, was designed by Sir Joseph Paxton, and constructed in 1854, chiefly of iron and glass, out of the materials of the Exhibition building of 1851, at a cost of £1,500,000, including the adornment of the grounds, 200 acres in extent. The Crystal Palace, Sydenham, which has a total surface of 1008 acres, was completed in 1876, after having been burned down in 1873. It is built of brick in the form of a parallel loggia, covering about 7½ acres, and consists of a central hall 384 feet by 184, two courts on each side 220 feet in length, and a concert-room and theatre detached from the main building. The Crystal Palace and other entertainments are given at the Royal Aquarium, Westminster, which was opened in 1875 at a cost of about £200,000.

In London there are probably a larger number of eminent pro-Musical fessors of the various branches of music than in any other city of modern the world, but almost no provision for public musical instruction has been made by the State. The Royal Academy of Music, instituted in 1822, and incorporated by royal charter in 1850, receives from Government only an annual grant of £500, and, though attended by over 400 students, chiefly professional, is hampered in its organization and plans by deficiency in funds. The Guildhall School of Music, in which instruction may be given at an earlier stage, was established by the corporation of the City in 1870, and is now attended by 1200 students. The National Training School at South Kensington, for which endowments for only five years were provided, is now discontinued, a proposal having been made to supersede it by a Royal College under the presidency of the Prince of Wales, and with endowments to be devoted to afford free education to 50 pupils, as well as maintenance and education to 50 others. The Tomte Sol-Fa College, Planter, was incorporated in 1876 for the special purpose of training teachers of music for the elementary schools of the country, that method of instruction in music being now used in the majority of schools where systematic musical instruction is given.

PAINTING, SCULPTURE, AND THE APPLIED ARTS.—The most Art influential and the oldest institution in London connected with galleries. painting and sculpture is the Royal Academy of Fine Arts, founded in 1768, which, besides its annual exhibition of art in its new buildings in Burlington Gardens, Burlington House, erected in 1868-69, in the Italian Renaissance style from the designs of Smirke, has also organized classes for art instruction. The Society of Painters in Water-Colours, established in 1804, the Society of British Artists, founded in 1822 and incorporated in 1847, and the Institute of Painters in Water-Colours, which hold each an annual exhibition. The National Gallery of Paintings originated in the purchase by parliament in 1824 of the collection of J. J. Anguier for £37,000. The present Crocker building by William in Trafalgar Square (1822-88) was enlarged in 1860 and 1880, and in 1878 a new wing was added by Barry at a

cost of over £80,000. The collection has received many additions both by purchase and bequest, and besides many noble examples of the old masters, contains some of the finest pictures of the English school, including the magnificent Turner collection. The National Portrait Gallery, the nucleus of which was formed in 1858, was removed to Exhibition Road, South Kensington, in 1870. In the Grosvenor Gallery, New Bond Street, erected by Sir Costa Lindsay in 1877, there are annual exhibitions of works of art, and occasionally other special exhibitions. Several of the mansions of the nobility contain art galleries, which are open to the public on certain conditions. The most famous of these are perhaps the Grosvenor Gallery in the residence of the duke of Westminster, and the Hughenden Gallery in the residence of the earl of Kilmorest.

British Museum. The British Museum, Bloomsbury, originated in the purchase by Museum Government in 1753 of the collection and library of Sir Hans Sloane, and occupies the site of Montagu House. For the reception of the Egyptian antiquities presented by George I. (1801) of the Torwally mummies (1805), and of the Elgin marbles (1816), a new wing was added to the building in 1823, but after the presentation of the king's library by George IV. in the same year, it was resolved gradually to reconstruct the whole building, the first portion being finished in 1828, and the work (except the new reading-room) completed in 1857. The exterior of the building is plain, with the exception of the massive Ionic portico at the principal entrance. The contents of the museum are divided into departments, which are under the charge of a keeper and one or more assistant keepers. The departments still at Bloomsbury are those of Printed Books, Manuscripts, Oriental MSS., Zoology, Oriental Antiquities, Greek and Roman Antiquities, Gems and Medals, British and Medieval Antiquities and Numismatics, and Prints and Drawings. The collection both as a whole and in several departments—especially Greek and Roman Antiquities and Engravings—is unequalled in the world, and in all the departments a very high degree of completeness has been attained. For the library and reading-room, see **LIBRARIES**, p. 515.

South Kensington Museum. which is under the direction of the Committee of Council on Education, was originated by the late Prince Consort in 1852. The present building, to which the collection was removed from Marlborough House in 1857, is erected of red brick and terra cotta in the Italian Renaissance style, and, though still in process of construction and development, includes a fine range of apartments, the interior consisting of courts and corridors of graceful proportions, and decorated with various designs. It contains a collection of works of ornamental art, both ancient and modern, as applied to manufacture, a national gallery of British art, in addition to the Foster and Dyce collections, and a fine collection of water colour paintings, an extensive art library, a collection of sculpture chiefly of the Renaissance period, reproductions of ancient sculpture and paintings, and collections of animal products employed in the arts of substance used for food, and of materials used for building and construction. Some of the rooms are occupied chiefly by articles on loan. In connexion with the institution there is a National Art Training School, as well as a School of Science and a School of Cookery. The Natural Green Museum, a branch of South Kensington Museum, opened in 1872, besides a permanent food collection, and a collection of animal products, is occupied with various collections on loan. The India Museum, which was removed in 1880 from the India Office to a building in Exhibition Road, South Kensington, and placed under the care of the South Kensington Museum directors, contains a magnificent collection of every variety of Indian art and manufacture. The Science Museum, Lincoln's Inn Fields, bequeathed to the nation by Sir John Soane in 1837, contains an architectural library, various models of famous ancient buildings, antique sculptures, gems, vases, and bronzes, and several fine paintings. The Royal Architectural Museum, Westminster, founded in 1847, is intended especially to advance the art of architecture by examples of the works of various nations and times, and by courses of lectures, and drawing and modelling classes.

CLUBS.—See **CLUBS**, vol. vi. p. 41.

Churches. **ECCLIASTICAL BUILDINGS.**—FitzStephen states that in his time there were in London and its suburbs thirteen larger conventual churches besides one hundred and twenty-six lesser parochial ones. Stow gives a list of churches existing when he wrote, mentioning those which he knew to be suppressed or united to others. He gives the names of 125 churches, including St Paul's and Westminster Abbey; 89 of these were destroyed by the great fire, and only 45 were rebuilt.

Paul's. St Paul's cathedral occupies the site of a church founded in 610 by Ethelbert. After the destruction of the church by fire in 1087, a new edifice in the Norman style was

commenced, which was forty years in building, and according to William of Malmesbury "could contain the utmost conceivable multitude of worshippers." In 1240 a new Pointed Gothic choir was added, and the erection of a lofty tower began. The work of renovation and adornment was continued until 1316, when the cathedral was declared complete. Its dimensions as given by Stow were as follows:—height of steeple 520 feet; total length of church 720 feet; breadth 130; and height of the body of the church 160 feet. In 1561 the spire was struck by lightning, and the roof of the church partly destroyed by the fire that ensued. From this time it remained in a dilapidated condition until the reign of Charles I., and the work of restoration under the direction of Inigo Jones, who added to the west front a Corinthian portico, had not been completed when the building was destroyed by the great fire of 1686. St Paul's cross, which stood at the north-east corner of the cathedral, was rebuilt by Bishop Kemp in the 15th century, but was removed in 1643, its place being now occupied by a fountain. At the cross great religious disputations were held and papal bulls promulgated, and in its pulpit sermons were preached before the court. The present St Paul's, erected in 1675-97 from the designs of Sir Christopher Wren at a cost of £747,954, is built in the form of a Latin cross, the length being 600 feet, the breadth at the transepts 250 feet, and of the choir and nave 125 feet. The dome, which separates the two transepts and the nave and choir, rises to a height of 385 feet, or of 404 feet to the top of the cross by which it is surmounted, the height of the interior dome being 225 feet. The principal front to the west consists of a double portico of Corinthian pillars flanked by campanile towers 120 feet in height. The transepts are bounded by semicircular rows of Corinthian pillars. St Paul's is remarkable chiefly for its massive simplicity and beautiful proportions. The interior is imposing from its vastness, but the designs of Wren for its decoration were never carried out. Some of the monuments of the old building are preserved in the crypt, where are also the tombs of Sir Joshua Reynolds, Dr Samuel Johnson, J. M. W. Turner, Lord Nelson, the duke of Wellington, and other distinguished men, especially admirals and generals.

Westminster Abbey, as the coronation church of the West-sovereigns of England from the time of Harold, and on account of its proximity to the seat of English government, has acquired a fame and importance which in a certain sense outvie those of St Paul's. It occupies the site of a chapel built by Sæbert, in honour of St Peter, on a slightly elevated spot rising from the marshy ground bordering the Thames. A church of greater pretensions was erected by King Edward about 860; but, this church being partly demolished by the Danes, Edward the Confessor founded within the precincts of his palace an abbey and church in the Norman style, which was completed in 1065, and of which there now only remain the pyx house to the south of the abbey, the substructure of the dormitory, and the south side of the cloisters. The rebuilding of the church was commenced by Henry III. in 1220, who erected the choir and transepts, and also a lady chapel, which was removed to make way for the chapel of Henry VII. The building was practically completed by Edward I., but the greater part of the nave in the Transition style, and various other improvements, were added down to the time of Henry VIII., including the west end of the nave, the deanery, portions of the cloisters, and the Jerusalem chamber; while the two towers at the west end were erected by Wren, who had no proper appreciation of Gothic. The length of the church, including Henry VII.'s chapel, is 531 feet, or, excluding it, 416 feet, the breadth of the transepts 208 feet, the height of the church 102 feet, and of the towers 225 feet. The choir, where the coronation of

English sovereigns takes place, is a fine specimen of Early English, with decorations added in the 14th century, and contains among other tombs those of Sisebert, king of the East Saxons, Anne of Cleves, and Edmund Crouchback, earl of Leicester. The north transept is occupied principally with monuments of warriors and statesmen, and in the south transept the "poet's corner" contains memorials of most of the great English writers from Chaucer to Thackeray and Dickens. The nave, with its clustered columns, its beautiful triforium, and its lofty and finely proportioned roof, is the most impressive portion of the interior. The monuments in its north and south aisles are of a very miscellaneous character, and commemorate musicians, men of science, travellers, patriots, and adventurers. The monuments in the chapels of St Benedict, St Edmund, St Nicholas, St Paul, St Erasmus, St John the Baptist, and the Abbot Islip are chiefly to ecclesiastics and members of the nobility. Henry VII's chapel, which is remarkable for the fretted vault work of the roof, with its magical fan tracery, contains besides the monument of Henry VII the tombs of many English sovereigns and their children, and also of various other personages of historic fame. In the chapel of Edward the Confessor are the shrine of Edward the Confessor in Purbeck marble, the altar tomb of Edward I., the coronation chairs of the English sovereigns, and the stone of Scone, the old coronation seat of the Scottish kings. In the chapter-house (1250) the meetings of the Commons took place before they were transferred to St Stephen's Chapel; and in the Jerusalem chamber (1376-86), where Edward V. is said to have been born and Henry IV. was brought to die, the sittings of the lower house of convocation of the province of Canterbury are now held.

Among the conventual churches existing in the time of Fitzstephen, there were destroyed by the fire three, those of St Thomas of Acon, St John the Baptist, and St Martin-le-Grand, founded of time in 700. Of the other churches there still remain the choir, part of the nave, and portions of the transepts of the old church of St Bartholomew the Great, dating from the foundation of the monastery by Rahew, minister to Henry I., included in the present church, restored 1835-59, which also contains the tomb of its founder, a pontical part of the old church of St Catherine Cree, which was the conventual church of St Asaph's proxy of the Holy Trinity, founded in 1168, but since rebuilt by Inigo Jones, the vaults and some of the old monuments of the old church of St James's, Clerkenwell, built in connexion with the Benedictine nunnery 1100, and replaced by the present structure 1788-92; the east wall and Norman crypt of the building which in the 16th century replaced the old church of the priory of St John's of Jerusalem, Clerkenwell, founded in 1100, and of which the south gate in the Perpendicular style, built in 1504, still remains, and the Temple church, raised in the reign of Henry III. Of the ancient church of St Saviour's, Southwark, belonging to the priory of St Mary Overy, a few seemingly Anglo-Saxon portions were incorporated in the building in the Early English style erected in the 13th century, which has been much designed by reconstructions and additions, although the beautiful choir, lady chapel, and transepts remain almost entire. The church of St Katherine's Hospital was removed in 1825 to make way for St Katherine's docks.

Of the other churches which escaped the fire the principal are the Chapel Royal, Surrey, rebuilt by Henry VII. on the site of Sorely Palace in connexion with the hospital of St John the Baptist, from 1584 till 1717 used as the parish church of St Mary-le-Strand, considered a chapel royal in 1778, and restored in 1805 by Sanluis after partial destruction by fire. All Hallows, Barking, founded in connexion with the Benedictine convent of Beaulieu, Essex, some time before Richard I., chiefly Perpendicular, and containing several brasses; St Andrew's Undershaft (1680-32), in the Perpendicular style, with a turret tower, and containing among other tombs that of Sir the chancellor; St Giles's, Cripplegate, founded 1090, rebuilt in the Gothic style after destruction by fire in 1646 (with the exception of the fine tower, added in 1660), where Cromwell was married, and Milton and Fox the martyrologist were buried; St Helene's, Backergate Street, founded in connexion with a priory of nuns (1218), chiefly in the Third Pointed style, and containing many brasses and monuments of city dignitaries; St Margaret's, Westminster, founded by Edward the Confessor,

re-erected by Edward I., and frequently restored, containing a window originally executed by Gouda for Waltham Abbey, and possessing a large number of monuments to eminent persons. St Olave's, Fleet Street, in the Gothic style, belonging to the 15th century, but much dilapidated by restoration, containing a large number of brasses and monuments, the small church of Trinity, in the Minster, formerly connected with a convent founded by Blanche, wife of Edmund Plantagenet, second son of Henry III., containing in a state of complete preservation the lead of the duke of Suffolk, father of Lady Jane Grey.

That the only important external feature of Wren's churches is Wren's the tower or steeple is a peculiarity to be explained by the fact, that the most of his style consisted, more in beauty of general outline than in elaboration of details, that from the amount of money placed at his disposal he was generally compelled to concentrate his chief attention on a special part of the building, and that on account of the crowding of surrounding buildings the steeple was often the only part of the church that could be made effective. His interiors, however, are finely proportioned. Among his more important churches are St Dunstons, Fleet Street, which possesses one of his finest steeples, and contains the statue of Richelieu the novelist; St Dunstons in the East, of which the only specimen by Wren now remaining in the city, resting on octagonal columns with a mural crown copied from St Nicholas, Newcastle; St James's, Piccadilly, only remarkable for its elaborate interior and a white marble font by Gibbons; St Lawrence, Jewry, St Mary-le-Bow, containing the Norman crypt of the old building, which was the first church in the city built on a new site, the nave, and adorned with one of the finest of Wren's steeples, in which are the proverbial "Bow Bells"; St Michael's, Cornhill, with Perpendicular tower mutated from that of Magdalen College, Oxford; St Mary, Aldermanbury, rebuilt by Wren on the Gothic model of the old church; St Stephen's, Walbrook, with an interior similar to St Paul's; St Andrew's, Cornhill Street, in a wall of which the famous "London Stone" is found, and St Clement Dances, in which Dr Samuel Johnson was accustomed to worship.

Of the churches of the period succeeding that of Wren, the most later notable are St George's, Hanover Square (1721), St James's, with churches, St George's, and St Andrew's, both in the city, and the church made at Marlborough, St Giles's in the field (1731), by Pitt-Croft, with tapering spire, and containing the graves of Livian in the sculptor and Andrew Marvel; St Martin-in-the-Fields (1726), by Gibbs, with a fine Corinthian portico, behind which the spire is a severely placed; St Mary-le-Strand (1717), by Gibbs, occupying the site of the old chapel; St Mary-le-Bow (1731), by Hardwick, in the Classic style, containing an altar-piece executed by Wren to the old church; St Paul's (1722), with a steeple in imitation of the Temple of the Winds, and a very elaborate interior copied from the Erechtemus at Athens; St Paul's, Covent Garden, originally designed by Inigo Jones, and restored after the fire in 1795. The more modern churches are wholly in the Gothic style.

Of the religious buildings connected with the monastic domain. Other towers and nationalities, few possess exceptional interest either for churches or architectural character. St George's, Cathedral, and Southwark (1848), designed by Pugin, is said to be the largest chapel. Roman Catholic buildings erected in England since the Reformation; and Ely Chapel, Holborn, the only remaining relic of the palace of the bishops of Ely, has lately been purchased and restored by the Roman Catholics. Among the chapels belonging to the Protestant dissenters the best known are perhaps All Saints on the Tottenham, the City Temple, and Christ Church, Nottingham. The Dutch Church in Amsterdam was presented by Edward VI. to the Dutch residents in London in 1550; the nave is in the Decorated style of the 13th century.

Lambeth Palace, situated near one of the old lakes or Lunden-Lambeth places of the Thames, came into the possession of the archbishops of Canterbury in 1197. The oldest portion of its present building, including the chapel in the Early English style, was erected by Archbishop Boniface (1544-70), but the Lollards' Tower, in which the Lollards were tortured and the civil of Essex was imprisoned, was built in 1484, and the great hall with an elaborate timber roof in 1558. The inhabited portion was erected 1828-48 from the designs of Blois. The handsome double staircase is the oldest part of which dates from the 14th century, contains the tombs of several archbishops, as does also the palace chapel. The library is noticed in LITERATURE, p. 516.

ROYAL PALACES AND GOVERNMENT BUILDINGS.—Stow mentions that in his time there was a large building called the Old Wardrobe in the Old Jewry, very ancient, but of which all that he knew was that it had been allotted to by Henry VI. as his principal palace in the Old Jewry. The palace of Westminster existed at least as early as the Palace reign of Canute, but the building spoken of by Fitzstephen of Westminster as an "incomparable structure furnished with a breastwork

and a bastion" is supposed to have been founded by Edward the Confessor, who built what was afterwards known as the Painted Chamber, and also the apartment afterwards used by the House of Lords. The palace was probably enlarged by William the Conqueror, and William Rufus built the great hall in 1087. The palace suffered severely from fire in 1563 and 1599, and after the great fire of 1513 it was no longer used as a royal residence, and was allowed for a time to fall into decay, with the exception of the great hall. Subsequently it was fitted up and made use of for the meetings of parliament until 1835, when again the whole, with the exception of the great hall, fell a prey to the flames. The apartment in which the House of Commons met was the beautiful St Stephen's chapel, originally built by Stephen. Westminster Hall, which is 290 feet long, 68 feet wide, and 90 feet in height, with a carved timber roof remarkable for its beauty and the ingenuity of its construction, is used as the vestibule of the law courts and the Houses of Parliament. According to Stow the "princes" after the destruction of Westminster Palace "lodged in other places about the city, as at Bernard's castle (which was destroyed in the great fire), at Drudwell, and Whitehall, sometimes called York Place, and sometime at St James's." It was at Drudwell, which occupies the site of an old Norman tower, and was for a long time the occasional residence of the kings of England, that Henry VIII., who, according to Stow, built there "a stately and beautiful house of new," was staying, on account of the destruction of Westminster Palace, when the interview took place in 1528 between him and his nobles, commemorated in the third act of Shakespeare's *Henry VIII.* After the fall of Wolsey, York House, which from 1546 had been the residence of the archbishops of York, came into the possession of the crown, and obtained the name of Whitehall. The palace was almost reconstructed by Henry VIII., who made it his principal residence, and employed Holbein in its decoration; but a new banqueting hall, erected by James I. in place of the old one burned down in 1615, was the only portion of the building which escaped the destruction caused by fire in 1691 and 1697. This hall, converted into a royal chapel by George I., is a fine specimen of Palladian architecture, and its ceiling is adorned with allegorical paintings by Rubens. Through the banqueting hall Charles I. passed on his way to execution beneath its windows, and Cromwell breathed his last within an apartment of the palace.

St James's Palace, which after the destruction of Whitehall continued to be the principal royal residence until it was nearly all destroyed by fire in 1809, with the exception of the old gateway, the chapel adjoining, and the presence chamber, was built by Henry VIII. for a country residence instead of Kennington, on the site of an old hospital for lepers founded in the 12th century.

Buckingham Palace, the town residence of Queen Victoria, occupies the site of Buckingham House, purchased by George III. in 1761. The present building in the Classic style was erected 1825-35 by Nash, a west wing with a dull facade 460 feet in length, facing St James's Park, being added in 1848, and a large ball-room in 1856. The picture gallery contains a specially fine collection of pictures by the great Dutch masters.

Kennington Palace, a favourite residence of several English sovereigns, is noticed under KENSINGTON. Marlborough House, built by the first duke of Marlborough in 1710 from the designs of Wren, came into the possession of the crown in 1817, and has been occupied by the Prince of Wales since 1863.

The Tower of London, on the east of the city on the left bank of the Thames, called by Fitzstephen the Palatine Tower, was, according to tradition, originally built by

Julius Caesar, but the nucleus of the present building was begun in 1078 by William the Conqueror, who erected the part now known as the White Tower to take the place of a portion of the walls and towers of the city which had been washed away by the Thames. This tower was completed in 1088 by William Rufus, who also began the St Thomas Tower and the Traitor's Gate. Additions were made at various periods, especially by Henry III., who used it frequently as a residence; and it now occupies an area of 13 acres surrounded by a moat, constructed in 1190, enclosing a double line of fortifications, behind which is a ring of buildings consisting of various towers, and the barracks and military stores, while in the centre is the massive quadrangular White Tower, with Norman arches and windows, and adorned with a turret at each corner. The St John's chapel in this tower is one of the finest and most complete specimens of Norman architecture in England. The Tower of London has an extensive collection of armour, and is the repository for the regalia of England. The execution of the long list of important political prisoners confined in the Tower took place on the neighbouring Tower Hill, and most of them were buried in the chapel of St Peter ad Vincula.

The new palace of Westminster (1840-67), built at a cost of about £800,000 from the designs of Barry, for the Houses of Parliament, stands on the site of the old palace destroyed by fire in 1855, is a vast and magnificent building in the Tudor-Gothic style, covering altogether an area of about 8 acres. Towards the river it presents a very richly adorned and electric facade. At the north-east corner is the clock-tower, 320 feet in height, resembling the clock-tower at Bruges; above the dome over the central hall a spire rises to the height of 400 feet, and the Victoria tower, 310 feet, surmounts the royal entrance at its south-west corner. The central hall, which is entered by St Stephen's Porch and St Stephen's Hall, built above St Stephen's Crypt, a portion of the old building, separates the House of Peers, which, along with the royal rooms, occupies the western portion of the building, from the House of Commons, to which the eastern portion is assigned.

The Government offices, situated in Whitehall and Downing Street, form several miscellaneous groups erected at different times and in very various styles of architecture. The Treasury offices, Whitehall (1787), containing the official residence of the premier, the Education Office, the Privy Council Office, and the Board of Trade, was improved in 1847 by the construction of a new facade designed by Barry. The Horse Guards, the headquarters of the commander-in-chief, an insignificant building with a central clock-turret, was erected in 1788 on the site of a guard-house built in 1681 for the security of Whitehall. The Admiralty, a plain structure with a Grecian facade, was erected in 1726. The new Public Offices, a fine range of buildings in the Italian style, erected from the designs of Sir Gilbert Scott at a cost of over £500,000, contain the Home, Foreign, Colonial, and Indian Offices, and various other departments. Somerset House, Strand (1778-86), a large quadrangular structure, the finest facade of which is that towards the river, occupies the site of a palace founded by Protector Somerset in 1547. It contains the Exchange and Audit Offices, the inland Revenue Office, the Office of the Registrar-General, the Admiralty, Register, and the Prerogative Will Office, removed from Doctor's Commons in 1874. The other Government offices at present occupy unpretentious buildings in various streets, chiefly in the neighbourhood of Whitehall and Westminster. Her Majesty's College (College of Arms), the authority in regard to pedigrees and armorial bearings, is located in Queen Victoria Street, in a building re-erected in 1668 from the designs of Wren. The General Post-Office, St Martin's-le-Grand, City (1826-39), designed by Smirke in the Grecian style, and occupying the site of St Martin's church and abbey, will probably soon be removed farther westwards. The General Telegraph Office, opposite the Post-Office, was erected 1870-73 at a cost of £450,000. The new Record Office in the Tudor style (1881-86) is situated in Fetter Lane.

The law courts, which are described in the article ENGLAND, vol. Law, viii. p. 261, and were accommodated in Lincoln's Inn and in courts, buildings adjoining Westminster Hall, where they were first established in 1254, will soon be all removed to the new Law Courts in the Strand, designed by Street, and estimated to cost about £500,000.

MEMORIALS AND STATUES.—The principal monuments are The Monument (1671-77), a fluted Doric column designed by Wren, and erected in commemoration of the great fire, at a cost of £18,700; the Nelson Column, Trafalgar Square, by Railton, erected in 1845 at a cost of £48,000, a copy in granite from the Temple of Mars Ultor,

Whitehall

St James's Palace

Buckingham Palace

The Tower

145 feet in height, crowned with a statue of Nelson by Barry, and having at its base four colossal bronze lions modelled by Sir Edwin Landseer; the Duke of York Column, Carlton House Terrace (1833), an Ionic pillar 124 feet, designed by Wyatt, surmounted by a bronze statue by Westminster; Westminster Column, erected to the memory of the old pupils of Westminster school who died in the Russian and Indian wars of 1854-59; the Guards Memorial, Waterloo Place, erected in honour of the foot guards who died in the Crimea, the Albert Memorial, Hyde Park, a highly decorated Gothic structure adorned with numerous niches and statues, erected from the designs of Sir Gilbert Scott at a cost of £190,000; Cleopatra's Needle, presented to the Government by Melomet Ali in 1819, brought from Alexandria in 1878, and erected on the Thames embankment on a pedestal of grey granite. Temple Bar, erected by Sir Christopher Wren (1670-72), was removed in 1877, but its site is at present occupied by an erection surmounted by a griffin.

Statues. The following is a list of the principal public statues:—

Name.	Site.	Sculptor.
Achilles	Hyde Park.	Westmacott.
Anna, Queen	St Paul's Churchyard.	Kneller.
Bateman, Earl of	Parliament Square	Westmacott.
Beckford, John, Duke of	Curzon Place	Kneller.
Burgoyne	Waterloo Place	Kneller.
Canning, George	New Palace Yard.	Westmacott.
Charles I.	White Horse	Le Sueur.
Charles II.	Chichester Hospital	Kneller.
Clyde, Lord	Waterloo Place	Kneller.
Cobden	Exmouth Road	W. C. Wyse.
Cumberland, Duke of	Greenwich Square	Kneller.
Derby, Earl of	Parliament Square	Westmacott.
Fox, Charles James	Broomfield Square	Kneller.
Franklin, Sir John.	Waterloo Place	Kneller.
George III.	Somerset House	Kneller.
Do	Cockspur Street	M. C. Wyse.
George IV.	Traveller Square	Kneller.
Harold	Traveller Square	Kneller.
Herbert, Lord	Pal Mall	Kneller.
Hill, Rowland	Whitehall	Kneller.
James II.	Whitehall	Kneller.
Jessner	Kensington Gardens	Kneller.
Kent, Duke of	Whitehall	Kneller.
Mill, J. S.	Victoria Embankment	Kneller.
Napier, Sir Charles	Traveller Square	Kneller.
Newton, Sir J.	Victoria Embankment	Kneller.
Pulford, Lord	Palace Yard	Kneller.
Philips, George	Royal Exchange	Kneller.
Port, Sir Robert	Cheapside	Kneller.
Pitt, William	Haymarket Square	Kneller.
Porter, General	Colston Viaduct	Kneller.
Richard I.	Old Palace Yard	Kneller.
Ross, Sir H.	Cholcon	Kneller.
Victoria	Royal Exchange	Kneller.
Wallington, Duke of	Green Park Arch.	Kneller.
Do	Royal Exchange	Kneller.
Do	Royal Exchange	Kneller.
William III.	St James's Square	Kneller.
William IV.	King William Street	Kneller.

HISTORY.

(C. F. H.)

BRITAIN AND ROMAN (to 449 A.D.)—Bishop Stillingfleet, writing in the London, stated that after the fullest inquiry he was enabled "to believe it of a Roman foundation, and no older than the time of Claudius" (*Origines Brit.*, 1665, p. 48); and several antiquaries and historians hold the same opinion. Although Geoffrey of Monmouth's vision of a great British city of Troynovant, founded by Brut, a descendant of Eneas, must be relegated to the limbo of myths, we need not anxiously dispute the existence of a British London. There can be little doubt that the name of London has a Celtic origin, and therefore there is probably a grain of truth in Geoffrey's fanciful description. The place was probably very small, but it must have been chosen for its commanding position on the banks of a fine river, and there may be some truth in the assertion that one Belinus formed a port or haven on the site of the present Dillinggate, although it does not follow that "he also made a gate of wonderful structure," or "ever it built a prodigiously large tower" (*Historia*, lib. i. cap. x.). What a British town was like we learn from Julius Cæsar, who tells us that it "was nothing more than a thick wood, fortified with a ditch and rampart, to serve as a place of retreat against the incursions of their enemies" (*De Bello Gallico*, v. 21). We may therefore imagine a clearing out of the great forest of Middlesex, extending probably from the site of St. Paul's Cathedral to that of the Bank of England, with the dwellings of the Britons spread about the higher ground looking down upon the Thames. The late Mr. Thomas Lewis believed that London had attained its prosperity before the

Romans came, and held that it was probably the capital of Cassivellaunus, which was taken and sacked by Julius Cæsar. Not satisfied with affirming the existence of a British London, he went further, and indicated its extent. On the hill situated between the river Fleet on the west and the Wallington on the east was seated the British town. The western gate was Ludgate and the eastern Dowgate, and much of Mr. Lewis's argument rests on the fact that these two names are of British origin (*Archæologia*, vol. xi. p. 48). The origin of London will probably always remain a subject of dispute, for want of decisive facts. A recent fact is suggested by any remains of an earlier date than the Roman occupation have been discovered, but, on the other hand, London could scarcely have come to be the important commercial centre described by Tacitus if it had only been founded a few years previously, and after the conquest of Claudius. Now then can be no doubt that the Britons made considerable progress during the period between Julius and Claudius, and it seems upon the whole highly probable that London as a British settlement may have come into existence then. There is some reason to believe that there were two settlements, one on the north and the other on the south bank of the Thames. If so they would be within the territories of distinct and possibly hostile tribes. There might be a ferry, and even, as we shall mention presently, a bridge of some description towards the close of the period, but this point will come before us again.

The Roman occupation of Britain extended over a period equal to that which has elapsed since Henry VIII. reigned. During those centuries (43-409 A.D.) there was ample time for cities to grow up from small beginnings, to overflow their borders, and to be more than once rebuilt. The earliest Roman London must have been a comparatively small place, but it probably contained a military fort intended to cover the passage of the river. The mouth of the Thames was then only a few miles from the large portions of what are now the counties of Kent and Essex being marshes overflowed with water. The original investigations of Sir Christopher Wren led him to take this view, and he expressed the opinion that "the whole country between Cumberwell Field and the hills of Essex might have been a great tract or mure of the sea, and much wider near the mouth of the Thames, which fills a large plain of sand at low water, through which the river found its way. This mighty broad sand (now good meadow) was restrained by large banks still remaining, and inducing the river into its channel, a great void, of which no history gives account, as the Britons were too rude to attempt it, and the Romans too much bound with continual wars, he concluding therefore it was Roman work" (Wren's *Antiquities*, p. 585). The opinion that these embankments are Roman work is the one generally held, but so greatly does opinion vary on all these points that some have supposed that they were not built until the reign of Henry VI. Neither Strabo nor the older Pliny allude to any such attempt; they wrote on Britain, and the name does not occur in literature until used by Tacitus. That author distinctly says that London had not in 61 A.D. been dignified with the name of a colony (*Annal.*, xiv. 33). The Roman general Tullius Suetonius, after marching rapidly from Wales to put down a serious insurrection, found Londinium unfortified for a basis of operations, and therefore laid the place to the mercy of Boadicea, who entirely destroyed it and killed the inhabitants in large numbers. When Tacitus wrote, Verulamium and Camulodunum possessed mure, but Londinium was not so distinguished. Subsequently, however, it became a place of importance. When the British power was finally destroyed, again grew into importance, and we find it holding an important position in the Itinerary of Antoninus, Londinium being either a starting-point or a terminus in nearly half the routes described in the portions devoted to Britain. Ptolemy mentions Londinium, but places it on the south side of the river; this may merely be a mistake on Ptolemy's part, but it seems probable that it was referred more particularly to Southwark, which, as has been already pointed out, may have had a distinct origin from the Londinium of the north bank of the river. Londinium was plundered in the reign of Diocletian and Maximian by the army of the usurper

¹ General Pitt Rivers (then Colonel James Pitt) discovered in 1857 certain piles in excavations near London Wall and Southwark River, probably the remains of a bridge, which he made the subject of a paper read before the Antiquarian Society of London (*Journal*, vol. v. pp. 122-124). These piles averaged 6 to 8 inches square, others of a smaller size were 4 inches by 1 inch, and one or two were as much as a foot square. They were found in long rows above the virgin gravel, and with them were found the refuse of kitchen middens, broken pottery, &c. of the Roman period, but there was no superstructure. There is not much here upon which to found a theory, but nevertheless the fact is a valuable item of evidence in a very complicated question. If, as seems certain, these piles are remains of the London of the Romans, and General Rivers thinks they were built by the Britons rather than by the Romans, and General Rivers thinks it probable that they are the remains of the British capital of Cassivellaunus, situated in the marshes, and of necessity built on piles, it is not probable that the

² Sir George Aylmer holds that the embankment of the lower reaches of the Thames could not have been undertaken until after the construction of Old London Bridge, as when that was built the tide was so high that it was necessary to build a bridge of 120 arches, which was the case. It is evident that, when the tidal water covered half the area of the Thames for a distance of 30 miles, the river proper must have been considerably shallower than at present, and it is not probable that the quantity of water shot off by the embankments equalled from five-eighths to three-fourths of the present tidal volume (*Proc. Inst. Civ. Eng.*, vol. xix. p. 67).

³ Dr. Guess affirmed that the notion of a British town properly "preceded the Roman camp has no foundation to rest upon, and is inconsistent with all we know of the early geography of this part of Britain" (*Archæologia*, vol. xii. p. 180). And Mr. J. B. Green in his lately published work, *The Making of England*, expresses the same opinion (p. 101). This was not, however, Mr. Kemble's belief, for he held that it was difficult to believe that Cæsar found an unimportant place even in Cæsar's day (*Sketches of England*, vol. ii. p. 219).

Allectus, but before the Franks who chiefly forced this army could fly Constantius sailed up the Thames and disembarked under the walls of the city, thus taking them by surprise. Under Julian London was the headquarters of Lupinus in his campaign against the Scots and Picts, and in the reign of Valentinian, Ammianus tells us, Theodosius came to London from Boulogne to mature his plan for the restoration of the tranquillity of the province. It is on this occasion that Ammianus speaks twice of Londinium as an ancient town, to which the title of Augusta had been accorded. By the anonymous geographer of Ravenna it is called Londinium Augusta. As Theodosius is said to have left Britain in a sound and secure condition, with all the fortified places restored, it has been supposed that to him was due the wall of the later Londinium. According to old tradition, however, Constantine the Great walled the city at the request of his mother Helena, who was said to be a native of Britain. In spite of these various references we should know very little of Roman London if it had not been that a large number of excavations have been made in different parts of the city, which have disclosed a considerable amount of early history.¹ These go to prove that the early city occupied a somewhat small area, for it has been discovered that the site of the Royal Exchange was originally a gravel-pit, and had then become a dirty pond outside the walls used as a receptacle for refuse. Constantine also once existed in Chispaide, on the site of St. Paul's, close to Newgate, and various other places known to have been included in the later Roman London. As it was illegal in Roman times to bury within the walls, these places must at one time have been extra-mural. Among the large number of important sepulchres remain lately found by Mr. Taylor in Newgate Street were several *ossuaries*, or leaden vessels for the reception of the calcined bones of the dead. Little attention had been paid to these objects until Mr. Roach Smith specially alluded to them in an article on "Roman Sepulchral Remains discovered near the Minors, London" (*Collections Antiquæ*, vi. 45-62). Subsequently Mr. Smith wrote a very elaborate article on "Roman Leadern Coffins and Ossuaries" (*Ibid.*, vii. 170-201), in which he refers to the wealth of the British natives as one of the chief incentives to the conquest of the country by the Romans, and that the large quantities of the costly metal, lead, "manufactured with much skill and so profusely as to supply not only the inhabitants of the towns, but those of villages and villas, with one of the chief requisites of advanced civilization," proves the prosperity and even luxury of the province. When Sir Christopher Wren was directing excavations for his building of Bow Church he sunk about 18 feet into the ground, where he first came upon "a Roman causeway of rough stone, close and well-rammed, with Roman brick and rubbish at the bottom for a foundation, and all firmly cemented." In consequence of this discovery the great architect came to the conclusion, which was corroborated by other remains, that the causeway he had found continued for the whole length of the town, and formed the northern boundary—"the breadth then north and south was from the causeway now Champagne to the river Thames, the extent east and west from Tower Hill to Ludgate, and the principal middle street or Prætorian Way was Watling Street" (*Parvula*, p. 269).

Although it is generally agreed that this early Roman city was comparatively small, and in form an oblong square (a *Londinium quadratum*), its exact situation must be a matter of conjecture. The late Mr. Arthur Taylor marked out a district which should be bounded on the west by the Walkbrook, on the east by Billingsgate, and on the south by the elevation of the bank of the Thames, as the northern boundary to be a line drawn below Lombard Street and Cornhill. Cannon Street and East Cheap would pass straight through the centre of this enclosure, with the other streets north and south (*Archæologia*, xxxii. 101). In corroboration of his views, Mr. Taylor points to the fact that no funeral urns have been discovered in the district he has marked out. Mr. Roach Smith agrees generally with Mr. Taylor, but includes a rather larger area. He writes—"I should be inclined to place the northern wall somewhere along the course of Cornhill and Leadern-hall Street; the eastern in the direction of Billings Street and Mark Lane; the southern, in the line of Upper and Lower Thames Street; and the western, on the eastern side of Walkbrook. This suggested plan will give the form of an irregular square, in about the centre of each side of which may be placed the four main gates corresponding with Bridge Gate, Ludgate, Bishopsgate, and Aldgate" (*Ibid.*, *Journal of London*, p. 14). The late Mr. W. H. Black, like his predecessors, takes the Walkbrook as a boundary, but, instead of making it the western limit, he makes it the eastern boundary, and places his western line at Ludgate. Newgate Street and Chispaide form the main thoroughfare of his city (*Archæologia*, xi. 41). Although Mr. Black argues his case with ability, his view is open to two principal objections,—(1) it leaves the site of London Bridge outside the enclosure, and (2) cemeteries have been

discovered within the proposed limits. As to the date when the hints of this early London were lost sight of in the larger area of the better known Roman city, we have hardly sufficient data even to hazard a conjecture. There is reason to believe, as already stated, that the site of the Royal Exchange was outside the city until the early part of the 3d century, because coins of Vespasian, Domitian, and Severan have been found among the refuse of this gravel-pit. Mr. Roach Smith suggests, however, that as no coins of the period between Domitian and Severan were found it is just possible that the plated denarius of the latter emperor may not have been found in the pit itself, but in the vicinity of the house which was built over the pit in subsequent years. On the other hand, Sir William Tite, in describing the tessellated pavement found in 1854 on the site of the Excise Office (Bishopsgate Street), expresses the opinion that the finished character of the pavement points to a period of security and wealth, and fixes on the reign of Hadrian (117-138 A.D.) to which the silver coin found on the floor belongs, as the date of its foundation. Of course this is not conclusive, as the pavement might have belonged to a villa outside the walls, but Sir William Tite places it within them. When the line of the walls which continued until the great fire was first planned out it is impossible to say with any certainty. Some antiquaries hold the opinion that these walls were post-Roman, but this is not the view of Mr. Roach Smith, one of our greatest authorities. Mr. J. E. Prie, after describing "a bastion of London wall" discovered in Canonio Street, Bishopsgate, arrives at "the conclusion that these interesting relics are portions of a Roman sepulchral monument which, falling into decay, became as years rolled on, a suitable quarry for medieval builders, providing from its position on the spot convenient materials for the erection of a structure requiring such solidity and strength as would a bastion to the city wall." In describing the outline of the Roman city it is impossible to make ourselves intelligible unless we use names adopted subsequently. The line of the wall runs straight from the Tower to Aldgate, where it bends round somewhat to Newgate.

It is bordered on the east by the Minors and Houndsditch. One of the finest remaining portions of the old wall was hidden from view a few years ago when some large houses were pulled down. It is the line from Bishopsgate now eastward to St. Giles's churchyard, where it turned to the south, as far as Falcon Square, again westerly by Aldgate against Clime's Hospital towards Giltspur Street, then south by Ludgate, and then down to the Thames. Mr. Roach Smith points out that the enormous gate which guarded the city from the east, known as the *Æliæ* gate, was built in 1848 a portion of the old wall was exposed to view in Playhouse Yard, Blackfriars, when a Roman monument erected to a "speculator" of the second legion, named *Celms*, was discovered. On the same line further north Sir Christopher Wren, while building St. Martin's, Ludgate, found a similar sepulchral monument "in the valley of the prætorian camp" to the memory of *Virianus Marcianus*, a soldier of the second legion (*Parvula*, p. 268). In the year 1275 the old wall south of Ludgate was pulled down and a new one built to enclose a larger circuit further west for the benefit of the Black Friars. There appear to be strong reasons for believing that a wall ran along the south, and that the Romans did not consider the river sufficient protection. William Fitzstephen, a monk of the 12th century, who wrote the earliest description of London, mentions the walls and tower in the south, and Sir Christopher Wren also alludes to the colony being walled near the Thames (*Parvula*, p. 264). The line from Lower Thames Street to Temple Street has been retrieved from the river by embankments, and in certain parts of the line the embankment was formed by substantial walling, such being found at the foot of Fish Street Hill, at the end of Queen Street, and from Broken Wharf to Lambeth Hill (*Tithe*). The *Æliæ* gate, as previously found at the Excavation at the *Æliæ* Exchange, 1848, p. xxiv). Mr. Roach Smith writes—"It was from 8 to 10 feet thick, and about 8 deep, reckoning the top at 9 feet from the present street level, and composed of ragstone and flint, with alternate layers of red and yellow, plain and curved-edged tiles, cemented by mortar and laid as the whole of the wall, which could not be separated. For the foundation strong, oaken piles were used, upon which was laid a stratum of chalk and stones, and then a course of heavy sandstones from 2 to 4 feet long, by 2½ in width" (*Archæologia*, *Journal*, i. 114). The names of the gates give us no clue as to which of them was the chief gate. Mr. Roach Smith does not doubt that the chief traffic was carried through the city from Ludgate to Aldgate, although some antiquaries have supposed that Newgate was the chief gate on the west side, leading as it would to Holborn, where Roman remains have been discovered. Bishopsgate must have been the principal gate on the east. Mr. Roach Smith has suggested the outside Newgate there was an amphitheatre built into a hill on the rising ground near what was lately the Little Old Bailey. He had often noticed the precipitous descent from Green Arbor Lane opposite Newgate into Sconcel Lane and the level space by Fleet prison, and he presumed to have been an excavation in the side of the hill, and that a smaller town than Londinium possessed a theatre in Roman times (*Middle-*

¹ A chronological list of the tessellated pavements discovered in London between 1851 and 1864 is given in a paper of the late Sir William Tite (*Archæologia*, vol. xlviii. p. 464). It is impossible to say how much more remains hidden many feet below the modern streets.

see *Arch. Trans.*, i. 33). The name Newgate is significant of its recent erection, and it has been remarked that it stands alone among the gates as not being attached to a ward bearing the same name. It is mentioned in an ordinance of Edward I., where it is connected with Ludgate.

A question arises as to the arrangement of the area included within the walls, the course of which has already been traced. There is a strong preponderance of evidence against the belief that the present line of streets follows that of Roman London to any considerable extent. Sir William Tite gave reasons for believing that Bishopsgate Street was not a Roman thoroughfare (*Archæologia*, xxvii. 293), and the late excavations in Leslie's Mill Mr. Loftus Brock found remains of a building which he supposed to be a basilica, apparently crossing the present thoroughfare of Gracechurch Street. Sir William Tite agreed with Dr Skeyley's suggestion that on the site of the Mansion House (formerly Stocks market) stood the Roman forum, and he states that a line drawn from that spot as a centre would pass by the pavements found on the site of the Exchequer Office. Besides the forum, Dr Skeyley suggested the sites of seven other public buildings,—the *Ara Palatina*, guarding the south-eastern angle of the city, where the Tower now stands, the grove and temple of Diana on the site of St Paul's, an episcopal residence, &c. No traces of any of these buildings have been found, and they are therefore purely conjectural. As to the temple of Diana, Wren formed an opinion strongly adverse to the old tradition of its existence (*Panthecon*, p. 266). Although we know that the Christian church was established in Britain during the later period of Roman domination, there is no reason to believe, as Mr. Loftus Brock has done, that the Bishop of Exeter who is said to have attended a council on the Continent is a somewhat mythical character.

After the walls the most important points for consideration in relation to Roman London are (1) the existence of a bridge, and (2) the purposes of the London Stone.

1. Dion Cassius, who lived in the early part of the 3rd century (*Hist. Rom.*, lib. ix. c. 20), states that there was a bridge over the Thames at the time of the invasion of Claudius (43 A.D.), but he places it a little above the mouth of the river ("higher up"). The position is vague, but, as already stated, the mouth of the Thames in these early times considered as not far from where the London Bridge now stands. Sir George Aylly holds that this bridge was not far from the site of London Bridge (*Proceedings of Institute. Civil Engineers*, xlix. 120), but Dr Guest was not prepared to allow that the Britons were able to construct a bridge over a tidal river such as the Thames, and he is of opinion that the difference of level at high and low water of nearly 50 feet. He therefore suggested that the bridge was constructed over the marshy valley of the Lea, probably near Stratford. It needs some temerity to differ from so great an authority as the late Dr Guest, but it does strike one as rather surprising that, having accepted the fact of a bridge made by the Britons, he should deny that these Britons possessed a town or village in the place to which he supposes that Antius Plautius retired. It may be considered certain that there was no bridge over the Thames in the time of Julius Cæsar; for he would not have marched his troops all the way to Coway Stakes in search of a ford if he could have crossed by a bridge at London.

As the Welsh word for "bridge" is "pont," and this was taken directly from the Latin, the inference is almost conclusive that the Britons acquired their knowledge of bridges from the Romans. Looking at the stage of culture which the Britons had probably reached, it would be further a natural inference that there was no bridge anywhere in Britain before the Roman occupation, but, if Dion's statement is correct, it may be suggested as a possible explanation that the increased intercourse with Gaul during the hundred years that elapsed between Julius Cæsar's raids and Claudius Cæsar's invasion may have led to the construction of a bridge of some kind, some 300 yards wide, at this point, through the influence and under the guidance of Roman traders and engineers. If so, the word "pont" may have been borrowed by the Britons before the commencement of the Roman occupation. Much stronger are the reasons for believing that there was a bridge in Roman times. Remains of Roman villas are found in Southwark, which was evidently a Roman station, and it is therefore hardly seem likely that a bridge-building people such as the Romans would remain contented with a ferry. Mr. Roach Smith is a strong advocate for the bridge, and remarks, "It would naturally be erected somewhere in the direct line of road into Kent, which I cannot but think pointed towards the site of Old London Bridge, both from its central situation, from the general absence of the foundations of buildings on the approaches on the northern end, and from discoveries recently made in the Thames on the line of the old bridge" (*Archæologia*, xlix. 120). Mr. Smith has, however, still stronger arguments, which he states as follows:—"Throughout the entire line of the old bridge, the bed of the river was found to contain ancient wooden piles; and, when these piles, subsequently to the erection of the new bridge, were pulled up to deepen the channel of the river, many thousands of Roman coins, with a small

ance of broken Roman tiles and pottery, were discovered, and immediately beneath some of the central piles brass medallions of Aurelius, Faustina, and Commodus. All these remains are indicative of a bridge. The enormous quantities of Roman coins may be accounted for by consideration of the well-known practices of the Romans to mark these imperishable monuments subservient towards perpetuating the memory, not only of their conquests, but also of those public works which were the natural result of their successes in remote parts of the world. They may have been deposited either upon the building or repairs of the bridge, as well as upon the accession of a new emperor" (*Archæologia*, xlix. 120). The "London Stone" has very generally been supposed to be a "milliarum" or central point for measuring distances, but Sir Christopher Wren believed it was part of some more considerable monuments in the forum, and his reason for this belief was that "in the adjoining ground on the south side (upon digging for cellars after the great fire) were discovered some tessellated pavements and other extensive remains of Roman workmanship and building" (*Panthecon*, pp. 265, 266). King, in his *Monuments Antiquæ*, writes—"London Stone, preserved with such reverential care through so many ages, and now having its top encased within another stone in Cannon Street, was plainly deemed a record of the highest antiquity of the still more important kind; though we sit at present unacquainted with the original intent and purpose for which it was placed. It is lived at present close under the south wall of St Swithin's Church, but was formerly a little nearer the channel facing the same place, which seems to prove its having had some more ancient and powerful designation than that of having been a Roman military station, as it was ever used for that purpose afterwards. It was lived deep in the ground, and is mentioned so early as the time of Attilian, king of the West Saxons, without any particular reference to its having been considered as a Roman military stone." Hollnhead (who was followed by Shakespeare in *2 Henry IV.*, act 4. sc. 6) tells us that when Cæsar, in 43, landed, he was very near London, he first of all proceeded to London Stone, and having struck his sword upon it, said in reference to himself and in explanation of his own action, "Now is Mortimer lord of this city." Mr H. C. Coote, in a paper published in the *Trans. London and Middlesex Arch. Soc.* for 1876, points out that this act meant something to the mob who followed the rebel chief, and was not a words of foolish acting. Mr G. L. Gomme (*Primitive Folk-Loose*, pp. 156, 156) takes up the matter at this point, and places the tradition implied by Cæsar's significant action as belonging to times when the London Stone was, as other great stones were, the place where the suits of an open-air assembly assembled to gather together and discuss the affairs of the government of the city. Corroborative facts have been gathered from other parts of the country, and, although more evidence is required, such as we have is strongly in favour of the supposition that the London Stone is a prehistoric monument.

Saxon (449-1066).—At the beginning of the 5th century the Roman legions left Britain. From this period to the arrival of the Saxons there was a space of time when the Britons were left alone, and there is no reason to believe that London craved to be the important commercial town which it had grown to be. After the Saxon invasion we do not hear of the city being ravaged, and it possibly held its own under the various vicissitudes it had to pass through, although Dr Guest writes this "good reason may be given for the belief that even London itself for a while lay desolate and uninhabited" (*Archæologia*, xix. 219). About 449 or 450 the invaders first settled in Britain, and in 467 Hengist and Æsc fought against the Britons at Owerford, driving them out of Kent. The vanquished fled to London in great terror, and spent the winter of 467 there. The Saxons disliked walled towns, and in many instances they destroyed those which they conquered. "This was not done in London, and it is just possible that the Britons may have been able to purchase their freedom from destruction. We have, however, little or no data upon which we can form an opinion. Mr Kenble writes of towns generally that the Saxons neither cared to take possession of them nor took the trouble to destroy them. They enslaved the inhabitants or expelled them, as a necessary precaution and preliminary to their own peaceable possession" (*Saxons in England*, i. 295). The only question is whether London, being an exceptional city, had an exceptional fate. Along the banks of the Thames are several small havens whose mounds have remained to us, such as Rotherhithe, Lambeth (Lambeth), Chelmsford (Chelms), and it is not unlikely that the Saxons who would not settle in the city itself associated himself with these small open ports. Fleets were thus founded over a large space which otherwise might have remained unsettled. At what time the

1. If the London-burg here mentioned in the Saxon Chronicle is not London itself of the Thames (or Southwark), the fugitives must have crossed the river, and if it is in addition reason for believing that there was then a bridge. The same reason will apply to whether the fugitives crossed the river to Surrey in the year 881, as it is not likely that a ferry would suffice on these occasions. Moreover, a bridge is shortly after specially mentioned by the

Saxons got over their repugnance and settled in London we cannot say, but the city is described by Bede as being in 604 the metropolis of the East Saxons, and an emporium of many peoples who came to it by sea and land. The riches of Roman London are, as we have already seen, very numerous, but we know nothing of the inhabitants. There is little human interest in the history.

When we come to Saxon London this position is reversed. There are no remains worthy of notice, but there is abundance of life. London appears to have held a very exceptional position, and to have been somewhat like a German free city. The Londoner within his strong walls defied the invader, and the Danes frequently attempted to conquer the city in vain. Mr. Freeman does justice to the stout heart of the Londoner, and calls London during this period "the stronghold of English freedom." The Saxon Chronicle has little to tell of London between the 6th and 9th centuries. The great change accomplished by Augustine in converting the Jutes and the Saxons to Christianity, is recorded in a few short lines, and we are told that in the year 604 Augustine consecrated two bishops, Mellitus and Justus, and that Ethelbert, king of Kent, gave Mellitus a bishop's see at London, then a part of the kingdom of the East Saxons, whose king, Suibert, was a tributary of his uncle the king of Kent. What blessing of the cathedral with us may suppose to have existed in London during the Saxon period we cannot tell, but we may guess that it was destroyed by the heathen Saxons. Bede records that the church of St Paul was built by Ethelbert, and from that time to this a cathedral dedicated to St Paul has stood upon the hill looking down on Ludgate. Mellitus became archbishop of Canterbury, and was succeeded by the sea of London by Ceolun, who was succeeded by Wina. Then came Theodore, archbishop of Canterbury, better known as the sainted Erkenwald, whose shrine was one of the chief glories of old St Paul's. He died on April 30, 690, a day which was kept in memory in his cathedral by special service. We must now pass over nearly a century and a half to the time when the Danes were harassing the country after the death of Egbert. The chronicle records that in the year 830 there was a great slaughter at London, but he gives no particulars. In 851 the Danes plundered the city and made themselves masters of it. Simon Turner quotes a conveyance of a place in London dated 857, which gives a slight piece of local information (*Anglo-Saxons*, p. 575). The name of the place was Colmaningehagen, and it was situated not far from the West Gate. We cannot tell whether Ludgate was meant or some other gate which marked the extent of the liberties on the west. In 871 the Danes, rebuffed at London, made great battles against the Danes in the kingdom south of the Thames, and that the West Saxons made peace with them. In the next year the Danes went from Reading to London, and there took up their winter quarters. Then the Mercians made peace with them. In 886 Alfred overcame the Danes, rebuffed at London, to the northwest, repulsed, it will, remember, the city to Merca, and committed it to Ethelred, alderman of Mercia. Then, as the chronicler writes, "all the Angle race turned to him [Alfred] that were not in bondage of the Danish men." In 890 the Londoners came off victorious in their encounters with the Danes. The king obstructed the river so that the enemy could not bring up their ships, and they therefore starved. The Londoners broke up some, and brought the strongest, and best to London. In 912 Ethelred, the alderman of the Mercians, who had been placed in authority by Alfred, died, and Edward the Elder took possession of London and Oxford, "and all the land which then belonged to him." Again we find a break in the continuity of the history, and pass on to the year 958, when King Edgar gave Dunstan the bishopric of Worcester, and afterwards that of London. In 992 there was a great fever and mortality in London, and St Paul's was burnt. It was, however, founded again in the same year. In the reign of Ethelred III. the Danes were more successful in their operations against London, but the inhabitants resisted stoutly. Snorro the Icelandic tells us that the Danes fortified Southwark with ditch and rampart, which the English assailed in vain. In 982 London was burnt, and in 994 Olaf and Swen (the father of Canute) came with ninety-four ships to besiege it. They tried to set the city on fire, but the townsman did them more harm than they "ever wowed." The chronicler proudly adds that "the holy Mother of God on that day manifested her mercy to the townsmen, and delivered them from their foe." The Danes went from the town and ravaged the neighbourhood, so that in the end the king was but witan agreed to give the enemy thousand pounds to be relieved of the presence of the enemy. In the year 1000 the Danes frequently attacked London, but they had no success, and failed ill in their attempts. The Londoners withstood Swen in 1013, but in the end they submitted and gave him hostages. Three years after this, Ethelred died in London, and such of the witan as were left fled to the townsmen chose Edward Ironside for king, although the witan outside London had elected Canute. Canute's ships were then at Greenwich on their way to London, where they soon afterwards arrived. The Danes at once set to work to dig a great ditch by Southwark, and then dragged their ships through to the west side of the bridge. They were able after

thus to keep the inhabitants from either going in or out of the town. In spite of all this, after fighting obstinately both by land and by water, the Danes had to raise the siege of London, and take the ships to the river Orwell. After a glorious reign of seven months Edmund died in London, and Canute became master of England. The tribute which the townsmen of London gave to Canute, 500,000, was about one-seventh of the amount which was paid by all the rest of the English nation. This shows the growing importance of the town. From this time there appears to have been a permanent Danish settlement in London. There is but little more to be said of the history of Saxon London than that Edward the Confessor had his witan assembled there, and built and consecrated a Abbey of Westminster. During the latter part of the Saxon period Westminster (originally Thorney Island) had been growing into some importance. Tradition affirmed that on the site of Westminster Abbey a temple of Apollo once stood, which was destroyed by an earthquake in the reign of the emperor Antoninus Pius. Out of the ruins King Lucius founded a church, 170 A.D. Sir Christopher Wien imagined that the monks, finding that the Londoners pretended to a temple of Diana where St Paul's now stands, did not wish to be behind hand in antiquity (*Peregrinations*, p. 266). The fragment respecting King Lucius is of about equal authority. There is no real reason for believing that Suibert, king of the East Saxons, may have built, as Stow says he did, "a church to the honour of God and St Peter, on the west side of the city of London." His sons reigned into idleness, and left the church to the mercy of the Danes. In a charter of King Edgar, dated 961, the original boundary of the church is clearly defined. This charter is marked by Kemble as doubtful (*Codex Dipl.*, 413x), but, if not of the date given, it is believed by competent authorities to be of great antiquity. Edward the Confessor took a particular interest in Westminster, and occupied much time in superintending the restoration of the church there. On Christmas day (December 28) 1065 the monastery was consecrated, and on the following "twelfth mass eve" the king died, being buried on the next day in the new church. The abbey of Westminster's manor is fully described in Domesday, but there is no mention of a palace, so that it has been conjectured that the Confessor lived in the monastery itself. With regard to the buildings of London we are left in the dark. As several of the Saxon kings lived in the city, we must conclude that they possessed a palace of some kind, and around the other buildings would arise. A port such as London naturally drew foreigners from all parts, and various communities of these strangers are believed to have been settled here as early as the reign of Alfred. As regard to the government of the city it is generally supposed that many of its institutions are due to Alfred the Great, although Mr. Coote with great ingenuity traces them back to the ordinances of the Roman *mundiculiarii*. The famous domes of the city of London are believed to have been erected by the king after the conquest. The bishop and the reeve belonged to London. William the Conqueror's charter, which he granted soon after his accession, is addressed to William the bishop and Godfrey the portreeve. The office of portreeve had then been long established, although we know but little of its origin. It was usually an office of popular election, but the king often interfered in the appointment. Considerably more than a century had elapsed after this Conquest before the title of portreeve gave way to that of mayor, as the designation of the chief officer of the city of London.

NORMAN (1066-1154).—After the battle of Hastings certain of the defeated chiefs retired upon London and urged the men in power to resist the Norman, and set up Edgar Atheling as king, which, as the Saxon chronicler says, "was indeed his natural right." On hearing of this action William marched towards London, and was attacked by the Saxon party at Southwark, where they were repulsed by the Norman horse, but with such loss to the latter that William thought it imprudent to lay siege to the city at that time. The Londoners began now to see the hopelessness of their cause, and Archbishop Eldred, and Edgar, and Eadric Elwin and Morcar, and "the best men of London" repaired to Berkhamstead, where they submitted themselves and swore fealty to the conqueror. One of the earliest acts of the Conqueror was to organize the erection of a citadel which should overcome the citizens and give him the command of the city. Some writers have supposed that King Alfred erected a palace or castle on the site of the Tower, but without sufficient authority, and a writer in the *Quarterly Review* (2d. Middlesex, vol. cl. p. 48 note) says, "the Tower almost certainly stands on foundations which was not dry land before the Conquest." As the Tower was situated at the eastern limit of the city, so not far from the western extremity was built a strong fortification called Baynard's Castle after its founder Baynard, one of the followers of the Conqueror. In the second year of his reign William granted the remarkable charter written in Anglo-Saxon which still exists among the archives of the city of London. There are but four lines and a quarter, and the size of the slip of parchment is only 6 inches by 1 inch. It runs thus—"William the king greets William the bishop, Godfrey the portreeve, and all the burgesses within London, both French and English. And I grant them

they be all law-worth, as they were in Edward the king's days. And I will that each child be his father's heir after his father's days. And I will not suffer that any man do you wrong, God keep you." William Sugard, the bishop of London, was a Norman, and possibly had some influence with the king in obtaining this charter. A wonderful improvement in the appearance of the state of the country almost immediately followed the advent of the civilizing Norman. Within a few years the whole area of London must have been changed, and handsome buildings arose as if by magic in all parts of the city. Many Normans had settled in London during the reign of Edward the Confessor, but after the Conquest they swarmed in, and naturally became the dominant party. In August 1077 occurred a most extensive fire, such a one, says the Chronicle, as "never was before since London was founded." This constant burning of large portions of the city is a marked feature of its early history, and we must remember that, although stone buildings were rising on all sides, these were churches, monasteries, and other public edifices; the ordinary houses remained as before, small wooden structures. The White Tower, the famous keep of the Tower of London, was commenced by Gundulph, bishop of Rochester, about the year 1078. In 1083 the old cathedral of St Paul's was commenced on the site of the church which Eadbert is said to have founded in 610. But four years afterwards the chronicle tells us "the holy monastery of St Paul, the episcopal see of London, was burnt, and many other monasteries, and the greatest and fairest part of the whole city." In this same year (1087) William the Conqueror died. In 1096 a tremendous hurricane passed over London, and blew down six hundred houses and many churches. The Tower was injured, and a portion of the roof of the church of St Mary-le-Bow, Chancery, was carried off and fell some distance away, being forced into the ground as much as 20 feet, a proof of the badness of the thoroughfares as well as of the force of the wind. William Rufus inherited from his father a love for building, and in the year 1087 he exacted large sums of money from his subjects with the object of carrying on some of the unled takings he had in hand. These were the walling round of the Tower, the rebuilding of London Bridge, which had been almost destroyed by a flood, and the erection of the great work with which his name is most generally associated, Westminster Hall. In 1100 Rufus died, and Henry I. was crowned as his successor. This king granted to the citizens their first real charter, in which he promised to observe the laws of the Conqueror and to redress many special grievances; but he paid little attention to his engagements, and constantly violated the articles of his charter. In 1116 he died, and his son Matilda, the wife of Henry I., he tried unsuccessfully to obtain the support of the people of London. He published a charter confirming in general terms the one granted by Henry, and commanding that the good laws of Edward the Confessor should be observed. The citizens, however, did not obtain their object, and the next year, in the year 1119 they paid Stephen one hundred marks of silver to enable them to choose their own sheriff. In this reign the all-powerfulness of the Londoners is brought very prominently forward. Stephen became by the shifting fortunes of war a prisoner, and the empress Matilda sought, if she had had the wisdom to favour the enemies, who soon afterwards replaced Stephen upon the throne. She, however, made them her enemies by delirring on the office of justiciary of London and the sheriffdom to her partisan Geoffrey, earl of Essex, and attempting to reduce the citizens to the enslaved condition of the rest of the country. This made her influential enemies, who soon afterwards replaced Stephen upon the throne. The Norman era closes with the death of Stephen, 1154.

We have already alluded to the great number of ecclesiastical foundations which marked the Norman period, and will here note some of the chief of these, to show how completely the new buildings must have changed the whole appearance of London, and raised it from a mean congregation of houses to the rank of a city having features of considerable architectural merit. The college of St Martin-le-Grand within Aldersgate was founded in the year 1058, and its rights were confirmed by the Conqueror in the second year of his reign. He gave to the whole appearance more land, and was added to their privileges. A monastery of the Benedictine order, dedicated to St Leonard, near Bromley, was founded in the reign of William the Conqueror by William, bishop of London, for a priory and nine nuns, and in Stephen's reign Sir William Mortmetcher founded an abbey of the same order at Langton, which was subsequently known as West Ham Priory. In 1083 a convent of nuns was dedicated to St Saviour was founded at Bermondsey by Alvin Ould, a wealthy citizen, and seven years afterwards some Cistercian monks came from France and settled in the new convent, of which one of them was chosen the first prior. In 1094 William Rufus added the manor of Bermondsey to the other possessions of this fortunate monastery, which became very powerful, and was frequently used as a royal residence. At Clerkenwell two religious houses were established in the year 1100, viz., the Knights Hospitallers of St John of Jerusalem and the priory of St Mary for nuns of the Benedictine order. It was said that the number of monasteries built in the reign of Henry I. was so great that almost all the labourers became

bricklayers and carpenters, and there was some discontent in consequence. Matilda or Mand, the wife of Henry I., was much interested in the foundation of those religious houses. She established the priory of Holy Trinity, called Christ Church, which was situated to the north of Aldgate, in 1108, and about 1110 two hospitals, one for lepers at St Giles-in-the-Fields, and the other for cripples at Chigwell. The priory of St Bartholomew was founded a few years earlier, and the Benedictine nunnery of St John the Baptist at Halliwell near Shoreditch soon afterwards. The Knights Templars made their first habitation in the neighbourhood of London in 1118, and did not remove from Holborn to Fleet Street until nearly seventy years afterwards. The royal hospital of St Katherine's at the Tower was originally founded by Matilda, wife of King Stephen, and the famous St Stephen's chapel at Westminster owes its origin to the king himself. It was, however, rebuilt by Edward I. It will be seen from the above list that a large proportion of those buildings were outside the walls, and this shows how extensive the outskirts of the city had become in Norman times. No doubt many of these religious persons sought out somewhat quiet neighbourhoods, but almost each of them would naturally grow up villages formed by those who were chiefly dependent upon the monks and nuns.

PLANTAGENET (1154-1485).—Henry II. appears to have been to a certain extent prejudiced against the citizens of London on account of their attitude towards his mother, and he treated them with some severity. On several occasions he exacted large sums from the city, which, although they were economically styled *taxes*, cannot be considered as free gifts. The severity applied to be very necessary, and was attended with good results. The streets were in a most dangerous condition at night, and bands of a hundred and more would sally forth to rob the houses of the wealthy. In 1175 some of these men were taken prisoners, and one of them was found to be a citizen of good credit and considerable wealth named "John the Old." He offered the king five hundred marks for his life, but Henry was inflexible, and after the man had been hanged the city became more quiet. In 1176 the rebuilding of London Bridge with stone was commenced by Peter of Colchester. This was the bridge which after much subsequent repair was pulled down early in the present century, and consisted of twenty stone arches and a drawbridge. There was a gateway at each end and a chapel or crypt in the centre, dedicated to St Thomas of Canterbury, in which Peter of Colchester the architect was buried in 1205. In 1184 the Knights Templars removed from Holborn to the Temple, and in the year 1190 and in the following year the beautiful Temple church was built. All this activity of building proves that the citizens were wealthy and their city handsome. This is corroborated by the interesting work of Fitzstephen, the monk of Canterbury, which was written at this time. Fitzstephen has left us the first picture of London, and a very vivid one it is. He speaks of its wealth, commerce, grandeur, and magnificence—"of the multitude of the climate, the beauty of the gardens, the sweet, clear, and salubrious springs, the flowing streams, and the pleasant clack of the water-mills. Even the vast forest of Middlesex, with its densely wooded thickets, its covets of game, stags, fallow deer, boars, and wild bulls is pressed into the description to give a contrast which shall enhance the prosperous beauty of the city itself. Fitzstephen's account of the sports of the people is particularly interesting. He tells how, when the great marsh that washed the walls of the city on the north (Moonhede) was frozen over, the young men went out to slide and skate and sport on the ice. Skating had, in fact, been dug up of late years in this district. This sport was allowed to fall into disuse, and was not again prevalent until it was introduced from Holland after the Restoration. In the first year of Richard I. the court of aldermen ordained that for the future houses should not be built of wood, but that they should have an outside wall of stone raised 16 feet from the ground, and be covered with slate or baked tile. This ordinance must have fallen into desuetude, for the houses continued largely to be built of wood. We learn that most of the houses were plastered and whitewashed. One of the earliest objections which the Londoners made to the use of sea-coal was that the smoke from it darkened the walls of their buildings. The first mayor of London was Henry Fitz Alwin, who was elected in 1159, and held the office until 1212.

London had to pay heavily towards Richard's ransom; and, when the king made his triumphal entry into London after his release from imprisonment, a German mobster in said to have remarked that had the emperor known of the wealth of England he would have insisted on a larger sum. The Londoners were the more glad to welcome Richard back in that the hand of the regency, Longchamps, bishop of Ely, was very unpopular from the encroachments he made upon the city with his works at the Tower. The first charter by which the city claims the jurisdiction and conservancy of the river

It was first admitted to the chief magistracy as bailiff, and there appears to have been a considerable variety in the titles which were given to the office. The *Liber Albus* that the chief officer was sometimes called "Justice" and "Judge-bailiff."

Thames was granted by Richard I. John granted several charters to the city, and it was expressly stipulated in Magna Charta that the city of London should have all its ancient privileges and free customs. The citizens opposed the king during the wars of the barons. In the year 1215 the barons having received intelligence secretly that they might enter London with ease through Aldgate, which was then in a very unwarlike state, removed their camp from Bedford to Ware, and shortly after marched into the city in the night-time. Having succeeded in their object, they determined that so important a gate should no longer remain in a defenceless condition. They therefore spoiled the religious houses and robbed the monastery colleges in order to have money wherewith to rebuild it. Much of the material was obtained from the destroyed houses of the unfortunate Jews, but the stone for the bulwarks was obtained from Caen, and the small bricks or tiles from Flanders. The church of St Mary Overy (now St Saviour's), Southwark, was begun in the year 1309, and in 1321 the foundation stone of the holy chapel at Westminster Abbey was laid by Henry III. We have alluded to the great change in the aspect of London and its surroundings made during the Norman period by the establishment of a large number of monasteries. A still more important change in the configuration of the interior of London was made in the 13th century, when the various orders of the friars established themselves there. The Bonaventuran monks preferred secluded sites; the Augustinians did not cultivate seclusion so strictly; but the friars chose the interior of towns by preference. The Black, Preaching, or Dominican Friars settled near Holborn, in what was afterwards Lincoln's Inn, in 1221, and removed to the ward of Castle Buryard in 1278, where the city wall was rebuilt to enlarge their boundaries. The district where the friary was built still retains its name. In 1234 John Iwyn or Ewan made over to the Grey Friars (or Franciscans) an estate situated in the ward of Farringdon Within and in the parish of St Nicholas in the Shambles, and on this site the first convent of the order was erected. The site is now occupied by the Blue Coat School. In 1341 the White Friars or Carmelites settled in a precinct or liberty between Fleet Street and the Strand which still retains their name. In 1563 the Austin Friars or Friars Eremites were founded in Broad Street ward, and the last of these houses to be established was that of the Grey or Carmelite Friars in 1598. By the establishment of these religious houses two thirds of the entire area of London was occupied by convents and hospitals. This is the most marked characteristic of Plantagenet London. We have no record of the date at which Temple Bar first marked out the extent of the liberties of the city, but the date of the establishment of the century Fleet Street was described as being in the suburbs. During the Norman period the road from the city to Westminster was quite open, but soon afterwards a commencement was made in building. The Savoy was built in 1245 by Peter, earl of Savoy and Richmond, uncle of Eleanor, wife of Henry III., and in the king's reign the Friars of the order of St Mary de Aroua are supposed to have established themselves near the site of Durham House (now the Adelphi). About the same time William Marshal, earl of Pembroke, founded and endowed a hospital and convent called St Mary Komersall at the village of Chiswick, so that in Henry III.'s reign there must have been several houses on the line of route to Westminster. Fitzstephen describes the latter place as follows:—"On the west also, higher up the bank of the river, the royal palace rears its head, an incomparable structure, furnished with a breastwork and bastions, situated in a populous suburb at a distance of two miles from the city." In the reign of Edward I. the king offended the king and the citizens were for a time deprived of their right of electing their chief magistrate. Gregory de Rokesley the mayor, the sheriffs, the aldermen, and other dignitaries of the city were summoned to appear on the 29th June 1285 before John de Kirkby, treasurer, and the other justifiers of the king in the Tower of London for the purpose of holding inquiries there. Now the mayor held that he was not bound to answer such a summons as this unless he had forty days' notice, so he resigned his mayoralty at Allhallows, Barking, and delivered the common seal of the city to Stephen Aysn and other aldermen, and then entered the Tower with the rest as an exile only. This action incensed the king greatly, and John de Kirkby was commanded to take over the mayoralty, a warrant being appointed by the royal authority. This arrangement continued until 1297, when Edward granted the prayer of the citizens, and allowed them again to elect a mayor. Royal wardens had filled the mayor's seat from 1046 to 1285, but the first charter of Edward in the following concession was made:—"Also that the liberties of the city of London shall not be taken into the hand of his lordship the king for any personal trespass or personal judgment of any officer of the said city; and that no warden shall in the same on such pretext be appointed." (*Charters of London*, edited by Riley, pp. 14, 15). In 1381 the first attempt was made to supply London with water artificially, and the great conduit in West Cheap (or Cheshide) was commenced. This led eastern, which was cisterned with stone, was supplied with water conveyed in leaden pipes from Tyburn. Soon afterwards a nobler building was erected in Cheshide. In 1390 the beloved Eleanor of Castile

died, and her husband erected stone crosses where her body had rested. Two of these crosses were in London, and there is some little difficulty in understanding why the two stations were so near each other. It has been suggested that the body really rested at St Paul's Cathedral. Cheshide Cross was erected by Michael of Cheshidebury, and cost £200, and Channing Cross, the most stupendous of the series, cost £450. It was commenced by Richard de Crundale, and completed after his death by Roger de Crundale. In this same year (1290) the Jews were expelled from England. The district in London in which they had lived since William the Conqueror's day came to be called the Old Jewry, but when the Jews returned to England after many centuries of exile most of them settled in the neighbourhood of Aldgate.

Smithfield is mentioned by Fitzstephen as a market for horses, and from this writer we obtain its correct etymology (the smooth field). As early as the reign of Henry III. it had become known as the place for executions. Close by a grove of elm trees that gave their name to the place Sir William Wallace was executed in the year 1305, and there also Mortimer experienced a similar fate five and twenty years afterwards. The history of Smithfield from that day has been a record of executions, jousts, and markets. In 1313 the celebrated order of the Knights Templar fell, and Edward II. gave their house in Fleet Street to Aymer de Valence, earl of Pembroke. At the earl's death the property passed to the Knights of St John of Jerusalem, who leased the Inner and Middle Temples to the students of the common law and the Outer Temple to Walter Stapleton, bishop of Exeter, and last treasurer. The Cheshidebury monks made on a piece of ground which had been used in 1849 as a burial-place for the thousands who died in that year of the plague. In 1371 Sir Walter Manny founded there a priory of Carthusian monks.

One of those pageants for which the streets of London were so famous took place in 1356 when Edward the Black Prince brought the French king John a prisoner from the battle of Poitiers. It is not necessary to do more than allude to this here, as the incident is a part of English history.

We have now arrived at the period of one of the greatest London-dances that ever lived. The life of Geoffrey Hamlyn, the man whose living interest around the several places with which he was associated. His father was a vintner in Thames Street, the garden of whose house was bounded by the Wall Brook. In 1374 Chaucer was appointed controller of the customs, and in the same year he went to live in the dwelling-house above the gate of Westminster. In 1380 he was appointed clerk of groves and waters in the Tower of London, and other places. In March 1390 we find him on the Thames bank repair commission, and in May of the same year he was employed in setting up scaffolds in Smithfield for Richard II. and his queen (Anne of Bohemia) to see the jousts at the place. His duties took him to the mews for the king's falcons at Cheshide Cross, and in 1390 he was robbed of some of the king's money on the high road at Westminster. We thus see that traces of the "morning star of English poetry" are to be found in all parts of London.

In 1381 another of the stirring incidents of English history occurred in London. The threatening usurpation of Wat Tyler was suppressed when the leader was killed by Sir William Walworth in Smithfield. Before that the rebels had done great damage to property in London and Southwark. About this time Henry was repulsed by Richard II. in 1387; the walls were carried up 2 feet higher, the windows were altered, and a new roof constructed. In 1411 the Guildhall was built, and the courts were removed from Aldermanbury.

During the troubles of the 15th century the authorities had seen the necessity of paying more attention to the security of the gates and walls of the city, and when Thomas Nevill, son of Thomas, Lord Fauconberg, made his attack upon London in 1471 he experienced a very spirited resistance. He first attempted to land from his ships in the city, but the Thames kids from Daynard's Castle to the Tower was so well fortified that he had to seek a quieter and less prepared position. He then set upon the several gates in succession, and was repulsed at all. On the 11th of May he made a desperate attack upon Aldgate, followed by 500 men. He won the bulwarks and some of his followers entered into the city, but the portcullis being let down there was cut off from the city, and the besieged fought their way against the rebels, who were soon forced to fly.

When Richard, duke of Gloucester, had his plans for seizing the crown, he obtained the countenance of the mayor, Sir Edmund Shute, whose brother Dr Shaw praised Richard at Paul's Cross. Croyly Hall, in Balphogate Street, then lately built, was made the lodging of the Protector. There he acted the accessible prince in the eyes of the people, for the last of the Plantagenets was another of the usurpers who found favour in the eyes of the masses of London. His day, however, was short, and with the battle of Bosworth ends Plantagenet London.

London continued to grow. In 1666 a conduit was constructed at Dowgate for the purpose of obtaining water from the Thames, and in 1589 Peter Moris, an ingenious Dutchman, brought his scheme for raising the Thames water high enough to supply the upper parts of the city under the notice of the lord mayor and aldermen, and in order to show its feasibility he threw a jet of water over the steeple of St. Magnus's Church (see p. 825). The maps show us much that remains somewhat the same as it was, but also much that has greatly altered. St. Giles's was literally a village in the fields. Popularly it was "the way to Bealinge," Oxford Street "the way to Uxbridge," Covent Garden an open field or garden, and Leicester Fields famous land. Moudfelds was a canal, and laid out in walks in Elizabeth's reign. At Spitalfields crowds used to congregate on Easter Monday and Tuesday to hear the Spital sermons preached from the pulpit cross. The ground was originally a Roman cemetery, and about the year 1676 bricks were largely made from the clayey earth, the mouldering of which is kept alive in the name of Brick Lane. Citizens went to Holborn and Bloomsbury for change of air, and houses were there prepared for the reception of children, invalids, and convalescents. In the north were sprinkled the outlying villages of Islington, Hoxton,

and Clerkenwell. The Strand was filled with noble mansions washed by the waters of the Thames, but the street, if street it could be called, was little used by pedestrians. Londons were frequented the river, which was then great highway. The banks were crowded with stairs for boats, and the watermen of that day answered to the charmen of a later date and the cabsmen of today. When Shakespeare and his companions went to see at the Globe Theatre they did not cross London Bridge, but took boat at Blackfriars Stairs, and were landed opposite at the Paris Garden Stairs on the Bankside. The Bankside was of old a favourite place for entertainments, but two only—the bull-baiting and the boat-racing—were in existence when Agassiz's map was first planned. On Norden's map, however, we find the gardens of Paris Garden, the boathouse, and the playhouse.

The settled character of the later years of Elizabeth's reign appears to have caused a considerable change in the habits of the people. Many of the chaf citizens followed the example of the courtiers, and built for themselves country residences in Middlesex, Essex, and Surrey, thus we learn from Norden that Alderman Roe lived at Mowell Hill, and we know that Sir Thomas Gresham built a fine house and planned a beautiful park at Osterley.



Norden's Map of Tudor London

STUART (1603-1714).—The Stuart period, from the accession of James I. to the death of Queen Anne, extends over little more than a century, and yet greater changes occurred during those years than at any previous period. The early years of Stuart London may be said to be closely linked with the last years of Elizabethan London, for the greatest men such as Raleigh, Shakespeare, and Ben Jonson lived on into James's reign. Much of the life of the time was then in the City, but the last years of Stuart London take us to the 18th century, when social life had permanently shifted to the west end. In the middle of the period occurred the civil wars and then the fire which changed the whole aspect of London. When James came to the throne the term suburbs had a bad name, as all those disreputable persons who could find no shelter in the city itself settled in these outlying districts. Then the line of the Strand was almost the only respectable outskirts. Stubbs denounced suburban gardens and garden houses in his *Anatomy of Abuse*, and another writer observed "how happy were men if they had no suburbs."

The preparations for the coronation of King James were inter-

rupted by a severe visitation of the plague, which killed off as many as 30,578 persons, and it was not till March 15, 1664, that the king, the queen, and Prince Henry passed triumphantly from the Tower to Westminster. The last mayor's show, which had been discontinued for some years, was revived by order of the king in 1609. The dissolved monastery of the Charterhouse, which had been bought and sold by the courtiers several times, was obtained from Thomas, earl of Suffolk, by Thomas Sutton for £15,000. The new hospital chapel and schoolhouse was commenced in 1611, and in the same year Sutton died. Somerset House was occupied by Anne of Denmark, and in 1616 James I. commanded it to be called Denmark House. In 1619 Inigo Jones commenced the Banqueting House at Whitehall, which was only part of a proposed vast palace, but which has remained to our time to be one of the chief ornaments of the town. The fatal vesper at Blackfriars threw a gloom over the year 1628. A large and mixed congregation of

¹ This map of London by Norden is dated 1698, as stated above. The same topographer published in his *Medicee* a map of Westminster as well as this one of the City of London.

Protestants and Roman Catholics had gathered together one Sunday evening at the house of Sir John, the French ambassador, to hear Father Drury (a converted Protestant) preach. As many as were able crowded into the room on the upper floor for that purpose, but those who could not get in were fain to remain on the floor below and listen to a preacher on the sacrament of penance. The floor both gave way, and a large number of persons were precipitated to the great depth and killed, both preachers being among the dead. With the death of James I. in 1625 the elder history of London may be said to have closed. During the reign of his successor the great change in the relative positions of London within and without the walls had commenced. Before going on to consider the third result of this change it will be well to refer to some features of the social life of London. Ben Jonson places one of the scenes of *Every Man in his Humour* in Moorfields, which at the time he wrote the play had lately been drained and laid out in walks. Beggars frequented the place, and travellers from the village of Horton, who crossed it in order to get into London and so with as much expedition as possible. Adjoining Moorfields were Finsbury Fields, a favourite practising ground for the archers. Mile End, a common on the Great Eastern Road, was long famous as a rendezvous for the troops. These places are frequently referred to by the old dramatists. Justice Shallow boasts of his doghouse at Mile End Green when he was Dogeant in Arthur's Show. Fleet Street was the show-place of London, in which were exhibited a constant succession of puppets, naked Indians, and strange fishes. The great meeting-place of Londoners in the day-time was the nave of old St Paul's. Crowds of merchants went to their hats on transacted business in the aisles, and used the font as a counter upon which to make their payments; lawyers received clients at their several pillars, and masterless serving-men waited to be engaged upon their own particular bench. Besides those who came on business there were galleed students in fashionable fustian, so that it was worth the student's while to stand behind a pillar and fill his table-books with notes. The middle or Mechtelmann aisle was the Paul's Walk, also called the Duke's Gallery from the erroneous supposition that the tomb of Sir Guy Beauchamp, earl of Warwick, was that of the "good" Humphrey, Duke of Gloucester. After the Restoration a fence was erected on the inside of the great north door to hinder a concourse of rude people, and when the cathedral was being rebuilt Sir Christopher Wren made a strict order against any profanation of the sacred building. Another of the favourite haunts of the people was the garden of Gny's Inn, where the choicest story-labourers in Chesapeake Road made the most of the elm trees which Bacon had planted, Pepps and his wife constantly walked. Mrs Pepps went on one occasion specially to observe the fashions of the ladies because she was then "making some clothes."

In those days of public conviviality, and for many years afterwards, the taverns of London held a very important place. The Bear's Head in Great Eastcheap was an inn of Shakespeare's own day, and the characters he introduces into his plays are really his own contemporaries. The "Mermaid" is sometimes described as in Broad Street, and at other times in Friday Street and also in Chesapeake. We are thus able to fix its exact position; for a little to the west of Bow Church is Broad Street, then come a block of houses, then Friday Street. It was in this block that the "Mermaid" was situated, and there appear to have been entrances from each street. What makes this fact still more certain is the circumstance that a haberdasher in Chesapeake Road was in Wood Street and Milk Street, two streets on the north side opposite Broad and Friday Streets, described himself as "over against the Mermaid tavern in Chesapeake." The Windmill tavern occupies a prominent position in the action of *Every Man in his Humour*. The Windmill stood at the corner of the old Jerry Leadenhall, and the Mitre close by the Mitre in the Strand. The Street. The Mitre in Fleet Street, so intimately associated with Dr Johnson, also existed at this time. It is mentioned in a comedy entitled *Love Alley* (1611), and Lilly the astrologer frequented it in 1640. At the Mermaid Ben Jonson may be supposed to have had such rivals as Shakespeare, Raleigh, Beaumont, Fletcher, Carey, Donne, Cotton, and Selden, but at the Devil in Fleet Street, where he started the Apollo Club, he was omnipotent. Herrick, in his well-known *Ode to Ben*, mentions several of the inns of the day.

Under James I. the theatre, which established itself so firmly in the latter years of Elizabeth, had increased its audience, and to the entertainments given at the many playhouses may be added the masques so expensively produced at court and at the inns of law. In 1615 "The Masque of Flowers" was presented by the members of Gny's Inn in the old Banqueting House in honour of the marriage of the Duke of York, and of Somerset, and the equally illustrious Lady Frances, daughter of the earl of Suffolk. The entertainment was prepared by Sir Francis Bacon at a cost of about £2000.

¹ Various changes in the names of the taverns are made in the folio edition of this play (1616) from the quarto (1611); thus the Mermaid of the quarto becomes the Windmill in the folio, and the Mitre of the quarto is the Star of the folio.

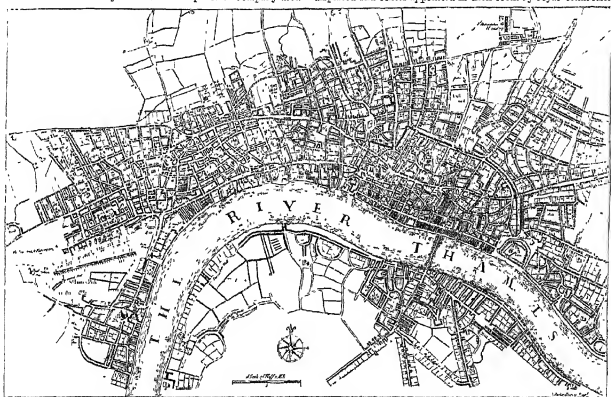
Charles I. and his counsellors were filled with the same fear of the increasing growth of London which showed itself in the prohibitory proclamations of his two predecessors. In 1630 a proclamation was issued in which "the election of any building upon a new foundation, within the limits of 3 miles from any of the theatres of the City of London, or suburbs of Westminster, was forbidden. The privy council in the following year put this question to the lord mayor—"What number of months are esteemed to be in the City of London and the liberty?"—the answer to be twelve, 320,268. These prohibitions were not allowed to remain a dead letter, and in 1635 Sir Pauline, a large landholder in Sussex, was fined by the Star Chamber in the sum of £2000 for living in London beyond the period prescribed in the proclamation of June 26th of that year. In April 1636 information was filed against Sir John Suckling the poet and others in the Court of Star Chamber for continuing to reside in London and Westminster. It was during this reign that the first great exodus of the wealthy and fashionable was made to the West End. The great system of piazzas of Covent Garden was formed from the designs of Inigo Jones about 1632. The neighbouring streets were shortly afterwards built, and the names of Henrietta, Charles, James, King, and York Streets were given after members of the royal family. Great Queen Street, Lincoln's Inn Fields, and the Strand were built about 1640, and named in honour of Henrietta Maria. Lincoln's Inn Fields had been planned some years before.

When the civil war broke out London took the side of the parliament, and an extensive system of fortification was at once projected to protect the town against the threatened attack of the royal army. A strong earthen rampart, flanked with bastions and redoubts, encircled the City, its liberties, Westminster, and Southwark, making an immense enclosure. Mount Street, Grosvenor Square, marks the spot of one of these fortifications called Oliver's Mount. In 1640 Cromwell allowed the Jews to return to England after a banishment of centuries, and those who settled in London mostly chose the neighbourhood of Aldgate as a place of residence. With the Restoration the separation of fashionable from dirty life became complete, and the West End grew into a formidable rival of the older London. In 1635 the game of ball mail was played in St James's Park, on the site of St James's Square and Pall Mall, but during the Commonwealth the park and the houses there were built round about. The square was planned out in 1663, and it soon became the most fashionable place in London. A mall was then prepared in St James's Park which still retains its name. About the same time the great houses in Piccadilly and Grosvenor Street, Berkeley Street, and Grosvenor Houses all appeared on the north side of that street about 1605.

London had been ravaged by plague on many former occasions, but the pestilence that commenced in December 1664 will ever live in history as "the Plague of London." On the 7th of June 1665 Samuel Pepys for the first time saw two or three houses marked with the red cross and the words "Lord, have mercy upon us," on the doors. The deaths daily increased, and business was stopped. Grass grew in the area of the Royal Exchange at Whitehall, and in the principal streets of the city. On the 4th of September, 1665, Pepys writes an interesting letter to Lady Carteret from Woolwich—"I have stayed in the city till about 7400 died in one week, and of them about 6000 of the plague, and little noise heard day or night but tolling of bells." . . . The plague was scarcely stayed before the whole city was in flame, a calamity of the first magnitude, but one which in the end raised much good, as the whole of the city was destroyed, and London has never since been visited by such an epidemic. On the 2d of September the fire broke out at one o'clock in the morning at a house in Pudding Lane. A violent east wind fanned the flames, which it raged with fury during the whole of Monday and great part of Tuesday. On Tuesday night the wind fell somewhat, and on Wednesday the fire slackened. On Thursday it was extinguished, but on the following day the flames again burst forth at the Temple. Some houses were at once blown up by gunpowder, and thus the fire was finally mastered. Many interesting details of the fire are given in Pepys's *Diary*. The distress of those who were made homeless by the calamity was great. The river swarmed with vessels filled with persons carrying away such of their goods as they were able to save. Some fled to the hills of Hampstead and Highgate, but Moorfields was the chief resort of the homeless Londoner. Some poor streets and two-story houses were seen in that swampy place. The people bore their troubles heroically, and Henry Oldenburgh, writing to the Hon. Robert Boyle on September 16, says, "the citizens, instead of complaining, discouraged almost of nothing but of a survey for rebuilding the city with bricks and large streets." Within a few days of the fire three several plans were presented to the king for the rebuilding of the city, by Christopher Wren, John Evelyn, and Robert Hooke. Wren proposed to build main thoroughfares north and south, and east and west, and to demolish the churches in conspicuous positions, to form the most public places into large piazzas, to unite the halls of the twelve chief companies into one regular square annexed to Guildhall, and to make a fine quay on the bank of the river from Blackfriars to the

Twenty. His streets were to be of three magnitudes—80 feet, 60 feet, and 30 feet wide respectively. Evelyn's plan differed from Wren's chiefly in proposing a street from the church of St Dunstan's in the East to the cathedral, and in having no quay or terrace along the river. In spite of the best advice, however, the jealousies of the citizens prevented any systematic design from being carried out, and in consequence the old lines were in almost every case retained. But, though the plans of Wren and Hooks were not adopted, it was to these two fellows of the Royal Society that the labour of rebuilding London was committed. Wren's great work, which has covered his name with renown, was the erection of the cathedral of St Paul's, and the many churches lauded round it as satellites. Hooks's task was the humbler one of arranging as city surveyor for the building of the houses. He laid out the ground of the several proprietors in the rebuilding of the city, and had no rest early or late from persons soliciting him to set out their ground for them at once. The first great impetus of change in the configuration of London was given by the great fire, and Evelyn records and regrets that the town in his time had grown almost as large again as it was within his own memory. Although for several centuries attempts had been made in favour of building houses with brick or stone, yet the carpenters continued to be the chief house-builders. As late as the year 1650 the Carpenters' Company drew

up a memorial in which they "gave their reasons that timber buildings were more commodious for this city than brick buildings were." The Act of Parliament "for rebuilding the city of London" passed after the great fire, gave the *corps de grace* to the carpenters as house-builders. After setting forth that "building with brick was not only more comely and durable, but also more safe against future perils of fire," it was enacted "that all the outside of all buildings in and about the city should be made of brick or stone, except doorcases and window frames, and other parts of the first story to the front between the joists," for which substantial oaken timber might be used "for convenience of shops." A third severe blow in addition to the plague and the fire overtook London in the reign of Charles II. The king and his brother had long entertained designs against the liberties of the city, and for the purpose of crushing them two measures were set up—(1) that a new rate of market tolls had been levied by virtue of an act of common council, and (2) that a petition to the king, in which it was alleged that by the monopolization of parliament public justice had been interrupted, had been printed by order of the Court of Common Council. Charles directed a writ *quo warranto* against the corporation at London in 1683, and the Court of King's Bench declared its charter forfeited. Soon afterwards all the obnoxious aldermen were displaced and others appointed in their room by royal commission.



London in 1723. Redwood Facsimile of Map by J. Senex

A new lord mayor and recorder, and new sheriffs were appointed in the same manner. This decision of the Court of King's Bench was reversed in 1697. In the winter of 1685-86 a fair was held for some time upon the Thames. The flood, which commenced about seven weeks before Christmas and continued for six weeks after, was the greatest on record, the water was 11 inches thick.

The revocation of the edict of Nantes in October 1685, and the consequent migration of a large number of industrious French Protestants, caused a considerable growth in the east end of London. The silk manufactures at Spitalfields were then established.

During the short reign of James II. the fortunes of the city were at their lowest, and nowhere was the arrival of the prince of Orange more welcomed. One of the first acts of James was to cause an indictment for high treason to be prepared against Alderman Cornish, who had been a zealous supporter of the Exclusion Bill. Sir John Hyles, who had never been sheriff nor was even a freeman of the city, was appointed lord mayor by the king in 1688 in succession to Sir John Shorter. When James found the danger of his position, and learned that William had landed, he sent for the mayor and aldermen and informed them of his determination to restore the city charter and privileges.

William III. cared little for London, the smoke of which gave him asthma, and when a great part of Whitehall was burnt in 1691 he purchased Notingham House and made it into Kensington

Palace. For convenience of communication with London he had a broad road made through Hyde Park, which was lighted by lanterns at night. Kensington was then an insignificant village, but the arrival of the court soon caused it to grow in importance.

Although the spiritual wants of the city were amply provided for by the churches built by Sir Christopher Wren, the large districts outside the City and its liberties had been greatly neglected. The Act passed in the reign of Queen Anne for building fifty new churches (1710) not only helped to supply this want, but also gave a special architectural character to the suburbs.

EIGHTEENTH CENTURY.—With the accession of George I. a considerable change in the habits of all classes was introduced. At no previous time probably was public taste so low or manners more depraved. These two evils naturally were felt over the whole kingdom, but nowhere was their baneful influence more apparent than in the capital. Public buildings of the most tasteless character were raised, and streets of private houses were built that were positively painful in their ugliness. London thus grew to be the ugliest of cities, a character which it is only now beginning to throw off. London had gradually grown up by the side of the Thames and extended itself along the river's banks, which were skirted by a succession of handsome palaces. The inhabitants moved from place to place in boats, and the river was the chief highway. In the 18th century this state of things had ceased,

and other parts of the town were more largely built upon. The inhabitants used coaches and chaises more than boats, and the banks of the river were neglected. London could no longer be seen as a whole, and it grew into a mere collection of houses. In spite of all this the 18th century produced some of the most devoted of Londoners,—men who considered a day lived out of London as one lost out of their lives. Of this class Dr Johnson and Hogarth are striking examples. The exhibitions of vice and cruelty that were constantly to be seen in the capital have been reproduced by Hogarth, and had they not been set down by as truthful an observer it would have been almost impossible to believe that such enormities could have been committed in the streets of a great city. A few days after his accession George I. addressed the representatives of the city in these words:—"I have lately been made sensible of what consequence the city of London is, and therefore shall be sure to take all their privileges and interests into my particular protection." On the following lord mayor's day the king witnessed the show in Chancery and attended the banquet at Guildhall. Queen Anne and the first three Georges were all accommodated, on the occasions of their visits to the City to see the show, at the same house opposite Bow Church. In the time of Queen Anne and George I. David Barclay (the son of the famous apologist for the Quakers) was an apprentice in the house, but he subsequently became master, and in honour of receiving George II and George III as his guests. There was a large balcony extending along the front of the house which was fitted with a canopy and hangings of crimson damask silk. The building, then numbered 108 Chancery, was pulled down in 1831. In September 1739 the burning of the Scotch Saftmill created the most fearful panic that London has ever seen. Trade was at a standstill, and many of the chief merchants, goldsmiths, and bankers stopped payment, thus causing ruin to numberless families.

Early in the 18th century there was a considerable extension of building operations in the West End. About the year 1716 the earl of Burlington commenced building on the Ten Acres Field at the back of the gardens of Burlington House, and shortly afterwards the City authorities, who were proprietors of the Conduit Head (containing 27 acres), followed his example. On June 1, 1717, the *Weekly Journal* announced that the new building between Bond Street and Mary-le-Bone go on with all possible diligence, and the houses even let and sold before they are built. The parish of St. George's, Hanover Square, was constituted in 1728. In 1716 Cavendish Square and the neighbouring streets had been planned, and the plan was carried out with the completion of the foundation stone of Harcourt House (duke of Portland's) on the west side of the square, which is now about to be destroyed, was laid in 1722; and the north side, which was originally intended to be occupied by the mansion of the duke of Chandos, was still in 1760. The first church in the parish, Vere Street, originally Oxford chapel, was built by Gibbs about 1728.

Still, however, the north of London remained unbuild upon, and the open character of this part is well shown in the map given above. In 1760 and for some years subsequently the land behind Montagu House (now the British Museum) was occupied as a farm, and when in that year a proposal was made to plan out a new road the tenant and the duke of Bedford strongly opposed it. In 1772 all beyond Portland Chapel in Great Portland Street was country. Portman Square was laid out about 1764, but it was nearly twenty years before the whole was finished. It was built on high ground with an open prospect to the north, which gave it a name as a peculiarly healthy part of London. Mrs Montagu called it the Montpellier of England, and said she "never enjoyed such health as since she came to live in it." In a map of London dated 1778 the villages of Hackney, Stepney, Islington, Finsbury, Marylebone, Paddington, Knightsbridge, and Chelsea are all shown as country outside of the town. Bedford House in Bloomsbury Square had its full view of Hampstead and Highgate from the back, and Queen's Square was built open to the north in order that the inhabitants might obtain the same aspect. Dr Hoberden recommended South Lambeth as a health resort on account of its situation on the banks of a tidal river with the south-west wind blowing fresh from the country and the north-east softened by blowing over the town.

In 1737 the Fleet ditch between Holborn Bridge and Fleet Bridge was covered over, and Stocks market was removed from the site of the Mansion House to the present site. The market, called Fleet market, On October 26, 1738, the first stone of the Mansion House was laid. Previously this first magistracies lived in several different houses. In 1760 Westminster Bridge was opened for passengers, and London Bridge ceased to be the only means of crossing the Thames at the present site. The bridge followed in 1768. A boat almost as severe as the memorable one of 1683-84 occurred in the winter of 1789-90, and the Thames was again the scene of a busy fair. In 1768 the houses on London Bridge were cleared away, and in 1790-92 several of the city gates were taken down and sold. Morgate is said to have fetched £166, Aldersgate £91, Aldgate £177, Cripplegate £80, and Ludgate £146. The statue of Queen Elizabeth

which stood on the west side of Ludgate was purchased by Alderman Goelling and set up against the east end of St Dunstan's church in Fleet Street, where it still remains.

The need of improving and opening out many of the streets of London was felt in the 18th century, but little or nothing was done, and the work was left to be accomplished in the present century. John Gwynn, a friend of Dr Johnson, paid considerable attention to this subject, and published in 1766 a work entitled *London and Westminster Improved, Illustrated by Plans*. Many of the author's suggestions have not been carried out, although they would often have been improvements upon what has been actually accomplished. Of such suggestions as have subsequently been executed we may note here the widening of Swallow Street, a much-needed improvement, which was not carried out until the beginning of the present century, a square where Trafalgar Square now stands and some straight streets on the site of Drury Lane House now the Adelphi, and a bridge where Waterloo Bridge was afterwards built.

Robert Adam and his brothers, Scotsmen who came to London under the protection of the earl of Bute, made a considerable improvement in the appearance of certain parts of London during the second half of the 18th century by the adoption of a combined system of architecture, in which several separate houses were grouped together to give the appearance of a continuous building. The Adelphi and Portland Place still remain good examples of their system. The brothers Adam were leaders in the revival of taste, and the interiors of their buildings are executed with great elegant detail. We have now come to a period when London outside the City may be considered as more important in many points than London within the liberties. "Why not," said Dr Johnson to Boswell, "Fleet Street has a very animated appearance, but I think the tide of human existence is at Charing Cross." This speech was made in 1776, and in spite of the vast increase of London in every direction Charing Cross still retains this pre-eminent position.

The latter years of the 18th century were exceedingly turbulent ones for London, but it is only necessary here to barely indicate the divisions between the court and the City relating to the election of Wilkes, and the Gordon riots of 1780, when the gates of Newgate were thrown open, and much property was destroyed by the mob. "It is a disaster," it is a disaster—it is a disaster, and it is a disaster like a full account of the history of London during the 19th century. Since 1800 the City itself has been almost entirely rebuilt, and the suburbs on all sides have been vastly extended. Russell Square was built about 1801, and the district north of Bloomsbury where the land out at the same time. Bloomsbury Square had been built in 1685, and Bedford Square at the end of the 18th century. Alexander Gibson Hunter, in a letter to Countess the publisher written in March 1807, says, "Young Pindar and I walked over all the duke of Bedford's new feeling grounds, Russell Square, Tavistock Place, Brunswick Square, &c. The extent of them, and the rapidity of the buildings, is beyond all comparison." Bedford and Russell Squares were for some years the favourite place of residence for the judges. To show how late has been the growth north of the New Road we may mention that at the beginning of the century grapes were reaped by the sun in the open air in gardens in Gower Street, and twenty five dozens of new berries were gathered in 1800 from three completely exposed trees in a garden in Upper Gower Street. Still later the richest flavoured calery was gathered in abundance in the same place. When dwelling was in fashion the duellists naturally chose out the most unsegregated places, and we thus obtain an idea where these places were situated. Chalk Farm for some time rivalled in popularity Wimbledon Common, where the duke of York fought Colonel Lennox in 1780, Battersea Fields, where the duke of Wellington fought the earl of Winchester in 1829, and Putney Heath, where Pitt met Manners in 1793, and Castlereagh and Canning fought in 1809. As late as 1848 a duel was fought at Chalk Farm between Lieutenant Monro and Colonel Fawcett, when the latter was killed.

In 1808 London saw the public funeral of three of England's greatest men. On the 8th February the body of Nelson was borne with great pomp from the Admiralty to St Paul's Cathedral, where it was interred in the presence of the prince of Wales and the royal dukes. Pitt was buried on 22d February, and Fox on the 16th October, both in Westminster Abbey.

The first exhibition of Wm. Smeaton's system of lighting the streets with gas took place on the king's birthday (June 4) 1807, and was made in a row of lamps in front of the colonnade before Carlton House. Fire-bury Square was the first public place in which gas lighting was actually adopted, and Grosvenor Square the last. On October 11, 1811, the first stone of Waterloo Bridge was laid, and on June 18, 1817, it was publicly opened. Southwark Bridge was opened in April 1819, and new London Bridge, the first stone of which had been laid on June 15, 1825, on August 1, 1831. Westminster and Blackfriars Bridges were both widened in the last few years, and thus not one of the London bridge dates back farther than the present century. One of the greatest improvements in the West End was the formation of Regent Street, intended as a communication between Carlton House and the Queen's Park.

in 1881; and the value of the exports from £76,000 to £131,141. Three daily and five weekly newspapers and three monthly periodicals issue from the local press. The city is divided into seven wards, and is governed by a mayor and aldermen. First laid out in 1826-6, it returned a member in 1836, and was incorporated in 1840. The population was 15,826 in 1871, and 17,476 in 1881; but the East, West, and South London suburbs—really part of the city, though not yet included within the municipal boundaries—have a population of upwards of 10,000.

LONDONDERRY, a maritime county in the province of Ulster, Ireland, is bounded on the N. by the Atlantic, on the W. by Lough Foyle and Donegal, on the E. by Antrim and Lough Neagh, and on the S. by Tyrone. It has an irregular oval form, its greatest length being about 50 miles, and it greatest breadth about 40. The area comprises 513,388 acres, or about 802 square miles. The county consists chiefly of river valleys surrounded by elevated table-lands rising occasionally into mountains, while on the borders of the sea-coast the surface is generally level. The principal river is the Roe, which flows northwards from the borders of Tyrone into Lough Foyle below Newtown-Linnavady, and divides the county into two unequal parts. Further west the Faghlan also falls into Lough Foyle, and the river Foyle passes through a small portion of the country near its north-western boundary. In the south-east the Moyola falls into Lough Neagh, and the Lower Bann from Lough Neagh forms for some distance its eastern boundary with Antrim. The only lake in the county is Lough Finn on the borders of Tyrone, but Lough Neagh, which is included in Antrim, forms for about 6 miles its south-eastern boundary. The valley of the Roe is a line of division between two entirely different geological structures. To the east there is a basaltic tract in all respects similar to that in Antrim, except that on the Londonderry side of the Bann the dip of the strata is reversed and lies north-east. At Boneyvenagh, which has an elevation of 1262 feet, the basalt reaches a thickness of 800 feet. It is succeeded by chalk lias, limestone, and red sandstone, the whole resting on primitive rock. The remainder of the county consists chiefly of moor-plate and primitive limestone, and includes the mountain of Sawel, with an elevation of 2236 feet, as well as other eminences approaching 2000 feet in height. Horblende and granite frequently emerge above the slate, and limestone is not uncommon. Sandstone crops to the surface throughout nearly the whole of the valley of the Roe. Fine rock crystals are found in Finglen, near Dungiven, and in several other districts. Iron was at one time worked at Slieve Gullion, and is obtained in abundance in the bogs. There are a few unimportant veins of copper and lead.

Agriculture.—The excessive rainfall and the cold and uncertain climate are unfavourable for agricultural operations, and except in the valleys the soil is unsuitable for tillage. In the basaltic region large tracts are partially submerged, and the hard and firm portions consist chiefly of rock. Along the sea-coast there is an extensive district of red clay formed by the decomposition of sandstone, and near the mouth of the Roe there is an extensive tract of a marly nature. Along the valleys the soil is often very fertile, and the elevated districts of the clay-slate region afford rich pasture for sheep.

In 1880 131,286 acres were under tillage, 264,044 were pasture, 5308 plantation, and 120,451 waste. The total number of holdings in the same year was 17,851, of which 1877 were under 1 acre. More than half of the total number were included in those between 5 and 16 acres and those between 16 and 80 acres, which numbered 6447 and 4845 respectively. The following table shows the area under the principal crops in 1865 and 1881—

	Wheat.	Oats.	Other Cereals.	Potatoes.	Turnips.	Other Crops.	Flax.	Acres in Clover.	Total.
1865	9,303	91,909	9,664	31,883	11,641	1,464	11,796	28,779	154,837
1881	1,817	74,689	6,162	84,487	27,481	8,960	18,830	38,062	164,918

The increase in the area under crops is due chiefly to the increase in that under flax and meadow, although there is an increase in all other crops except wheat and oats.

The number of horses since 1865 has increased very slightly—from 20,381 to 20,749, of which 17,068 were used for agricultural purposes. Cattle in 1865 numbered 102,155, and in 1881 only 86,693, an average of 25 to every 100 acres under cultivation, the average for Ireland being 25.8. The number of milch cows was 39,893. Sheep numbered 29,688 in 1865, and 30,101 in 1881, pigs in the same years numbering 22,898 and 23,946. Goats in 1861 numbered 4666, and poultry 288,486.

According to the latest return, the land in 1873 was divided amongst 2178 proprietors possessing 511,838 acres, with a total annual value of £264,732, the annual value per acre being 15s. 4d. Of the owners about 83 per cent. possessed less than 1 acre. As many as 163,419 acres were possessed by the Irish Society and seven of the livery companies of London—the Irish Society possessing 675 acres, the Drapers' Company, 27,025, the Fullmerton's, 20,509, the Grocers', 11,638, the Ironmongers', 12,714, the Mercers', 21,214, the Salters', 19,446, and the Skinners', 34,772. In addition to this Sir H. Bruce owned 20,801 acres, S. G. Bruce 34,671, the representatives of T. R. Richardson 13,159, Chancery Commissioners 13,418, C. S. M'Causland 12,886, and J. B. Keirwood 10,420.

Manufactures.—The staple manufacture of the county is linen. In 1880 the number of scutching mills was 185. The manufacture of coarse earthenware is also carried on, and there are large distilleries and breweries and some salt-works. There are important fisheries of salmon and eels on the Bann.

Railways.—The only railways in the county are those which skirt its northern and western boundary, and which belong to the Belfast and Londonderry and Coleraine and Londonderry and Coleraine Companies, and another line connecting Londonderry with Enniskillen.

Administration and Population.—The county comprises 6 baronies, with 49 parishes and 1902 townlands. It is in the north-west corner. Assizes are held at Londonderry, and quarter sessions at Coleraine, Londonderry, Magherafelt, and Loughinisletty. Within the county there are 14 petty sessions districts. It includes two poor-law unions and portions of other three. Londonderry is in the Belfast military district and Omagh subdistrict. The county is represented in parliament by two members, and the borough of Londonderry (28,947) and Coleraine (6684) by one each. The population of the county, which in 1780 was only 46,182, had increased by 1821 to 168,886, and by 1841 to 222,461, but in 1851 had diminished to 192,269, in 1871 to 178,060, and in 1881 to 164,714, of whom 79,138 were males and 85,676 females. From the 1st May 1851 to 31st December 1881 the number of emigrants was 78,726. For every 1000 of the population the death-rate in 1880 was 19.2, the marriage-rate 4.5, and the birth-rate 23.2.

History and Antiquities.—At an early period the county was inhabited by the O'Connors, or O'Connors, who were tributary to the O'Neals or O'Neals. Towards the close of the reign of Elizabeth the county was seized with the purpose of changing the power of the O'Neals, when it received the name of Coleraine, in honour of that town for its capital. In 1609, after the confiscation of the estates of the O'Neals, the citizens of Londonderry obtained possession of the towns of Londonderry and Coleraine and adjoining lands, 60 acres out of every 1000 being assigned for church lands, and certain other portions to three native Irish gentlemen. The citizens of Londonderry undertook to expend £20,000 on its reclamation, and elected a body of twenty-six for its management, who in 1613 were incorporated as the Irish Society, and retained possession of the towns of Londonderry and Coleraine, the remainder of the property being divided among twelve of the great livery companies of the city. Notwithstanding the expenditure of large sums by these companies in its management, their estates were afterwards sequestered by James I., and in 1637 the charter of the Irish Society was cancelled. Cromwell restored the society to its former position, and Charles II. at the Restoration granted it a new charter, and confirmed the companies in the possession of their estates. In the reclamation of 1641 Magherafelt was seized by the Irish, and Magherafelt and Bellaghy, then called Vintner's Down, burned, as well as other towns and villages. The most remarkable ancient ruin is that of the Cyclopean fortress of the Giant's Scourie or Ring, situated in the pass between Drumbo and Larne, the interior of which, 600 feet in length, is partially hollowed out of a knoll of boulder, by which it is enclosed on all sides except the north-east, where it is defended by a wall of great thickness, with access for only one person in a stooping posture. The most remarkable of the Druidical circles is that at Slieve

MAONS There are a large number of artificial caves. The most ancient castle of Irish origin is that of Carrucknaghy; and of the castles erected by the English those of Dungiven, Salterstown, and Meaf are still in good preservation. The old abbey of Dungiven, founded in 1109, and standing on a rock about 200 feet above the river Roe, is a very picturesque ruin.

LONDONDERRY, or DERRY, a county of a city, parliamentary borough, and the chief town of the county of Londonderry, is situated on an eminence rising abruptly from the west side of the river Foyle to the height of about 120 feet, 4 miles from the junction of the river with Lough Foyle, and 80 miles north-north-west of Belfast. It is still surrounded by an ancient rampart about a mile in circumference and having seven gates, but the buildings now extend considerably beyond this boundary. The summit of the hill, which is at the centre of the town, is occupied by a quadrangular area from which the main streets, which for the most part are spacious, diverge at right angles. Some of the original houses with high pyramidal gables remain, but they have been much modernized. The river is crossed by an iron bridge 1200 feet in length. The cathedral in the Later English style, and consisting of nave and aisles separated by pointed arches, with tower and spire at the west end, was completed in 1633 at a cost of £4000, contributed by the city of London. The building is 240 feet in length with a breadth of 63 feet, and the height of the tower and spire is 228 feet. The spire was added in 1788, when the old tower was raised 21 feet, and in 1802 the spire was rebuilt. The bishop's palace, erected in 1716, occupies the site of the abbey founded by Columba. The abbot of this monastery, on being made bishop, erected in 1164 Temple More or the "Great Church," one of the finest buildings in Ireland previous to the Anglo-Norman invasion. The original abbey church was called the "Black Church," but both it and the "Great Church" were demolished in 1600, and their materials used in fortifying the city. There is a large Roman Catholic cathedral. The court-house was completed in 1824 at a cost of about £24,000. For the free grammar school, founded in 1617, a new building was erected in 1814 at a cost of over £14,000. There are a number of charitable foundations. The staple manufactures of the town is linen, and there are also shipbuilding yards, iron foundries, saw-mills, munition-works, distilleries, breweries, and flour-mills. The salmon fishery on the Foyle is also very valuable. The river affords facilities for a secure and commodious harbour, its greatest depth being 33 feet, with a depth of 12 feet at low water. The port has a considerable coasting trade with Great Britain, exporting agricultural produce and provisions. For the last five years its imports have averaged over £500,000 (chiefly grain and provisions), and its exports, which vary very greatly, over £10,000. In 1880 the number of vessels that entered the port was 1569, with a total tonnage of 335,544, the number that cleared 1452, with a tonnage of 326,178. Londonderry returns one member to parliament. The population of the city, which in 1867 was 19,399, had increased in 1871 to 23,242, and in 1881 to 28,947.

Derry, the original name of Londonderry, is derived from *Dobru*, the "place of oaks." It owes its origin to the monastery founded by Columba in 546. From the 9th to the 11th century the town was frequently in the possession of the Danes, and was often burned and devastated, but they were finally driven from it by Muringh O'Brien about the beginning of the 12th century. In 1811 it was granted by Edward II. to Richard de Burgo. After the Irish Society of London obtained possession of it, it was in 1613 incorporated under the name of Londonderry. The fortifications which were begun in 1600, were completed in 1618 at a cost of nearly £9000. Its charter was confirmed in 1662 by Charles II. From April 18, 1690, the Protestants of the north defended themselves within its walls against James II., until the siege was raised in the following August. See the *History* by Hempton (1851).

LONDONDERRY, ROBERT STEWART, SECOND MARQUIS OF (1769-1822), better known by his courtesy title of Viscount Castlereagh, which he held until the last year of his life, the statesman who brought about the union with Ireland, who was foreign minister for ten eventful years, who represented England at the congress of Vienna, and who was the recognized leader of the aristocratic and reactionary party which owed its being to the excesses of the French Revolution, was born on June 18, 1769, and was thus one year older than his great rival George Canning. His father, Robert Stewart of Ballylawn in the county of Londonderry, and Mount Stewart in Down, had represented the latter county in two Irish parliaments; and his marriage with Lady Sarah Seymour Conway, daughter of the earl of Hertford, in 1766, had brought him into connexion with many of the great Whig families of England, as did also his second marriage with the eldest daughter of Lord Camden. His elder son, the future minister, was educated at a school in Armagh, and proceeded in 1786 to St John's College, Cambridge. He spent only a single year at the English university, and was on his grand tour through Europe when he was summoned home by his father, who had just been created Lord Londonderry in the peerage of Ireland, to stand for the county of Down as the candidate of the smaller landholders against the influence of the marquis of Downshire. The election cost the new Lord Londonderry £60,000, a sum which crippled him for his whole life. But he was successful, and the young Stewart entered the Irish parliament as one of the few really independent members who sat there, bound by no ties to a great lord, but the representative of three thousand freeholders of the richest county of the most educated province of Ireland. He joined the opposition, like his father before him, and eagerly pressed for the extension of the franchise to the Roman Catholics, even going so far, and his enemies later, as to become a contributor to the *Northern Star* of Belfast, the organ of the seditious party in Ulster; but the great events of the French Revolution soon showed their influence on his opinions, as on those of most landed proprietors. His thoughts on politics already clearly pointed towards the necessity of a union between England and Ireland, a necessity by this time obvious to all political thinkers and practical politicians. But for the time he held firmly to the popular side, voting for the removal of Catholic disabilities, and the right of Irishmen to trade with India. At last, however, Lord Camden came over to Ireland, in March 1795, as lord-lieutenant, with Mr Pelham as his secretary, on a mission to tell the Catholics and reformers that they must expect no further relief and no further reform. He took much notice of his sister's step-son, young Robert Stewart, who was quite willing to be won over from the opposition, and who had in the previous year married Lady Emily Hobart, daughter of the late earl of Buckinghamshire, and near relative of many great political personages. Lord Camden used his influence to obtain for his brother-in-law a viscountcy as Viscount Castlereagh in October 1795, and in the following August an earldom as earl of Londonderry. In that same August 1796 he made Robert Stewart, who by his father's promotion had become Viscount Castlereagh, keeper of his signet, an honorary post which merely marked his accession to the Government, and in February 1797 acting secretary in the place of Mr Pelham. Taking office at a time when everything was at the height of confusion, Lord Castlereagh soon began to show his splendid administrative genius, which, indeed, consisted in his "finite capacity for taking pains" and careful mastery of details. During the rebellion of 1798, when Lord Camden resigned in panic, Castlereagh showed all the qualities of a splendid

minister of police, and heartily co-operated with the wise measures of Lord Cornwallis, by which the rebellion was soon brought to an end. He was equally useful to Cornwallis in the second part of his mission to Ireland, namely, the union with England. The measure was to be carried; the means were bribery whether in honours or in money. The details of the passage of the measure through the House can be studied in the correspondences of Cornwallis and Castlereagh, in which appear clearly the utter disgust of Cornwallis at the work he was doing and the country he was in, and Castlereagh's pride in his successful manipulation of men. The Union carried (1800), then came the fulfilment of promises made to secure support or disarm opposition, and first in importance those to the Catholics. It was thoroughly understood between Pitt, Cornwallis, and Castlereagh that full rights of citizenship were to be given to the Catholics as a reward for the loyal behaviour of the greater men during the rebellion, and to induce them not to oppose the Union. But the promise was not fulfilled. Pitt had indeed promised to carry the measure; but the king's conscience was worked upon by Lord Loughborough, and to Pitt's surprise and disgust his resignation was accepted, and immediately followed by that of the ablest half of the cabinet, and necessarily of Cornwallis and Castlereagh. With his resignation ends the first epoch of Castlereagh's political life. On very many occasions in his correspondence Cornwallis mentions him with warm praise of his "talents, temper, and judgment," and only qualifies his opinion in one place, when he says, on July 3, 1800, that "Littleholes very much surpasses Lord Castlereagh in the private management of mankind from his good humour and kind attention to everybody." Here Cornwallis touches the greatest political fault of Castlereagh, which destroyed his popularity and ruined his reputation—his want of sympathy for human weaknesses.

Castlereagh was sworn of the English privy council in December 1799, and returned to the first united parliament for the county of Down. He had no intention of permanently losing office by his advocacy of the Catholic claims, and therefore, instead of going into violent opposition like Canning and others of the late administration, he supported the weak Addington ministry, and in June 1802 was appointed president of the Board of Control. On Pitt's return to power in December 1804 he kept Castlereagh in office, and in 1805 made him secretary of state for war and the colonies, as well as president of the Board of Control. For the six months he held the war office he was Pitt's right hand in administration, as Canning was in debate. He now prepared a great expedition of thirty thousand men, who were to land in Hanover and make a diversion in northern Germany in favour of the Russians and Austrians. The expedition was too late to be of any use, but it deserves notice as illustrating Castlereagh's favorite idea that England should carry on "a grande guerre," which was to appear to a greater extent later. His present tenure of office was but short, for Pitt's Government resigned on his death in January 1806.

When Pitt died, Castlereagh was prime mover in the attempt to make Lord Hawkesbury premier, and when that failed, sooner than give up all hope of place, he declared that he and his friends "looked to." Lord Grenville. Grenville, however, formed his ministry of "all the talents" out of the sections which followed Fox, Windham, and Sidmouth. The opposition was led in the House of Commons by Castlereagh and Canning. Now began the close association of these two celebrated men, each of whom hoped to lead the Tory party, and who did so in turn, both Irishmen from the same county of Londonderry, both in the prime of life, and distinguished

—the one for his surpassing eloquence, the other for his administrative powers. Each rival despised the other. Castlereagh, conscious of his high birth and noble connections, looked down on the son of the actress. Canning, conscious on his side of his great talents for debate, looked down on the dunny debater and laborious parliamentary tactician, who looked to governing the country rather by a careful manipulation of boroughs and patronage than by eloquence and statesmanship. Castlereagh again, proud of his position as an ex-cabinet minister, pretended to lead Canning, who had held but inferior posts, while Canning, in his ardent devotion to the memory of Pitt, sneered at the man who had taken a seat in Addington's cabinet. This rivalry was increased almost to personal dislike by the marriage of Castlereagh's sister to the son and heir of that uncle of Canning's, Paul, in whose favour his own father had been disinherited, and who some years later was made Lord Garvagh. The rivals were not long in opposition, the new ministry resigning in 1807. The duke of Portland formed a new administration on strictly anti-Catholic principles, in which Castlereagh and Canning, both advocates of the Catholic claims, were secretaries of state, the former for war and the colonies, the latter for foreign affairs. During the two years they remained in office together each chafed at the other. The chief events connected with the war office during this tenure of office were the expeditions to Copenhagen, the Peninsula, and Walcheren. Of the Copenhagen expedition the chief credit or discredit must rest with Canning, but the merits of its execution rest entirely with Lord Castlereagh, who showed himself a war minister far superior to Dundas and Windham, and despatched in perfect secrecy a large military and naval expedition, which was swiftly and entirely successful. On the subject of the Portuguese expedition and the assistance to be afforded to the Spanish insurgents, the two secretaries were of different opinions. Canning sent the Spaniards officers, money, and arms in profusion, but was reluctant to send a great army, while Castlereagh planned the Portuguese expedition, chose Sir A. Wellesley to command it, and deserves the credit of Vimiera. Napier in his *Penninsular War* proves how wrong Canning was, how impossible it was to organize out of the Spaniards a force able to resist Napoleon, and how right Castlereagh was in believing in the efficiency of a British army. The Walcheren expedition went far utterly to ruin Castlereagh's reputation, and completed the difference between Canning and himself. Yet the conception was good. Castlereagh prepared the expedition with skill and secrecy, though with slight regard for men's lives, as appeared in his choice of the unhealthy island of Walcheren for debarkation, and in his refusal to send enough doctors or hospital ships, and in his appointment of Lord Chatham to command in chief. In this appointment of Chatham appears the radical vice of his war administration: he looked before giving a command on active service to parliamentary influence, not tried ability. The failure of the expedition brought about a crisis in the cabinet. In April 1809 Canning had sent in his resignation to the duke of Portland, declaring that he could no longer serve with Castlereagh, but the matter was put off from time to time, and at length Canning consented to wait till the Walcheren expedition was over. In September he insisted once for all that something must be done, and then for the first time Castlereagh heard that his dismissal had been determined on for some months. He was naturally indignant, and, being unable to challenge Lord Camden, his benefactor, who had really behaved worst to him, or the old duke of Portland, he challenged Canning, who had throughout protested against the manner in which Castlereagh had been treated. On September 21 they met

on Putney Heath, when Canning was slightly wounded in the thigh, and Castlereagh had a button shot off his coat. After this duel both resigned, and remained out of office two years, but Castlereagh did not intend to remain so, and through the influence of his aunt, old Lady Hertford, with the prince regent he was, after the refusal of Canning, offered the secretaryship of state for foreign affairs in March 1812 in the room of Lord Wellesley. On Perceval's assassination in May 1813, the leadership of the House of Commons was given to Castlereagh. The first ten years of Lord Liverpool's administration were the palmy days of the Tory aristocracy, and during them Lord Castlereagh was the guiding spirit of foreign policy in the cabinet, and the faithful interpreter of Lord Sidmouth's home policy in the House of Commons. Once in power, he perceived that Napoleon must be beaten in Germany, and that, though Lord Wellington's army in Spain must be supported to maintain the credit of English soldiers, and occupy as many French troops as possible, the important point was for the Russian and Prussian monarchs to be joined by the Austrian emperor, and follow up the blow Napoleon had dealt himself in his invasion of Russia. To bring Austria into the field, manage the crown prince of Sweden, maintain the alliance of the great powers and the harmonious working of their armies and policies, Castlereagh gave the English ambassadors at the courts of Austria, Russia, and Prussia, full powers to correspond with each other, and follow the allied forces. The ability with which these instructions were carried out is to be read in the history of the whole campaign of 1813, and of the congresses of Mannheim and Frankfurt. When the allies entered France, Castlereagh himself left England to attend the congress of Chatillon. He remained with armies of the allies, entered Paris with them, and signed the preliminaries of peace. Great was the applause he received on his return from the people, and above all in the House of Commons. The prince regent made him a Knight of the Garter, an honour which had only been conferred on two commoners, Sir H. Walpole and Lord North, for the last two hundred years, and when the allied sovereigns visited London they treated him with marked favour, so that it was no wonder, when he started to take his seat as British plenipotentiary at the congress of Vienna, he believed himself to be a great diplomatist. That he was mistaken in this was conclusively proved by that congress where, as Von Gentz said, England could have done anything, and did nothing. Throughout he supported Metternich, partly because Metternich's nature had mastered him, but more because he had imbibed a blind distrust of Russia. When the return of Napoleon from Elba put an end to the quarrels which were nearly ending in a general war between Prussia and Russia on the one side and England, France, and Austria on the other, and united all parties against him, Castlereagh returned to England, and expressed his confidence in a speedy termination of the new struggle, which indeed was closed at Waterloo. He signed the second peace of Paris on behalf of England, and on his return his father was created marquis of Londonderry. From this time his career can be sketched very shortly. At home the grand harvest of 1815 was followed by very bad ones, and great discontent existed both among the agricultural and manufacturing classes. The Government pursued the same tactics which had in 1793 united nearly all the upper classes in a fever of reaction; they established a secret committee which declared the existence of a widespread conspiracy, and it was often their spies who threw into the meetings of the discontented sufficient politics to make them look like conspiracies. The bad feeling existing came to a climax with the Peterloo massacre, and Lord Sidmouth introduced his Six Acts to check a network

of conspiracies which mostly did not exist. Castlereagh had to introduce the Six Acts in the House of Commons, and as usual spoke of the people with the air of hauteur and contempt which made him so particularly obnoxious to them. His foreign policy during these years was chiefly inspired by a real desire to maintain the peace of Europe, which he believed was only to be preserved by the harmony of all the monarchs and their foreign ministers, and to preserve this harmony he was so loth to differ from them on any subject that it was commonly believed among the people that he had signed the Holy Alliance. At the congress of Aix-la-Chapelle in 1818 it was for this reason that he recommended that France should be freed from the army of occupation. The death of George III. in January 1820 made no difference to Castlereagh, who was greatly in the favour of the new king, and who had no difficulty in supporting the Bill of Pains and Penalties against the queen. Scarcely was the excitement of the queen's trial and the king's coronation over, when Lord Londonderry, for he had succeeded to that title in this very year, accompanied the king to Hanover in October 1821 to discuss the revolutions in Greece and Spain with Metternich. The interviews which then took place are fully described in Metternich's *Autobiography* (vol. iii. pp. 552-560), and exhibit clearly the paramount influence of Metternich over Lord Londonderry, whom he persuaded to take part in a congress at Verona in the following year. While he was making preparations to start, he became possessed by many strange delusions, which clearly indicated that his mind was unbalanced by overwork, as it had been once before after the passing of the Union with Ireland. This soon became obvious to every one, the king noticed it; and the duke of Wellington sent a physician down to Fonthill to see him. The doctor found him suffering from melancholia, and ordered his razors to be taken away, but in spite of all precautions he procured a penknife and committed suicide on August 12, 1822. His body was conveyed to London to be buried in Westminster Abbey, and just as it was being lowered into the grave a cry of exultant hatred arose from that rabble he had so despised.

Castlereagh's character illustrates the strange difference which in corrupt times can exist between public and private morality. In private life he was a strictly honourable and affectionate man; he was a good husband, a good son, a good brother, and a good master; but even in his private relations that want of warmth which made Cornwallis declare he was utterly unlike an Irishman, and Wilberforce liken him to a fish, seems to have existed, and seems to have been part of his temperament. In public life he played quite a different part, and though he had one or two firm political principles, as appears in his steady advocacy of Catholic emancipation, he seems as a rule to have regarded politics as a game, in which all means were fair to win, and very extraordinary some of his means appear to be. Though a very bad and confused speaker, he was very successful as a parliamentary leader, from the care with which he used his patronage, and the amount of votes he won by it. While not a great diplomatist, as the mastery Metternich obtained over him clearly proved, as an administrator he deserves the highest praise, steadily punctual to his work, never allowing arrears to accumulate, and never neglecting a detail; but his parliamentary necessities stood in his way; every appointment was given from a party point of view, and if, as in the case of Sir A. Wellesley, chance sometimes led him right, jobbing more often led him wrong. But the chief interest which centres in Lord Londonderry is that he was the last leader of an extinct class. The old aristocrats who lived by politics, and thought all means fair in politics, are gone

for ever, and with Londonderry's death the unnatural tension of the reaction from the excesses of the French Revolution ceased, and modern Conservatism, containing indeed many prejudices and an exaggerated admiration for what is fixed, came into being with its real sympathy for all mankind, which the old Tories, and more especially Lord Londonderry, would have deprecated.

The best materials for studying Londonderry's life and opinions are his *Despatches* edited by his brother, the third marquis, in 19 volumes. They are, however, very incomplete from the loss of the most valuable at sea in the wreck of the ship which was taking Mr. Turner, Lord Londonderry's chosen biographer, to India. The *Correspondence* for his Irish work, and the supplementary *Wellington Despatches* should also be used. Alison's *Lives* of Lord Castlereagh and Sir Charles Stewart are interesting readings, but abound with that celebrated author's usual faults, and should be corrected by Walpole's *History of England* from 1815. Of contemporary diaries, Rose's, Lord Colchester's, Remilly's, and Wilberforce's, with Pellet's *Life of Lord St. John*, should be consulted, and Metcalf's *Autobiography* for the latter foreign policy. Mr. Thorneycroft has a short biography in his *Lives of the Foreign Secretaries from 1800*, which is chiefly valuable from his access to the unpublished memoranda of Lord Bexley, who as Mr. Valentia was chancellor of the exchequer, and helped to lead the Commons from 1812 to 1822. (H. M. S.)

LONG, GEORGE, an English scholar (1800-1879), was born at Ponton in Lancashire, on the 4th of November 1800. From Macclesfield grammar school he went to Trinity College, Cambridge, in 1818. He was elected Craven university scholar in 1821, together with Lord Macaulay and Professor Malden, took his degree in 1822 as wrangler and senior chancery medalist, and the next year gained a fellowship over the heads of his two distinguished rivals. In 1824 Long went out to be professor of ancient languages in the new university of Virginia. There he married his first wife, the widow of Colonel Selden. In 1828 he returned to England to accept the Greek professorship in the newly-founded university of London. His introductory lecture in 1828 was followed in 1830 by another entitled *Observations on the Study of the Latin and Greek Languages*. The etymological appendix to this lecture is of interest in the history of classical philology in England, as illustrating the scientific comparative method of teaching the Greek and Latin languages first adopted in the London university by himself and his colleague, Professor Key. He published a *Summary of Herodotus* (1829), and editions of Herodotus (1830-33) and Xenophon's *Anabasis* (1831). He was one of the founders of the Royal Geographical Society in 1830, and was for twenty years a member of the council, or officer of the society; in the same year he joined the committee of the Society for the Diffusion of Useful Knowledge, and was till 1846, when the society was dissolved, one of its most active workers. In 1831 he resigned his professorship and became editor of the society's *Quarterly Journal of Education* (1831-35), for which he wrote many articles. He wrote for the society's Library of Entertaining Knowledge the two volumes of *The British Museum: Egyptian Antiquities* (1832-36), and edited, improved, and wrote parts of the companion volumes *Elgin and Phigaleian Marbles* (1833) and *Townley Marbles* (1836). He planned and edited for the Library of Useful Knowledge a *Geography of America and the West Indies* (1841), of which he wrote a small part, and a *Geography of Great Britain. Part I. England and Wales*, part of which he also wrote himself. He contributed two maps of Egypt and Persia, ancient and modern, to the society's *Atlas* (1831). From 1833 to 1846 he was engaged on the great labour of his life, the editing of the twenty-nine volumes of the *Penny Cyclopædia*, to which he was also an extensive contributor of articles. The committee appointed Long and Charles Knight editors, but after the publication of a few numbers Knight took no part in the superintend-

ence of the work, and all the editorial labour was done by Long.

A more colossal and the final venture of the society was its *Biographical Dictionary*, of which Long was also appointed editor. He wrote numerous articles in the seven volumes which appeared (1842-44), but the great expense did not allow it to proceed beyond the letter A. Long was also a member of the committee of the Society for Central Education, instituted in London in 1837, and contributed two essays to its *Second and Third Publications* (1838-39). In 1837 he was called to the bar at the Inner Temple. He accepted in 1842 the professorship of Latin in University College, vacated by his friend Mr. Key, which he resigned in 1846, on being appointed by the benchers of the Middle Temple their reader on jurisprudence and the civil law. Two Discourses delivered in the Middle Temple Hall, with an Outline of the Course, were published in 1847. He wrote all the articles on Roman law in the *Dictionary of Greek and Roman Antiquities*, edited by Dr. William Smith (1842), and contributed also to the companion *Dictionaries of Biography* (1844-49) and *Geography* (1854-57). His translation of thirteen of Plutarch's *Lives*, with copious notes, first came out in five of Knight's weekly volumes under the title *The Great Warring Rome* (1844-48). He planned and edited Knight's *Political Dictionary* (1845-46), a revision of articles from the *Penny Cyclopædia*. Knight published in parts his *History of France and its Revolutions*, 1789-1848 (1850).

In 1849 he left London and went to Brighton College, where he was classical lecturer until midsummer 1871. He was an excellent teacher, and was beloved by both masters and pupils. Whilst here he edited, at first jointly with the Rev. A. J. Maclean, and after that gentleman's death by himself, the *Bibliotheca Classica* series, to which he himself contributed the edition of Cicero's *Orations* (1851-52), a task for which his legal knowledge eminently qualified him. He also revised, making many corrections and additions, Maclean's editions of Juvenal and Persius (1867) and Horace (1869). He made for Bell's Grammar School Classics editions, with introductions and notes, of Cicero's *De Senectute* and *De Amicitia*, with a selection from his *Epistulae* (1850), Caesar's *Gallia* (1853), and Sallust's *Catalina* and *Jugurtha* (1860). He also edited an *Atlas of Classical Geography* (1854). His translation of *The Thoughts of the Emperor M. Aurelius Antoninus* was published in 1862. The same year appeared anonymously the amusing and instructive little volume called *An Old Man's Thoughts about Many Things*. He was sixty-four when he issued the first of the five large octavo volumes of his *Decline of the Roman Republic*. In 1871 he resigned his post at Brighton College, and retired to Portfield, Chichester, to take a rest well-earned but from labours ill-rewarded. In 1873 the Queen, on the recommendation of Mr. Gladstone, granted him a pension of £100 a year. At Portfield he completed his *Roman History* (1874), and translated *The Discourses of Epictetus, with the Enchiridion and Fragments* (1877). This was the last work of his laborious and useful life. He died after a long and painful illness on the 10th of August 1879.

In addition to the works already noticed, Long was the author of two papers in the *Journal of the Royal Geographical Society*, a few in the early numbers of the *Penny Magazine*, and several in the *Classical Museum and English Journal of Education*. He also wrote on "Grammar Schools," in Knight's *Store of Knowledge*.

Long has exercised by his writings, and indirectly through some of his London university pupils, a wide influence on the teaching of the Greek and Latin languages in England. The publication of the *Bibliotheca Classica* (began in 1851) did important service, and set English scholars an excellent example, at a time when editions with English notes containing accurate learning and sound scholarship were, with very few exceptions, not to be found. Some of the volumes of this series still remain the standard

English editions. In the knowledge of Roman law Long stood by himself amongst English scholars, and his well-known articles on that subject were the first valuable contribution to the study from any English writer. He had also a profound knowledge of ancient geography. He was an excellent French, German, and Italian scholar, and also read Spanish. His extensive and accurate learning may be explained from the combination of a tenacious memory with a clear judicial intellect. His character was as elevated as his intellect. His simplicity and manly independence may be seen partly in his writings. His faculty for discriminating evidence and his strong common sense appear in everything that he wrote.

(H. J. M.)

LONG BRANCH, a fashionable seaside resort of the United States, in Ocean township, Monmouth county, New Jersey. The old village lies about a mile inland, but the watering-place proper is for the most part situated on the bluffs and plateau immediately above the beach. The bathing-grounds are excellent; there are fine drives along the beach in the vicinity; upwards of twenty thousand visitors can find accommodation in the hotels alone, of which there are no less than thirty-three, and there are besides hundreds of private residences occupied mainly by the wealthier classes from New York and Philadelphia. Since 1874 it can be reached directly from New York both by railway and by steamers. Long Branch has a corporation of seven commissioners. Its permanent population in 1880 was 3633, in 1882 about 5000.

LONGEVITY is a term that may be applied to express either the length or duration of life of any organism, or the prolongation of life to an advanced age. The first meaning is the more scientific of the two, as it may be applied to the duration of the life of any organism, although that duration may be relatively short; thus, we may contrast the longevity of the mould which lives only a few hours with that of the forest tree which has survived for centuries, or the longevity of the ephemeral insect with that of an eagle or a swan, whose lives may be prolonged to over a century. On the other hand, the second meaning is the more common, as when an instance of very advanced age is spoken of as an example of great longevity.

The information we possess as to the natural duration of life of the lower forms of plants and animals is very meagre, and it can scarcely be asserted that in all there is a natural period of life. A simple organism composed of cells, or even one more complicated but still having the organs necessary to life constructed upon a simple type, may continue to live and grow so long as external conditions are favourable. There may be no tendency to decay of tissue inherent in the organism, so that life may be prolonged until a change in external conditions, quickly or slowly, so affects the processes of nutrition as to make the continuance of life impossible beyond a certain time. It is also highly probable that in both the animal and vegetable worlds comparatively few individuals are permitted to live undisturbed for a sufficient length of time to allow any inherent tendencies to decay to show themselves. In the struggle for existence few individuals even reach maturity; at an early period they are used to support the lives of other and perhaps stronger organisms.

Excluding the lower forms of plants, as to the duration of whose lives we know nothing, the higher plants may be classed, according to duration of life, as follows:—*annuals*, or *semi-annuals*, which grow up in spring and die in autumn; *biennials*, which die at the end of the second year; and *perennials*, the duration of which may last from four to thousands of years. Succulent plants have a short life, lasting only one or two years; the formation of wood is necessary for prolonged vegetable existence. It has been pointed out that strongly scented plants have often a longer duration of life than those destitute of smell. Thus thyme, mint, hyssop, marjoram, sage, &c., can live for two years or longer; whilst lettuce, wheat, oats, barley, live no more

than a year. Trees of rapid growth, such as fir, birch, horse-chestnut, form soft wood, and have a comparatively short life; whilst hard-wood trees, such as the oak, grow slowly and live long. It is not, however, an invariable rule that trees yielding hard wood live longest. The beech, cypress, juniper, walnut, and pear all form hard wood, but they do not live so long as the lime, which forms a softer wood. Trees which are long in producing leaves and fruit, and which also retain these for a long time, live longer than those in which these changes occur quickly. Fruit-bearing trees, producing a sour harsh fruit in the wild state, have longer lives than those bearing sweet fruits in the cultivated state. By skilful pruning, or lopping off the branches and buds, the term of life of even short-lived plants may be lengthened.

According to Hufeland, the chance any plant has of attaining a great age depends on the following conditions:—(1) it must grow slowly, (2) it must propagate slowly and late in life, (3) it must have a certain degree of solidity and hardness in its organs, a sufficiency of wood, and the sap must not be too watery; (4) it must be large and have a considerable extent of surface, and (5) it must rise into the atmosphere. If we view a tree as consisting of an enormous number of buds clustered on a common stem in which the vessels or channels for the circulation of the sap remain pervious, and in which also new wood is formed annually, there seems to be no limit to age, provided external conditions are favourable. Many large trees have reached a vast age, as shown by the following table compiled by De Candolle:—

	Years		Years
Dim (<i>Ulmus campestris</i>) ..	385	Oriental plane (<i>Platanus orientalis</i>)	723
Olive (<i>Oleaceae sempervirens</i>) ..	525	Cedar (<i>Cedrus Libani</i>) ..	800
Chestnut (<i>Castanea vesca</i>) ..	400	Lime (<i>Fraxinus excelsa</i>) ..	1076-1127
Fir (<i>Abies balsamifera</i>) ..	400	Oak (<i>Quercus Robur</i>) ..	1100, 1200
Larch (<i>Larix europæa</i>) ..	675	Yew (<i>Taxus baccata</i>) ..	1214, 1468
Chestnut (<i>Castanea vesca</i>) ..	600		1260
Orange (<i>Citrus Aurantium</i>) ..	800	Paradise distichum ..	3000-4000
Palms (<i>Corymbus and Cocco</i>) ..	100-750	Isobol (<i>Adiantum digitata</i>) ..	3000
Grove (<i>Alnus europæa</i>) ..	700		

In the animal kingdom there is great variety as regards the duration of life, but no accurate data have yet been collected. Certain *Infectoria* have been watched during the whole period of their existence, which has not lasted more than forty-eight hours; on the other hand, *Actinia*, or sea anemones, may live to a long age, as shown by the case of a specimen of *Actinia mesembryanthemum*, still alive in Edinburgh, which belonged to Sir John Dalyell, and which must be at least about seventy years of age. It is highly probable that cold-blooded animals, such as fishes, frogs, toads, in which tissue-changes go on with extreme slowness, especially during a period of muscular inactivity, may live for many years. In the imperial fish-ponds of ancient Rome lampreys were said to have attained their sixtieth year; pike and carp have been ascertained to live a hundred and fifty years; tortoises have reached the age of one hundred years; and it is alleged by natives of India that the crocodile may live for at least a hundred years, and that there seems to be no limit to its time of growth. Many birds have a long period of life. Eagles and crows have been known to live a hundred years, and parrots have been kept in confinement for sixty years. Peacocks attain an age of twenty years; barn-door fowls live for a much shorter period, from six to twelve years. Small birds seem to have shorter lives than large ones. Blackbirds, goldfinches, and canaries have been known to live for twenty years, but many of the smaller birds attain an age of only five or six years.

Amongst mammals, the elephant is supposed to attain the greatest age, reaching above a hundred years; the camel generally lives to fifty years, and may live to eighty; the horse does not live more than forty years; the deer, thirty years; the ox, fifteen to twenty years; sheep, goats,

foxes, hares, rabbits, from seven to ten years; and dogs and pigs from fifteen to twenty years. Certain general statements may be made, which do not deserve to be termed laws, but which briefly express relations that undoubtedly exist in many cases between the degree of longevity enjoyed by any species of animal and the conditions of its existence.

1. A relation can often be traced between the duration of life and the time of the development of the animal *in utero*. To this statement there are many exceptions, as will be apparent from the following table, in which the periods of gestation are given on the authority of Professor Owen (*Comp. Anat. and Phys. of Vertebrates*, vol. iii.).—

Name	Period of Gestation in Days	Longevity in Years	Name	Period of Gestation in Days	Longevity in Years
Elephant	630	100	Monkey (Orang)	160	10
Giraffe	440	Not known	Pig	120	15-20
Norse and Ass	300	10-40	Manatee	120	Not known
Cow	280	15-20	Walrus	100	Not known
Human Being ..	280	70	Long	90	15-30
Roebuck	260	20	Cat	60	15-20
Red Deer	240	20	Wolf	60	Not known
Yellow Dog	240	20	Badger	40	Not known
Procyon	240	Not known	Kingfisher	35	Not known

In the case of birds no relation of this kind can be discovered. For times of incubation of many birds see Owen, *op. cit.*, vol. ii. p. 267.

2. It would appear that the sooner a being attains maturity the sooner it propagates, and the shorter will be the duration of its life. The reproductive act may be regarded as the culminating act of the organism, requiring the highest degree of vitality, and involving the largest expenditure of energy. This act will therefore be performed when the organism has reached maturity; in some cases the animal reaches maturity late, in other cases early; but in all the epoch of maturity may be taken as about a fifth part of the whole duration of life. Thus the elephant and the human being do not reach maturity till say the twentieth year, and the period of longevity is about a hundred years; the horse, ass, and bull are mature in the third or fourth year, and live from fifteen to twenty years, sheep come to maturity in the second year, and live from eight to ten years; whilst rabbits and guinea pigs are mature within one year, and live only from four to five years. Here again there are exceptions, as, for example, the cat is mature before the end of the first year, and still it may live to the age of twenty years. Much information is still required on these points before a law can be formulated.

The question of longevity, however, probably presents the greatest interest in its relation to man. It is still a popular belief that the earliest inhabitants of the world possessed an incredible strength, were of an enormous size, and lived to a very great age; and the ages of the patriarchs before the flood are often taken literally, although the conditions making such long lives possible are at variance with those of human existence at the present day. In ancient history there are instances given of heroes who attained the age of several hundred years, but these must be regarded as mythical. For an interesting account of these, see Huxford's *Art of Prolonging Life*, p. 62 *sq.*

The following are a few instances of extreme longevity which have been placed on record:—Margaret Paton, 137; the countess of Desmond, 145; Thomas Parr, 152; Thomas Damme, 154; John Rowin, 173; and Peter Torton, 185. There can be little doubt that the ages of these persons have been much exaggerated. They lived at a time when no accurate chronological records were kept, and when it was the habit to fix the dates of occurrences by comparing them in the memory with other events believed to have happened about the same time. Thus

there were many sources of fallacy, although the narrators no doubt believed their statements to be quite accurate. Still these were instances of prolongation of human life far beyond the usual limits, and there is no reason for doubting that they all lived till they were upwards of a hundred years of age.

Perhaps the best authenticated instance of this kind is that of the famous Thomas Parr of Shropshire. "He was a poor farmer's servant, and obliged to maintain himself by daily labour. When above one hundred and twenty years of age he married a widow for his second wife, who lived with him twelve years, and who asserted that during that time he never betrayed any signs of infirmity of age. Till his one hundred and thirtieth year he performed all his usual work, and was accustomed even to thresh. Some years before his death his eyes and memory began to fail, but his hearing and senses continued sound to the last. In his one hundred and fifty-second year his fame had reached London, and, as the king was desirous of seeing so great a rarity, he was induced to take a journey thither. Thus, in all probability, shortened his existence, which he otherwise might have protracted some years longer, for he was treated at court in no royal a manner, and his mode of living was so totally changed that he died soon after, at London, in 1685. He was one hundred and fifty-two years and nine months old, and had lived under nine kings of England. What was most remarkable in regard to this man is that, when his body was opened by Dr Harvey (the discoverer of the circulation of the blood), his internal organs were found to be in the most perfect state, nor was the least symptom of decay to be discovered in them. His cartilages even were not ossified, as is the case in all old people. The smallest cause of death had not yet settled in his body; and he died merely of a plethoria, because he had been too well treated."—Huxford, p. 71.

The late Sir George Cornewall Lewis attempted to show that all such narratives were so inaccurate as to reduce the ages of the persons to something under a hundred years, and he was disposed to think that there had been no instance of a human being attaining the age of a hundred years. But subsequent cases have shown that a few have attained that great age. In these cases the evidence has not been of a collateral kind, nor has it depended on human memory, but it has been established by written records. Scarcely a year passes without instances occurring in which the evidence that the deceased attained a hundred years cannot be controverted, and there is no doubt that, when a sufficient time from the beginning of the system of registration of births has elapsed, such cases will be more common.

The average duration of life in Europe is about thirty-four years. It oscillates between 28-18 years (Prussia) and 39-8 years (Schleswig-Holstein, Lauenburg). In Naples it is quoted at 31-65 years. This falls far short of the possible longevity, a circumstance chiefly to be accounted for by the great mortality in the early years of life. According to De Quatrefages, the duration of life is almost universally the same amongst the best known peoples. Lepers live to a great age, men of from seventy to ninety years of age being common among them. The American Indians have apparently as long a life, on the average, as the white man living in the same locality. It would appear to be the same in the case of the negro. Prichard quotes from an official document of the State of New Jersey, showing that the census gave one negro centenarian in the 1000, but only one white centenarian in 150,000, on the other hand, the negro of the Senegal ages early, and does not live long. In his native place he is exposed to unhealthy influences which tell upon him, although he resists the bad effects of these longer and better than the white man; but when he is transplanted to America he enjoys a longer life.

The manner of life and nature of the occupation, apart from hereditary and special causes, have a most important influence on the duration of life. Few emperors or kings have attained the age of eighty; and, of more than three hundred popes, only six have exceeded the age of eighty. It

would seem that brain work is not unfavourable to longevity. It is almost proverbial that statesmen and judges often reach an advanced age. Many men famous in literature and science have lived to an old age. Thus from fifty to sixty we have Tasso, Virgil, Shakespeare, Molière, Dante, Pope, Ovid, Horace, Racine, Montesquieu; from sixty to seventy, Lavater, Galvani, Boccaccio, Fenelon, Aristotle, Cuvier, Milton, Rousseau, Erasmus, Cervantes, from seventy to eighty, Dryden, Potnam, Linnaeus, Locke, Handel, Galileo, Swift, Roger Bacon, Charles Darwin; from eighty to ninety, Thomas Carlyle, Young, Plato, Buffon, Goethe, Franklin, Sir W. Herschel, Newton, Voltaire, Haller; and from ninety to one hundred, Sophocles, Leuwenhoek, Michelangelo, Titian. Physicians are often long lived. Boerhaave, Haller, Gall, Darwin, Van Swieten, Fallopius, Jenner, Cullen, Galen, and Spallanzani died between seventy and eighty years of age, and Harvey, Duhamel, Pamel, Morgagni, Heberden, and Ruych between eighty and ninety; whilst the father of medicine, Hippocrates, is credited with one hundred and nine years.

A valuable set of statistics have been collected by Hirt (*Die Krankheiten der Arbeiter*) regarding the influence of trades on longevity. An abstract of these will be found in Buck's *Hygiene and Public Health*, vol. ii. pp. 71, 72.

The best indication of longevity in a community is given by the expectation of life from any given age. It is obtained by adding together the number of years which the entire population live from any specified age, and dividing the resulting total "years of life" by the number living at the year of age for which the expectation of life is desired (*English Life Table*, p. xxxii). Thus we may find the duration of the portion of human life which an individual at any age may expect to enjoy. Such calculations are of great value in connexion with assurance, and indeed in all pecuniary transactions in which the value of life contingencies are taken into account. They are the bases of all systems of life assurance. Life assurance companies have now been able to collect sufficient numbers of cases of their own experience on which to find trustworthy calculations showing the expectation of life at different ages. Such tables have really been compiled from selected cases, namely, from those who have assured, and consequently differ somewhat from those compiled on the broader data obtained from the whole population. The following table, derived from both sources of information, is given briefly to indicate the expectation of life, or the longevity, from various ages, reference being made for details to the article *INSURANCE*. The table to be read thus: a person at thirty years of age has an average expectation of living 33·3 years longer, or of attaining the age of 63·3 years.

Ages.	England and Wales, Jan. 1, 1851-54	Combined Experience of 17 English Offices, 1843	Ages.	England and Wales, Farr, 1858-64	Combined Experience of 17 English Offices, 1843
0	40·9	—	30	13·9	13·77
10	47·4	48·36	70	8·7	8·64
20	39·9	41·49	80	5·1	4·78
30	33·3	34·43	90	2·9	2·11
40	28·7	27·28	95	2·2	1·28
50	20·1	20·18			

What are the physiological conditions in the human being that determine longevity? In the first place, there is the influence of heredity. Certain peculiarities of tissue are transmitted from parent to offspring that determine whether or not the tissue will remain for a lengthened period of time in a normal condition, or whether it will quickly yield to external influences and take on an abnormal action. As the life of the body is really the sum of the lives of its constituent parts, or in other words,

of the cellular elements composing it, it is evident that anything affecting the healthy action of these elements will affect the life of the body as a whole. In some individuals the tissues have what may be termed a hereditary taint, by which is meant a want of stability, so that they pass readily from a normal into an abnormal condition, and this is unfavourable to longevity.

In the next place, even healthy tissues capable of resisting ordinary influences may be unable to resist long-continued unfavourable conditions. In course of time slow changes begin in the tissue; these in turn affect the organ in which the tissue exists, and the organ, by improperly performing its functions, injures the organism. Thus it is that habitually breathing an impure atmosphere, eating improper food, saturating the body with drugs or with alcohol, over-exerting the nervous system by excitement or prolonged brain-work or worry, and sexual excesses debilitate the body by working slow but sure changes in the tissues which will inevitably tell upon the longevity of the individual.

But even in the most favourable conditions there seems to be a limitation to the healthy action of tissues, and old age comes on. Whether this is or is not the result of long hereditary transmission it is not of much practical importance to ask, as it is a state of things all flesh is heir to. But, if it be hereditary, as is highly probable, there is the satisfaction of knowing that hereditary states can be slowly influenced by individuals living in the best possible conditions and transmitting the influences of good moral and physical hygiene. If bad hereditary qualities are transmitted, good qualities have even a better chance of being perpetuated, as they favour the individual in the struggle for existence. Thus a race which has a low degree of longevity may acquire, by persistent attempts to live in the best conditions, a long average duration of life. This is also true, though to a less extent, of an individual life.

Each tissue has a life of its own; it is developed, reaches maturity, declines, and dies. It may be replaced by successive generations of similar tissues, but the power of reproduction of tissue becomes weakened, and by slow degrees the tissue may disappear, or it may become so altered as to be quite unlike what it was at first. By these tissue-changes functional changes of great importance to the body are brought about. Thus, as age comes on, the blood becomes poorer; respiration is less active; the vital capacity of the chest, that is the working-quantity of air, is diminished; the temperature of the body is slightly increased, so that the aged are more sensitive to cold; the digestive organs are less vigorous; the walls of the arteries become hardened by earthy matter, and lose their elasticity; the veins become dilated, and the circulation is not efficiently performed; the teeth decay and disappear; the cartilages become calcified and hard; the skin is shrivelled and dry, and cutaneous respiration and excretion are less perfect; the hair whitens or falls off; the stature and the weight diminish. By and by muscular movements are less energetic and less precise; the hands tremble and the head shakes; and there is a tottering gait. The cartilages of the larynx ossify, the vocal cords lose their elasticity, and the voice becomes a shrill treble. Then the involuntary muscular tissues are affected so that the bladder is less powerful and defecation is feeble. The transparent media of the eye become dimmed, the near point of vision is pushed back so that the old man becomes presbyopic, or far-sighted, and the power of accommodation, or focussing of the eye, is entirely lost; the delicate mechanism of the drum and bones of the ear is impaired, so that deafness results; and even touch becomes less delicate. Slowly the intellectual faculties become weakened, the emotions are blunted, and the memory becomes by degrees less

trustworthy, and at last vanishes. Much of the time is now spent in sleep, and unless some intercurrent disease snags the thread of life there is a slow ebbing of existence into natural death. Essentially these phenomena are due to delicate changes in the tissues, visible only with the aid of the microscope. These changes are those of wasting or atrophy, meaning a failure of nutrition, or fatty changes, or those caused by infiltration into the tissue of earthy matter, which soon destroys its healthy functions.

Literature—Elliotson, *Human Physiology*; Hufeland, *Art of Prolonging Life*; P. Flourens, *De la Longevité Humaine, et de la Quantité de Vie sur le Globe*; Quetelet, *Physique Sociale*, vol. 1, p. 808; De Quatrefages, *The Human Species*; *An Account of Persons remarkable for their Health and Longevity*, by a Physician, London, 1829; Sir G. Cornewall Lewis's *Lectures*; Thoms, *On Longevity* (J G M)

HENRY WADSWORTH LONGFELLOW.

Copyright, 1882, by Thomas Davidson

HENRY WADSWORTH LONGFELLOW, (1807-1882), the best known of American poets, was born on the 27th February 1807, at Portland, now the capital of the State of Maine, to which his ancestor, William Longfellow, immigrated, in 1678, from English Hampshire. His father was Stephen Longfellow, a lawyer and United States congressman, and his mother, Zolpha Wadsworth, a descendant of John Alden and of "Precilla, the Puritan maiden."

Longfellow's external life presents little that is of stirring interest. It is the life of a modest, deep-hearted gentleman, whose highest ambition was to be a perfect man, and, through sympathy and love, to help others to be the same. His boyhood was spent mostly in his native town, which he never ceased to love, and whose beautiful surroundings and quiet, pure life he has described in his poem "My Lost Youth." Here he grew up in the midst of majestic peace, which was but once broken, and that by an event which made a deep impression on him—the war of 1812. He never forgot

"the sea-fight far away,
How it thundered o'er the tide,
And the dead captains as they lay
In their graves overlooking the tranquil bay,
Where they in battle died."

The "tranquil bay" is Casco Bay, one of the most beautiful in the world, studded with bold, green islands, well fitted to be the Hesperides of a poet's boyish dreams. At the early age of fourteen Longfellow entered Bowdoin College at Brunswick, a town situated near the romantic falls of the Androscoggin river, about 25 miles from Portland, and in a region full of Indian scenery and legend. Here he had among his classmates Nathaniel Hawthorne, George B. Cheever, and J. S. C. Abbott. During the latter years of his college life he contributed to the *United States Literary Gazette* some half-dozen poems, which are interesting for two reasons—(1) as showing the poet's early, book-mediated sympathy with nature and legendary heroisms, and (2) as being almost entirely free from that supernatural view of nature which his subsequent residence in Europe imparted to him. He graduated in 1825, at the age of eighteen, with honours, among others that of writing the "class poem." After graduation, he remained for a short time at Bowdoin College in the capacity of tutor, and then entered his father's law office, intending, it may be presumed, to devote himself to the study of the law. For this profession he was, both by capacity and tastes, utterly unfitted, and it was fortunate that, shortly after, he received an offer of a professorship of modern languages in his alma mater. In order the better to qualify himself for this appointment, he came to Europe and spent three years and a half travelling in

France, Italy, Spain, Germany, Holland, and England, learning languages, for which he had unusual talent, and drinking in the spirit of the history and life of these countries. For an American, while still in a plastic state, to spend much time in Europe is a doubtful and, not unfrequently, a disastrous experiment, unfitting him for a useful, contented life in his own country. The effect of Longfellow's visit was twofold. On the one hand, it widened his sympathies, gave him confidence in himself, and supplied him with many poetical themes; on the other, it traditionalized his mind, coloured for him the pure light of nature, and rendered him in some measure unfit to feel or express the spirit of American nature and life. His sojourn in Europe fell exactly in the time when, in England, the reaction against the sentimental atheism of Shelley, the pagan sensitivity of Keats, and the sublime, Satanic outcastness of Byron was at its height, when, in the Catholic countries, the negative exaggerations of the French Revolution were inducing a counter current of positive faith, which threw men into the arms of a half-sentimental half-aesthetic mediævalism; and when, in Germany, the aristocratic paganism of Goethe was being swept aside by that tide of dutiful, romantic patriotism which flooded the country, as soon as it began to feel that it still existed after being run over by Napoleon's war-chariot. When, in 1829, he returned to assume his duties at Bowdoin College, he saw the world and man no longer in the clear effulgence of nature, but in the subdued and tinted light that comes through painted cathedral window, or in the reflected rays that fall from scintillating moons. He remained six years at Bowdoin College. In his twenty-fourth year (1831) he married Miss Mary S. Potter, one of his "early loves," and in 1833 published, first, a small volume of translations from the Spanish, with an introductory essay on the moral and devotional poetry of Spain, and then part of *Under the Allee*, a youthfully brilliant work, for which a fitting title would have been "Poetry and Truth from my Travels." The latter contained some translations from the French, and was completed in 1835.

In 1835 Longfellow was chosen to succeed George Ticknor as professor of modern languages and belles-lettres in Harvard College, Cambridge, Mass., the oldest and most illustrious institution of higher learning in the country. On receiving this appointment, he paid a second visit of some fifteen months to Europe, this time devoting special attention to the Scandinavian countries and Switzerland. During this visit he lost his wife, who died at Rotterdam, November 29, 1835. The poet speaks of her in "Footsteps of Angels" as

"the Being Dearest
Who unto my youth was given,
More than all things else to love me,
And is now a saint in heaven."

On his return to America in 1836, Longfellow took up his residence in Cambridge, and began to lecture and write. In his new home he found himself amid surroundings entirely congenial to him. Indeed, there are few places in the world which a man of learning, refinement, sociability, and liberal views would rather choose for a residence than Cambridge. Its spaciousness and free rural aspect, its old graveyards and towering clime, its great university, its cultivated society, for admission to which unabsorbed wealth is a positive disqualification, and its vicinity to humane, substantial, busy Boston, are all attractions for such a man. In 1837-38 several essays of Longfellow's appeared in the *North American Review*, and in 1839 he published *Hyperion*, and his first volume of original poetry, entitled *Voices of the Night*. The former, a poetical account of his travels, had, at the time of its

publication, an immense popularity, due mainly to its sentimental romanticism. At present few persons beyond their teens would care to read it through, so unnatural and stilted is its language, so thin its material, and so consciously mediated its sentiment. Nevertheless it has a certain historical importance, for two reasons—(1) because it marks that period in Longfellow's career when, though he had left nature, he had not yet found art, and (2) because it opened the sluices through which the flood of German sentimental poetry flowed into the United States—a flood whose waters, after forty years, are not yet assuaged. The *Voices of the Night* contains some of his best minor poems, e.g., "The Psalm of Life" and "Footsteps of Angels." In 1841 Longfellow published a small volume of *Ballads and other Poems*, containing some of his most popular pieces, e.g., "The Skeleton in Armour," "The Wreck of the Hesperus," "The Village Blacksmith," "To a Child," "The Bridge," "Excelsior." In 1842 he paid a third brief visit to Europe, spending the summer on the Rhine. During his return-passage across the Atlantic he wrote his *Poems on Slavery*, which he published the same year, with a dedication to Channing. These poems went far to wake in the youth of New England a sense of the great national wrong, and to prepare them for that bitter struggle in which it was wiped out at the expense of the lives of so many of them. In 1843 he married again, choosing this time Miss Frances E. Appleton of Boston, a daughter of Hon. Nathan Appleton, one of the founders of Lowell, and a sister of Thomas G. Appleton, himself no mean poet.

About the same time he bought, and fixed his residence in, the house in which he had formerly only been a lodger, an old "revolutionary house," built about the beginning of last century, and occupied by General Washington at the time when he took command of the United States army in 1776. This quaint old wooden house, which stands in the midst of a large garden full of splendid elms, continued to be his chief residence till the day of his death. Of the lectures on Dante which he delivered about this time, James Russell Lowell says:—"These lectures, illustrated by admirable translations, are remembered with grateful pleasure by many who were thus led to learn the full significance of the great Christian poet." Indeed, as a professor, Longfellow was eminently successful. Shortly after the *Poems on Slavery*, there appeared in 1843 a more ambitious work, *The Spanish Student*, a kind of sentimental "Morality," without any special merit but good intention. If published nowadays it would hardly attract notice; but in those gushing, emotion-craving times it had considerable popularity, and helped to increase the poet's now rapidly widening fame. A huge collection of translations of foreign poetry edited by him, and entitled *The Poets of Europe*, appeared in 1845, and, about the same time, a few minor poems—songs and sonnets—under the title *The Belfry of Bruges*. In 1847 he gave to the world the greatest of all his works, and the one which will carry his name down to posterity—*Evangeline, a Tale of Acadie*. It was, in some degree, an imitation of Goethe's *Hermann and Dorothea*, and its plot, which was derived from Hawthorne's *American Note-Books*, is even simpler than that of the German poem, not to say much more touching. At the violent removal by the British Government of a colony of French settlers from Acadie (Nova Scotia) in 1755, a young couple, on the very day of their wedding, got separated and carried in different directions, so that they lost all trace of each other. The poem describes the wanderings of the bride in search of her lover, and her final discovery of him as an old man on his death-bed, in a public hospital which she had entered as a nurse. Slight as the story is, it is worked out into

one of the most affecting poems in the language, and gives to literature one of its most perfect types of womanhood and of "affection that hopes and endures and is patient." Though written in a metre deemed foreign to English ears, the poem immediately attained a wide popularity, which it has never lost, and secured to the dactylic hexameter a recognized place among English metres.

In 1849 Longfellow published a novel of no great merit, *Kavanagh*, and also a volume of poems entitled *The Seaside and the Fireside*, a title which has reference to his two homes, the seaside one on the charming peninsula of Nahant, the fireside one in Cambridge. One of the poems in this collection, "Resignation," has taken a permanent place in literature; another, "Hymn for my Brother's Ordination," shows plainly the nature of the poet's Christianity. His brother, the Rev. Samuel Longfellow, is a minister of the Unitarian Church.

Longfellow's genius, in its choice of subjects, always oscillated between America and Europe, between the colonial period of American history and the Middle and Romantic Ages of European feeling. When tired of the broad daylight of American activity, he sought refuge and rest in the dim twilight of mediæval legend and German sentiment. In 1851 appeared *The Golden Legend*, a long lyric drama based upon Hartmann von Aue's beautiful story of self-sacrifice, *Der arme Heinrich*. Next to *Evangeline*, this is at once the best and the most popular of the poet's longer works, and contains many passages of great beauty. Binging his imagination back to America, he next applied himself to the elaboration of an Indian legend. In 1854 he resigned his professorship. In the following year he gave to the world the Indian Edda, *The Song of Hiawatha*, a conscious imitation, both in subject and metre, of the Finnish epic, the *Kalevala*, with which he had become acquainted during his second visit to Europe. The metre is monotonous and easily ridiculed, but it suits the subject, and the poem is very popular. In 1858 appeared *The Courtship of Miles Standish*, based on a charming incident in the early history of the Plymouth colony, and, along with it, a number of minor poems, included under the modest title, *Birds of Passage*. One of these is "My Lost Youth."

Two events now occurred which served to cast a gloom over the poet's life and to interrupt his activity,—the outbreak of the civil war, and the tragic fate of his wife, who, having accidentally allowed her dress to catch fire, was burnt to death in her own house in 1861. It was long before he recovered from the shock caused by this terrible event, and in his subsequent published poems he never ventured even to allude to it. When he did in some measure find himself again, he gave to the world his charming *Tales of a Wayside Inn* (1863), and then a "second flight" of his *Birds of Passage*. Among the latter is a poem entitled "The Children's Hour," which affords a glance into the home life of the widowed poet, who had been left with five children—two sons, Ernest and Charles, and three daughters,

"Grave Alice, and laughing Allegra,
And Edith with golden hair."

The *Birds of Passage* was succeeded by a small volume entitled *Flower de Luze* (1868), which contains, among other fine things, the beautiful "threnos" on the burial of Hawthorne, and "The Bells of Lynn." Once more the poet sought refuge in mediæval life by completing his translation of the *Divina Commedia*, parts of which he had rendered into English as much as thirty years before. This work appeared in 1867, and gave a great impulse to the study of Dante in America. It is a masterpiece of literal translation. Next came the *New England Tragedies* (1868), and *The Divine Tragedy* (1871), which found no large

public. In 1868-69 the poet visited Europe, and was everywhere received with the greatest honour. In 1872 appeared *Three Books of Song*, containing translated as well as original pieces, in 1873 *Aftermath*, in 1874 *The Hanging of the Crane*, and in 1875 *The Mask of Pandora*, and other Poems. Among these "other poems" were "The Hanging of the Crane," "Mortuiri Salutamus," and "A Book of Sonnets." *The Mask of Pandora* is a proof of that growing appreciation of pagan naturalism which marked the poet's later years. Though not a great poem, it is full of beautiful passages, many of which point to the riddle of life as yet unsolved, a conviction which grew ever more and more upon the poet, as the bullenness of romanticism gave way to the calm of classic feeling. In the "Book of Sonnets" are some of the finest things he ever wrote, especially the five sonnets entitled "Three Friends of Mine." These "three friends" were Cornelius Felton, Louis Agassiz, and Charles Sumner, whom he calls

"The noble three,
Who half my life were more than friends to me."

The loss of Agassiz was a blow from which he never entirely recovered; and, when Sumner also left him, he wrote—

"Thou hast but taken thy lamp and gone to bed,
I stay a little longer, as one stays
To cover up the embers that still burn."

He did stay a little longer; but the embers that still burnt in him refused to be covered up. He would fain have ceased writing, and used to say, "It's a great thing to know when to stop"; but he could not stop, and did not stop, till the last. He continued to publish from time to time, in the magazines, poems which showed a clearness of vision and a perfection of workmanship such as he never had equalled at any period of his life. Indeed it may be said that his finest poems were his last. Of these a small collection appeared under the title of *Keramos, and other Poems* (1875). Besides these, in the years 1875-78 he edited a collection of *Poems of Places* in thirty-one small volumes. In 1880 appeared *Ultima Thule*, meant to be his last work, and it was nearly so. In October 1881 he wrote a touching sonnet on the death of President Garfield, and in January 1882, when the hand of death was already upon him, his last poem, *Hermes Trismegistus*, in which he gives utterance, in language as rich as that of the early gods, to that strange feeling of awe without fear, and hope without form, with which every man of spotless life and upright intellect withdraws from the phenomena of time to the realities of eternity.

In the last years of his life he suffered a great deal from rheumatism, and was, as he sometimes cheerfully said, "never free from pain." Still he remained as sunny and genial as ever, looking from his Cambridge study windows across the Brighton meadows to the Brookline hills, or enjoying the "free wild winds of the Atlantic," and listening to "The Bells of Lynn" in his Nahant home. He still continued to receive all visitors, and to take occasional runs up to Castine and Portland, the homes of his family. About the beginning of 1882, however, a serious change took place in his condition, and he was obliged to withdraw from the public gaze. Dizziness and want of strength confined him to his room for some time, and, although after some weeks he partially recovered, his elasticity and powers were gone. He now acknowledged the receipt of letters with a printed form. At last the end came. On the 19th March he was seized with violent paroxysms of vomiting and pain, which continued until the 22d, when his mind began to wander. The 23d was passed in a torpid condition, which, though it vanished on the morning of the 24th, returned in the course of the day, and passed, by insensible degrees, into the profound sleep of death.

The poet was buried on the 26th, near his "three friends," in Mount Auburn cemetery. The regret for his loss was universal; for no modern man was ever better loved or better deserved to be loved.

Longfellow was made an LL.D. of Bowdoin College in 1898, at the age of twenty-one, of Harvard in 1859, and of Cambridge (England) in 1868, and D.C.L. of Oxford in 1869. In 1873 he was elected a member of the Russian Academy of Science, and in 1877 of the Spanish Academy.

In person, Longfellow was rather below middle height, broad-shouldered, and well built. His head and face were extremely handsome, his forehead broad and high, his eyes full of clear, warming fire, his nose straight and graceful, his chin and lips rich and full of feeling as those of the Praxitelean Hermes, and his voice low, melodious, and full of tender cadences. His hair, originally dark, became, in his later years, silvery white, and its way locks combined with those of his flowing beard to give him that leonine appearance so familiar through his later portraits. Charles Kingsley said of Longfellow's face that it was the most beautiful human face he had ever seen. And many agreed with him.

In trying to form an estimate of Longfellow, we are not obliged, as in the case of so many other poets, to distinguish the poet from the man, or to degrade the nature of the former by making it an excuse for the failings of the latter. In Longfellow, the poet was the flower and fruit of the man. His nature was essentially poetic, and his life incomparably the greatest of his poems. Those who knew only the poems he wrote could form but a faint notion of the harmony, the sweetness, the manliness, and the tenderness of that which he lived.

Of the two orders of poets distinguished by Aristotle—that of the imitator of plastic, and that of the versifier of abstract—Longfellow belonged distinctly to the latter. Nature did not come to him as to a Pythia seated on a tripod, and fill him with wisdom expressible only in rhythmic prophecy; she did not even call him as a private secretary, and dictate to him her secret messages of love and kindness; justice and watchfulness were his constant attendants. He went to nature, sometimes as the Angel of the Annunciation, revealing to her that she was pregnant with divinity, sometimes as a priest pronouncing a benediction over her. What he would have been as a poet, if, instead of visiting Europe in early life and drinking in the spirit of the Middle Ages, he had been a mystic, a seer, a prophet, that point upwards to a world above nature, and backwards to a time when that world darkened the law of nature, he had, like Whitman, grown old amid the unexamined paganism of American scenery and life, we can only guess from his earlier poems, which are as naturalistic, fresh, and unmythical as could be desired, but certain it is that, from his long familiarity with the medieval view of nature, and its semi-pagan offshoot, the romantic view, he was brought, for the greater part of his life, to look upon the world of men and things either as the middle scene of a miracle play, with a heaven of rewarding happiness above and a purgatory of punishing pain below, or else as a garment concealing, while it revealed, spiritual forms of unfathomable mystery. During this time he could hear "the trailing garments of the night sweep through her marble halls," and see "the stars come out to listen to the music of the oars." Later on, as he approached his second youth (he was spared a second childhood), he tended to a more pagan view. About the time when he was writing *The Mask of Pandora*, he could see "in the sunset Jason's fleece of gold," and hear "the waves of the distracted sea, piteously calling and lamenting" his lost friend. But through all the periods of his life his view of the world was essentially religious and subjective, and, consequently, his manner of dealing with it hymnical or lyric. This fact, even more than his merits as an artist, serves to account for his immense popularity. Too well-informed, too appreciative, and too modest to deem himself the peer of the "grand old masters," or one of "those few stars that come in sight once in a century," he made it his aim to write something that should "make a yonder faith and mankind alive in the untutored heart," and to do this in the way that should best reach that heart. This aim determined at once his choice of subjects and his mode of treating them.

The subjects of Longfellow's poetry are, for the most part, aspects of nature as influencing human feeling, either directly, through historical association, the tender or repulsive side and incidents of life, or heroic deeds preserved in legend or history. He had a special fondness for records of human devotion and self-sacrifice, whether they were monkish legends, Indian tales, Norse *dröms*, or bits of American history. His mode of treatment, as we have already said, is subjective and lyric. No matter what form his works

anyme, whether this epic, as in "Evangeline," "The Courtship of Miles Standish," and "Huwatha," the dramatic, as in "The Spanish Student," "The Golden Legend," and "The Mask of Pandora," or the didactic, as in "The Psalm of Life" and many of the minor poems, they are all subjective. This is not the highest phase that can be given to works of art; but it implies less disservice in Longfellow's case than in almost any other, by reason of his noble subjectivity.

If we look in Longfellow's poetry for originality of thought, profound psychological analysis, or new insights into nature, we shall be disappointed. Though very far from being hampered by any dogmatic philosophical or religious system of the past, his mind, until near the end, found sufficient satisfaction in the Christian view of life to make it indifferent to the restless, inquiring spirit of the present, and disinclined to play with any more recent solution of life's problems. He had no sympathy with either scepticism or formal dogmatism, and no need to hazard rash guesses respecting man's destiny. He was willing to say—

"I do not know, nor will I vainly question
Those pages of the mystic book which hold
The secret still unsold.
But without rash conjecture on speculation
Turn its last leaves in reverence and good heed,
Until 'The End' I read."

He disliked the present psychological school of art, believing it to be essentially nihilist and unhealthy. He had no sympathy with the tendency represented by George Eliot, or with any attempt to be analytic in art. He held art to be essentially synthetic, creative, and unanalyzing, not analytic, destructive, or questioning. Hence he never strove to draw from nature some new secret, or to show us her relations never discovered before. His aim was to impress upon her familiar facts and aspects the seal of his own gracious nature. And in this no one ever succeeded better. "The light of the life of him is on all past things. For his reason, while his poems never reveal to us a new meaning in nature or show us a new spring of hope in man, they make us love both better than we did before. Though he never raised the curtain that hides the stage upon which the physical and moral powers of nature rehearse the drama of human life, yet he opens our eyes to the notes of the orchestra that sets before the stage and plays the overture, and, as we listen to these notes, there before us touching pictures of love, and faith, and devotion, until we find ourselves melted down and simplified into little children, whereof is the kingdom of heaven."

We have said that Longfellow's protracted residence in Europe in some degree unfitted the new life of the American republic; and this is true. He was essentially a poet of the past, not, like Lowell, a gripper and moulder of the present, or like Whitman, a John the Baptist of the future. But, just as Dante summed up the ages of faith, and Shakespeare the ages of fondalism, so Longfellow has summed up the period of transition from these to the ages of truth and liberty—a period in which the killing letter of Christian womanliness and pagan manliness has slowly been yielding to their vivifying spirit, and preparing the way for that simple humanity of which he was the earnest and the type.

As a man, Longfellow was almost perfect, as much so as it is even given to human nature to be. A man in intellect and courage, yet without conceit or bravado, a woman in sensibility and tenderness, yet without shrinking or weakness; a saint in purity of life and devotion of heart, yet without asceticism or religiosity; a knight-errant in hetero, wrong and confusion of business, yet without self-righteousness or cynicism; a prince in dignity and courtesy, yet without formality or condescension; a poet in thought and feeling, yet without jealousy or affectation; a scholar in tastes and habits, yet without aloofness or bookishness; a dutiful son, a loving husband, a judicious father, a trusty friend, a useful citizen, and an enthusiastic patriot—he united in him strong, transparent humanity almost every virtue under heaven. A thoroughly healthy, well-balanced, harmonious nature, accepting life as it came, with all its joys and sorrows, and living it beautifully and hopefully, without canker and without uncharity. No man ever lived more completely in the spirit than Henry Wadsworth Longfellow.

Perhaps the most remarkable traits in Longfellow's character were his accessibility and his charity. Though a great worker, he seemed always to have time for anything he was asked to do. He was never too busy to see a caller, to answer a letter, or to assist, by word or deed, anyone that needed assistance. He was ready to all visitors, even to strangers and children who called to look at him, or who, not venturing to call, hung about his garden-gate in order to catch a glimpse of him, was almost a marvel. He always took it for granted that they had come to see Washington's study, and accordingly, took the greatest interest in showing them that. He never, as long as he could write, was known to refuse his autograph, and so far was he from trying to protect himself from intruders that he rarely drew the blinds of his study windows at night, though that study was on the ground floor and faced the street. His acts of charity, though performed in secret, were neither few nor small. Of him it may be said with perfect truth, "He went about doing good"; and not with his money merely, but also with his presence

and his encouragement. To how many sad hearts did he come like an angel, with the rich tones of his voice waking harmonies of hope, where before there had been despair and silence! How many young literary people, disappointed of the unsuccesses of their first attempts, did he comfort and spur on to renewed and higher efforts! How careful he was to quench no smoking fire! How utterly free he was from jealousy or revengefulness! While poor, modest Edgar Allan Poe was writing violent and scurrilous articles upon him, accusing him of plagiarism and other literary misdemeanours, he was delivering enthusiastic lectures to his classes on Poe's poetry. His charity was unbounded. Once when the present writer proposed to the president of the Harvard University Visiting Committee that Longfellow should be placed on that committee, the president replied: "What would be the use? Longfellow could never be brought to find fault with anybody or anything." And it was true. His whole life was bathed in that sympathy, that love which suffers long and envies not, which forgives unto seventy times seven times, and as many more if need be. Even in his last years, when loss of friends and continual physical pain made life somewhat "cold and dark, and dreary" for him, he never complained, lamented, or blamed the arrangements of nature, and the only way in which it was possible to know that he suffered was through his ever increasing delight in the health and strength of younger men. His whole nature was summed up in the lines of his favourite poet

"Amore intellettuale, pieno d'amore,
Amor di vero ben, non di lusinga,
Lodate che succedete nel dolore."

(T. DA)

LONGFORD, an inland county of Leitrim, Ireland, is bounded on the N.W. by Leitrim, N.E. by Cavan, E. by Westmeath, S. by Westmeath and Meath, and W. by Lough Ree and Roscommon. With the exception of Carlow, Louth, and Dublin, it is the smallest county in Ireland, its greatest length being about 28 miles, its greatest breadth about 20, and the total area comprising 239,409 acres, or about 421 square miles.

The general level surface of the county is broken occasionally by low hills, which cover a considerable area at its northern angle. The principal rivers are the Camlin, which rises near Grunard, and flows past Longford to the Shannon, and the Inny, which, entering the county from Westmeath, crosses its southern corner, and falls into Lough Ree. Lough Ree is partly included in Longford, and the other principal lakes are Lough Gownagh, Derrylough, Lough Dumm, and Lough Bannow. The Royal canal intersects the county. The southern division of the county, bounded partly by the Camlin, belongs to the great limestone plain of Ireland, and the northern division is occupied chiefly by clay-slate and greywacke. In the west of the county there is an interpolation, between the two divisions, of yellow sandstone and conglomerate. Isolated hills of sandstone occur at Slievegandry and at Ballymahon, on both sides of the Inny. Marble of fine quality has been raised near Ledwithstown. In the north indications of iron are abundant, and there are also some traces of lead.

Agriculture.—The climate is somewhat moist and cold, partly owing to the large extent of marsh and bog. The soil in the southern districts resting on the limestone is a deep loam well adapted for pasture, but in the north it is often so thin and poor as to be incapable of reclamation.

In 1881 there were 74,876 acres under tillage, 125,838 pasture, 3697 plantation, and 61,333 waste. The total number of holdings in 1880 was 2682, of which 985 were less than 1 acre. More than one-half of the total number were included in those between 5 and 16, and 16 and 30 acres in extent, which numbered respectively 2482 and 2658. The following table shows the areas under the principal crops in 1880 and in 1881:—

Wheat.	Other Cereals.	Potatoes.	Turnips.	Other Green Crops.	Flax.	Meadow and Clover.	Total.
1880	2,513	38,841	828	15,268	2,701	666	58,166
1881	2,507	37,570	583	15,168	2,700	918	57,936

The total number of horses in 1881 was 6886, of which 4265 were used for agricultural purposes; of cattle 51,847, of which 10,212 were milch cows; of sheep, 24,140; of pigs, 17,900; and of poultry, 292,824. These were valued at 674,000. According to the latest return, the land was divided among 493 proprietors possess-

ing 256,608 acres, with an annual rateable value of £161,789, the average rateable value per acre being 11s. 1d. The average was 58s. 8d. acre, and 14 per cent. possessed less than 1 acre. The largest owners were Colonel King Harman, 28,779 acres, earl of Granard, 14,678, Lord Annulla, 15,161, George Masonochy, 10,319.

Manufactures.—These are confined almost entirely to coarse woollen and linen cloth.

Railways.—One branch of the Midland Great Western Railway skirts the eastern boundary of the county, and another passes through its centre to Longford.

Administration and Population.—The county includes 6 baronies, with 26 parishes and 801 townlands. It is in the north-west circuit. Assizes are held at Longford, and quarter sessions at Ballynashon, Granard, and Longford. There is one poor-law union wholly within the county, with portions of other two. It is in the Dublin military district and Burr subdistrict. There are barracks for infantry and cavalry at Longford. The county returns two members to parliament.

The only town of any importance in the county town, Longford. From 25,142 in 1780 the population of the county gradually increased till in 1841 it was 116,491, but since then it has diminished to 82,348 in 1851, 64,501 in 1871, and 61,009 in 1881, of whom 30,770 were males and 30,239 females. From 1st May 1881 to 31st December 1881 the number of immigrants was 49,728. For the ten years 1871–81 the marriage-rate per 100 of the population was 4, the birth-rate 24.8, and the death-rate 16. In 1881 23.1 per cent. of the population above five years of age were illiterate, the percentage in 1871 being 32. The Roman Catholics formed 91 per cent. of the population in 1881, and the Episcopalian 8.

History and Antiquities.—The early name of Longford was Analló or Anall, and it was a principality of the O'Farrells. Along with the province of Meath, in which it was then included, it was given by Henry II. to Hugh de Lacy, who planted in it an English colony. On the division of Meath into two counties in 1543, Annulla was included in West Meath, but in the 17th of Elizabeth it was made share ground under the name of Longford, and included in the province of Connaught from which it was transferred to Leinster in the 27th of the same reign.

The principal antiquarian ruin is the Danish rath called the Mot of Granard, at the end of the main street of the town, and occupying a position 598 feet above sea-level. There are monastic remains at Ardagh, Longford, Moyish, Clone, Deig, Dunsinnet, and Kilmonee, as well as on several of the islands of Lough Ree. The principal old castles are those of Rathenee near Lanesborough, and Ballymahon, Burnagee, and Ceshcor on the Lary. The principal modern seats are those of Castlekeech on the Camlin, and Castle Forbes, the seat of the earl of Granard. Oliver Goldsmith was born at Pallas, a village near Ballynashon, in this county.

LONGFORD, the chief town of the above county, is situated on the river Camlin, and on a branch of the Midland Great Western Railway, 75 miles west-north-west of Dublin. The principal buildings are the parish church in the Grecian style, St. Mell's Roman Catholic cathedral (one of the finest Roman Catholic churches in Ireland), the court-house, the market-house, and the county jail. Of the old castle and of the Dominican abbey there are slight remains. The town has a considerable trade in grain, butter, and bacon. There are corn-mills, a spool factory, and tanneries. The population in 1871 was 4376, and in 1881 it was 4380.

The ancient name of the town was *Athfada*, and it is said to occupy the site of a monastery founded by St. Idus, a disciple of St. Patrick. The town obtained a fair and market from James I., and a charter of incorporation from Charles II., as well as the right to return two members to parliament. It was disfranchised at the Union.

LONGINUS, a philosophical critic of great eminence, and one of the brightest spirits of antiquity, uniting Greek subtlety with Roman fervour, flourished in the 3d century, and is known to have perished under sentence of the emperor Aurelian in 273 A.D. He forms one of the last brilliant cluster of pagan literati; and Porphyry, round whom it centred, was the pupil of Longinus. As Porphyry is known to have been born in 233, it is probable that his preceptor, who could not have been less than twenty years his senior, may have been born about 210 A.D. The main authority for the facts of his life is a notice in Suidas, where we find it stated in a preface to a list of his writings that "Longinus Cassius, philosopher, preceptor of Porphyry the philosopher, a learned scholar and critic, lived in the time of the emperor Aurelian, and was cut off by him as

having conspired with Zenobia, the wife of Odenathus." From the same authority we learn that Phronto, the rhetorician of Emesa in Syria, was his uncle, and that Phrontonius, sister of Phronto, was mother to Longinus, who thus became heir to his uncle Phronto. As to his birthplace there is no tradition, but it is probable that he was a native of Syria, possibly of Emesa, to which he undoubtedly belonged. He tells us, as we learn from fragments of his works, that he enjoyed great advantages in travel and education, that his parents, being rich, took him to travel and he saw much of the world, and that he studied at Athens under Phronto, at Alexandria under Ammonius Saccas and the pagan Origenes, and at Rome under Plotinus and Amelius. The Neo-Platonic philosophy was then in the ascendant, but Longinus did not embrace the new speculations which Plotinus was then developing, and continued a Platonist of the old type. Hence the sting of a sarcasm attributed to Plotinus—"Longinus may be a philologist, but he is no philosopher." Longinus did not appear to have reciprocated the sarcastic feeling, for we have still extant a fragment of a letter in which he asks Porphyry to come to Phoenicia and to bring with him the treatises of Plotinus, for, he observes, though he does not feel much attraction for the subjects, he yet likes the man. The reputation which Longinus acquired by his learning was immense; it was of him that Euphrasius first used the expression that has since become proverbial—"living library"—in modern phrase, a walking encyclopædia.

The most conspicuous event of his life was also the most tragic in its consequences. He became secretary to Zenobia, the widowed queen of Palmyra, who, apart from him a knowledge of Greek, and made him her chief counsellor in state affairs. In this capacity he favoured the policy by which she aimed at independence of the Roman empire, encouraged, doubtless, to do so by the recent fate of Valerian, and by the feebleness of the tenure by which Rome held the Syrian provinces. Antioch, however, crushed the pretension, and, while Zenobia lost her power and was, led captive to Rome, Longinus paid the forfeit of his life. According to Zosimus, Zenobia sought to exculpate herself with Aurelian by laying the whole blame on her adviser. He died bravely, not seeking to escape his fate by suicide as a Stoic might have done, but following the example of Socrates and the precept of Plato, to whose philosophy he adhered.¹

The remains of Longinus that have come down to us, unfortunately scanty, are partly fragments of letters, and extracts from criticisms on points of diction; and they bear out the impression we derive from the historical notices of the man. He is vivid and yet minute, lively and penetrating, and his observations show taste, learning, and judgment. Among the most notable of the fragments we have a defence of the Platonic doctrine of the soul as a distinct essence from the body, which defines clearly his philosophical position.

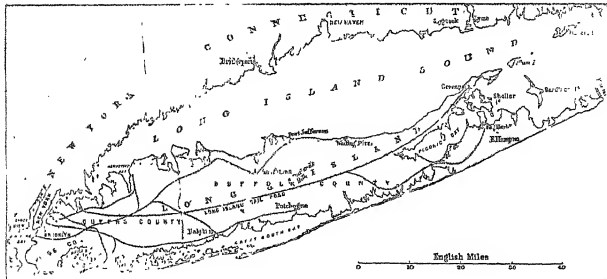
It only remains to advert in a few words to the remarkable production called the *Treatise on the Sublime*, which has usually passed current as a work of Longinus. This remarkable work, which is among the most notable productions of ancient criticism, second only in importance to the *Poetics* of Aristotle, and superior to that work in luminous tenacity and sense of form, cannot be with certainty ascribed to Longinus, although the internal evidence favours the usual ascription. Of the two most startling difficulties the first is the absence of any mention of a treatise *peri hypous* in the list by Suidas. The enumeration is, however, incomplete, and the phrase "many other works," with which it closes, may be held to cover much. A more formidable difficulty is the circumstance that in the most important

¹ It is probable that he owed part of his political fervour to the influence or inheritance of the name "Cassius," from whatever source this surname was derived. The associations of this name were distinctly anti-imperial and even regalistic, as seen in Caius Cassius and in Cassius Cherea.

names up (that is the Paris Catalog, No 2936, of the 10th century) the heading is *Ancientia & Arriphe* giving thus an alternative author "Dionysius," and in the other important MS., the Laurentian of Florence, the title is *Ancientia*, implying that the author was unknown. According to Vandel (*Rhodes*, p. 134) this title is not the original one, and there are traces of an earlier title *Arriphe*, which had formed the superscription. Full information as to the origin of question will be found in the editions of A. E. Egger (*Laurentia quæ superscribitur*, Paris, 1877), Vandel's *Diachronologie* (*Texte de l'histoire de son livre de Rhodes de Longue*, Geneva, 1864), and Otto J. Müller's *Ancientia & Arriphe quæ superscribitur de Solimutella* (*Leipzig*, Bonn, 1862). Vandel ascribes the treatise to Phylarchus, but the evidence negates that supposition, and, although there are difficulties in ascribing the work absolutely to Longinus, as Bodæus did, and even the critics of last century traditionally assumed, there is no other name than that of Longinus that presents so many convincing coincidences, to justify provisionally the current ascription. The fragments that remain of the undoubted works of Longinus are largely characterized by the same lively force and epigrammatic force, which distinguish the treatise, "On the Sublime." The translations of this treatise into all the European languages have been almost infinite, including the famous one by E. de la Motte, who translated the work the favourite vehicle of the belles-lettres to come in the 18th century. The most important English translations are by William Smith, 1759, frequently reprinted, H. D. La Motte, 1840, and by W. D. G.

LONG ISLAND, an island with an area of 1682 square miles lying off the coast of the United States, between

40° 33' and 41° 10' N lat, and forming part of the State of New York. While the length from east to west is about 120 miles, the width nowhere exceeds 24 miles, and in some places falls to 13 or 15. The western end is separated from the city and State of New York by the East River, which is nowhere more than three quarters of a mile in breadth, and has been spanned by a great suspension bridge, but between the main body of the island and the mainland (Connecticut, Rhode Island) lies Long Island Sound, widening out to a breadth of 20 miles. The sound, however, is comparatively shallow, the depth in the eastern and seaward portion being usually under 200 feet, while in the portion west of Connecticut river it is nowhere more than 170 feet, and in general only 75-100 feet. Geologically the island is very interesting, consisting, as it does for the most part, of an immense moraine deposit of glacial drift. A range of hills extends with some interruptions for about 60 miles in the line of its longer axis, varying in height from 150 to 381 feet above sea-level. Fort Pond Hill for instance is 194 feet, Neapeague, 135, Annagisset, 161, Shinnecock, 140, Osborn's Hill, near Riverhead, 293, Highland's south of Coram, 310, West Hills (Jama's Hill), 354, Lloyton's Hill, 380, Westbury, 260, Hempstead



Map of Long Island

Harbour Hill, 384; John M. Clarke's Hill, 326. From the foot of the hills southward stretches a vast newly level plain, with an average height of 70 feet, and consisting of post-glacial stratified sand and gravel, and across this run a large number of shallow parallel watercourses, remarkable mainly for the regularity with which they present an elevated bank on the western side and a long declivity on the eastern. On the northern side of the range the surface is very uneven, some of the elevations exceeding 200 feet, and deep broad valleys stretching down to the sound, and forming a series of excellent harbours. The glacial drift of Long Island is of immense depth, and contains a wonderful number of boulders. "At the eastern extremity," says Lyell on the authority of Mather, "they are of such kinds of granite, gneiss, mica, slate, greenstone, and syenite as may have come across the sound from parts of Rhode Island. Opposite the mouth of the Connecticut river they are of such varieties of gneiss and hornblende slate as correspond with the rocks of the region through which that river passes. Still further west they consist of red sandstone and conglomerate and the trap of that country, and lastly, adjoining the city of New York, we find serpentine, red sandstone, and various granitic and crystalline rocks

which have come from the district immediately to the north." One of the boulders near Mather's measures 54 feet long and 40 feet wide, and lies 16 feet above the level of the soil. Of the numerous boulders scattered throughout Long Island it is enough to mention Ronkonkoma, near Lakeland, the waters of which are said to decrease and increase in regular periods of four years. Much of the surface of the country is still covered with wood—oak, hickory, and chestnut growing freely on the unmodified drift, and pine forests extending for about fifty miles through the sandy plains. A good rich loam abounds in the northern districts, and the lighter soils of the south are easily rendered productive. Market-gardening especially is carried on with success. The climate is comparatively mild, the mean annual temperature being 49° to 51°, the maximum for the year between 95° and 100°, and the minimum 4° to 8°. The average rainfall is about 42.1 inches. Towards its western and more especially the northern coast of Long Island presents a number of important bays—Glen Cove, Oyster Bay, Huntington Bay, Smithtown Bay, &c.; the western extremity is deeply bifurcated by a very irregular inlet, broken up by various islands into Gardiner's Bay, Little Peconic, and Great

Peconic, and along a large part of the southern coast stretches a remarkable series of lagoons, formed by a line of dunes varying in breadth from 1 to 1 mile, and connected at various points with the ocean. Those last—of which the most important is Great South Bay, 40 miles long by about 5 or 6 miles wide—are of great service to the island, and an Act has been passed to increase their utility by connecting them by canals. Coney Island and Rockaway Beach, the most frequented of the many seaside resorts in the island, lie near the south-western extremity. As regards both birds and fishes, Long Island seems a kind of meeting place between the arctic and the equatorial species. In winter, for instance, it is visited by the eider-duck, the little white geese, the great osprey, and the ank, in summer by the turkey buzzard, the swallow-tailed kite, and the fork-tailed flycatcher. A few deer are still to be found; and various tracts of country and islands in the great bays are stocked with game and fish by sportsmen's clubs. The east portion of the island is one of the chief seats of the menhaden fisheries, and the oyster beds of both the north and the south coast are of great value. Those of the Great South Bay (furnishing, amongst others, the famous "blue points") alone give employment in the season to 1500 fishermen. (See E. Ingersoll, "The Oyster Industry," in the *Tenth Census* publications of the United States, 1881.)

Administratively Long Island consists of King's County (72 square miles), Queen's County (410), and Suffolk (1300), which in 1880 had the following population—

	Total	Males	Females	Native	Foreign	White	Coloured
King's ...	289,649	149,289	140,360	411,295	168,324	500,278	6,271
Queen's ...	208,647	104,700	103,947	68,056	21,931	86,707	5,840
Suffolk ...	46,938	23,760	23,178	25,510	5,428	31,477	2,455

Of the thirteen or fourteen Indian tribes living on the island at the time of the discovery, the only remnants are about fifty Shinnecocks and Montauks.

Besides Brooklyn, which had 666,680 inhabitants, King's County contains Flatbush town, 7834; Flatlands town, 3127; Gravesend town (including Coney Island village), 8576; New Lots town, 18,581; and New Utrecht town, 4742. In Queen's county are Flushing town, 16,919; Hempstead town (including East Rockaway, Garden City, and sixteen other villages), 18,160; Jamaica town, 10,089; Long Island City, 17,129; Newtown town, 9798; North Hempstead town, 7562; and Oyster Bay town, 11,928. In Suffolk there are no cities, and none of the villages have 500 inhabitants. The "towns" are Babylon, Brookhaven, East Hampton, Huntington, Illy, Riverhead, Shelter Island, Smithtown, Southampton, and Southold. Garden City was built by A. T. Stewart as a model suburban settlement, and contains a fine cathedral. Hicksville is associated with the memory of Elias Hicks the Quaker missionary. Sag Harbor was formerly a great whaling station, and still maintains a good coasting trade. Five miles from Flushing is Greenvale rifle range, the finest in the United States. On Gardner's Island the pirate Kidd concealed the treasures partly recovered by the governor of Massachusetts in 1699.

Long Island was so called by its Dutch discoverers in 1609, and the name Nassau, bestowed in 1683 by the colonial legislature, never found popular acceptance. Breucklen (Brooklyn), Amersfoort (Flatlands), Vlissingen (Flushing), Rensselaer (Jamaica), and New Utrecht were founded by the Dutch between 1630 and 1664; and between 1640 and 1660 the English from the New England colonies established Southold, Southampton, Southampton, Hempstead, Huntington, Oyster Bay, Smithtown, Illy, &c. Though the charter granted by James I. in 1620 expressly excluded territory actually possessed or inhabited by any other Christian prince or state, the grantees in 1686 conveyed to the earl of Stirling among other lands the island of Matinecock or Long Island. A treaty concluded between Dutch and English at Hartford (Connecticut) in 1650 surrendered to England all the land south of Oyster Bay; but, though it was ratified by the states-general of Holland in 1656, no action was taken by the English Government. Long Island was included in the territory assigned to the duke of York in 1683-84, and in 1684 an English squadron conquered the Dutch in time of peace, and set up a government in the duke's name. When the Dutch governor, who had recovered New York in 1673, issued a proclamation requiring the submission of the Long Island towns, they all obeyed except the three most eastern; but the treaty of Westminster in 1714 left Long Island to the English, and it became a regular colony of the crown. In the beginning of the

war of American independence, Long Island actually played a prominent part. The efforts made by Washington to defend it were frustrated by the British under Cornwallis in 1776, and it remained in their hands till the close of the contest.

LONG ISLAND CITY, a city of the United States, the capital of Queen's County, New York, situated on the west coast of Long Island, and separated from New York by the East River and from Brooklyn by the Newtown Creek. The area, which includes what were the past villages of Astoria, Newtown, and Ravenswood, measures 3 miles from east to west and 5 miles from north to south, and the general plan of the place is constructed on a spacious scale. The river frontage extends to about 10 miles. Hunter's Point, as the south-west portion is called, contains the terminal depôts of several railway lines, extensive warehouses for the storage of petroleum, and a variety of industrial establishments—such as granite-works, chemical works, engine-works. In the Astoria district there are factories for pianos, carriages, and carpets. Long Island City dates from 1870, in 1871 its population was about 16,000, and in 1880 17,117.

LONGITUDE. See **GEOGRAPHY (MATHEMATICAL)** and **TIME**.

LONGOMONTANUS, or **LONGIBURG**, **CHRISTIAN** (1562-1647), a Danish astronomer, was born at Loughere, a village of Jutland, in Denmark, on the 11th of October 1562. Having, when only eight years old, the misfortune to lose his father, who was only a poor labourer, he was taken charge of by a maternal uncle, through whose influence he received lessons from the clergyman of the place. Although, owing to the poverty of his parents, the instruction which he had received up to this time had been of the most elementary kind, his aptitude for learning was so great that, under the tuition which he now received, he made rapid progress in his studies, especially in the mathematical sciences, for which he acquired an intense liking. His mother, however, was unable to pay any longer for his education, and he was reluctantly compelled to return home to work in the fields. By improving every opportunity which his laborious life now permitted, he was still enabled to pursue, to some extent, his favourite studies. This state of matters continued for some time; but his intense thirst for knowledge, and the unrelieved jealousy of his friends, led him in 1577 to steal away from home, to try his fortune in the world. Accordingly, at the age of fifteen, he went to Wiborg, a town about 12 miles distant from his native village. There he spent eleven years, dividing his time between attending the lectures of the professors in the college of that town, and working in the fields. By this means he was able not only to earn a sufficient livelihood, but also to defray the expenses of his education; and his close application to study soon enabled him to acquire considerable knowledge of literature and of the sciences. In 1588, at the age of twenty-six, he removed to Copenhagen, where his great abilities speedily secured for him the esteem and admiration of the professors in the university of that town. By this means he was brought under the notice of the eminent astronomer Tycho Brahe, who received him very kindly, and ultimately appointed him his assistant. He remained with Tycho Brahe for eight years in the island of Høene, and during that time rendered him such valuable services in his astronomical observations and calculations, that, when Tycho Brahe settled in Germany, he invited Longomontanus to accompany him. This offer he accepted; but having shortly afterwards expressed to Tycho Brahe his desire to return to his native country, the latter at once furnished him, not only with excellent testimonials, but also with money for his journey. On his return to Denmark he made a long detour in order to visit the places whence Copernicus

had made his celebrated astronomical observations. On his arrival at Copenhagen, he found a patron in the person of Christian Friis, chancellor of Denmark, who gave him employment in his household. He continued in this situation till 1603, when he received the appointment of rector of the college of Wiborg. Two years later (1605) he was elected to the chair of mathematics in the university of Copenhagen. This appointment he held till his death, on the 8th of October 1617. Longomontanus, although one of the best astronomers of his age, inherited some of his worst prejudices. A firm believer in astrology, he held, among other things, that comets were messengers of evil. He also imagined that he had squared the circle. He found that the circle whose diameter is 43 has for its circumference the square root of 18253, — which gives 3.14185 for the value of π . Poll and others endeavoured to prove that he was mistaken, but they failed to convince him of his error. He refers to his imagined discovery in almost all his published works, and defends his position with great zeal.

The following is a list of his more important works in mathematics and astronomy, with the dates of their first publication: — *Synopsis Mathematica*, &c. 1611; *Cyclometriae et Logarithmorum de monstrata*, &c. 1612; *Disquisitiones de Logarithmo*, 1616; *Astronomiæ Dialectica*, &c. 1622; *Disquisitiones quatuor Astrologicae*, 1622; *Poetæ præfationibus Philosophicis*, 1623; *De Chronologia Historica, seu de Temporis Dispositione*, &c. 1627; *Geometriae quædam XLII. de Cyclometriae rationibus et versis*, 1631; *Summa Quatuordecim Circuli*, 1634; *Disquisitiones de Arithmetica Indole*, 1636; *Comæ Prædictæ et de Mysteriis tractatus Numerorum*, 1637; *Problematum de Geometria*, 1638; *Problematum cum Pantomatibus de Geometria*, 1638; *Inductio in Theatrum Astronomicum*, 1639; *Quædam in Pantomatibus*, &c. 1641; *Admiranda Operum verum Numerorum*, &c. 7. 8. &c. 1645; *Opus Geometricum seu de Geometria Mysteriis*, &c. 1646.

LONGUEVILLE, ANNE GENEVIEVE, DUCHESS DE (1619-1679), who played the greatest part in the troubles of the Fronde, and whose name has come down to posterity as the brilliant intriguer in politics in her early and the pious protectress of the nuns of Port Royal in her later years, was the only daughter of Henri de Bourbon, Prince de Condé, and his wife Charlotte Marguerite de Montmorency, and the only sister of Louis, the great Condé. She was born on August 28, 1619, in the prison of Vincennes, into which her father had been thrown for opposition to Marshal D'Ancre, the favourite of Marie de' Medici, who was then regent in the minority of Louis XIII. She was educated in the convent of the Carmelites in the Rue St Jacques at Paris, which had been recently established under the influence of St Teresa's reforms by nuns of the strictest piety, whose teaching she never entirely forgot. Her early years were clouded by the execution of the young and brilliant Duc de Montmorency, her mother's only brother, for intriguing against the great Richelieu in 1631, and that of her mother's cousin the Comte de Montmorency Boutteville for dwelling in 1635; but, in spite of their sorrow, her parents made their peace with Richelieu, and when she was introduced into society in 1635 she found plenty of court society to enjoy. She soon became one of the bright particular stars of the Hôtel Rambouillet, where all that was learned, witty, and gay in France used to assemble, and which had not yet degenerated into the meeting place of those *précieuses* whom Molière was to laugh out of existence. It was first proposed to marry her to the young Prince de Joinville, and thus unite the Guises and Condés, but he died in 1639, and her parents could only find for her husband the Duc de Longueville, a prince of the blood indeed, and governor of Normandy, but a widower, and twice her age. The marriage could not be a happy one, but the young duchess long remained faithful to him, and bore him four children. After Richelieu's death her father became chief of the council of regency during the minority of Louis XIV., her brother

Louis won the great victory of Rocroy in 1643 (see CONDÉ), and the duchess became of political importance. In 1647 she accompanied her husband to Münster, where he was sent by Mazarin as chief envoy, and where she charmed the German diplomatists who were making the treaty of Westphalia, and was addressed as the "goddess of peace and concord." On her return she fell in love with the Duc de la Rochefoucauld, the author of the *Maxims*, who made use of her love to obtain influence over her brother, and thus win titles and honours for himself. She was the guiding spirit of the first Fronde, when she brought over Armand, Prince de Conti, her second brother, and her husband to the malcontents, but she failed to attract Condé himself, whose loyalty to the court overthrew the first Fronde. However, La Rochefoucauld won the titles he desired. The second Fronde was again her work, owing to her lover's disgust at losing his new honours, and in it she played the most prominent part in attracting to the rebels first Condé and later Turenne (see CONDÉ). It is not necessary to give the whole history of the wars of the Fronde, which is detailed elsewhere, but it must be noticed that the duchess herself only mingled in politics to please her lover, and gain his ends. In the last year of the war she was accompanied into Guienne by the young and handsome Duc de Nemours, her intimacy with whom gave La Rochefoucauld an excuse for abandoning her, and who himself immediately returned to his old mistress the Duchesse de Choiseul. Thus abandoned, and in disgrace at court, the duchess betook herself to religion. She accompanied her husband to his government at Rouen, and devoted herself to good works. She took for her director M. Singlin, so famous in the history of Port Royal, and from that time began her new religious life. Till 1663 she chiefly lived in Normandy, when her husband died, and she came to Paris. There she became more and more Jansenist in opinion, and her piety and the remembrance of her influence during the disastrous days of the Fronde, and above all the tender love her brother, the great Condé, bore her, made her a conspicuous figure. The king pardoned her, and in every way showed the respect he had for her. She became the great protectress of the Jansenists; it was in her house that Arnauld, Nicole, and De Lane were protected; and to her influence must be in great part attributed the release of De Saoy from the Bastille, the introduction of Pomponne into the ministry and of Arnauld to the king. Her famous letters to the pope are part of the history of PORT ROYAL (q.v.), and as long as she lived the nuns of Port Royal des Champs were left in safety. Through the latter years of her life she had, despite the honour in which she was held, much to bear. Her elder son resigned his title and estates, and became a Jesuit under the name of the Abbé d'Orléans, while the younger, after leading a very debauched life, was killed, bravely leading the attack in the passage of the Rhine in 1673. As her health failed she devoted herself more and more to religion, and hardly ever left the convent of the Carmelites in which she had been educated. On her death in 1679 she was buried with great splendour by her brother Condé, and her heart, as she had directed, was sent to the nuns of that Port Royal des Champs which she had so greatly protected and defended. Her life is noteworthy, both from the harm she did in the turbulent days of the Fronde, though she acted, hardly knowing what she did, from love rather than from selfish ambition, and also from the greatness of her penitence, when her protection of Port Royal more than redeemed her fame, and gave her a title to the grateful remembrance of all who reverence true piety and learning more than the artificial glitter of the reign of the "grand monarch."

The chief authority for Madame de Longueville's life is a little book in two volumes by Villafra the Jansenist, published in 1738.

Cousin has devoted four volumes to her, which, though immensely diffuse, give a vivid picture of her time. Her connexion with Port Royal should be studied in Arnauld's *Mémoires*, and in the difficult histories of that institution.

LONGUS, the Greek romancer. Nothing is known of the life of the author of *Daphnis and Chloe*, and it is only inferred from some apparent imitations of the *Æthiopica* of Heliodorus that he wrote after the time of Theodorus. He may therefore be placed in the 5th century. His position in literature is interesting and not unimportant. He represents the romantic spirit of expiring classicism, the yearning of a highly artificial society for primitive simplicity, and the endeavour to create a corresponding ideal. The little idyl in the seventh edition of Dion Chrysostom is a beautiful example of this tendency three centuries before Longus, and the letters of Symeas, newly in his own day, attest a genuine feeling for nature and a country life. In its literary aspect, nevertheless, this movement has little in common with the return to pure nature which inspired a Wordsworth, or the realism of George Sand's delineations of the peasantry of Berri. Longus's style is rhetorical, and his shepherds and shepherdesses are wholly conventional. It is no small credit to him to have achieved so purely ideal a delineation with so little apparent affectation, and without any of the tediousness of almost all modern pastoral writers. If unable to blend the reality and idealism of the pastoral life as Shakespeare has done in *As You Like It* and *The Winter's Tale*, he has nevertheless imparted real human interest to a purely fanciful picture, and shows no little knowledge of human nature in his delineation of the growth of a passionate attachment between two innocent children. *Daphnis and Chloe* were probably the prototypes of Paul and Virginia; and, notwithstanding the naïveté of some details, the Greek has a decided advantage over the Frenchman in the simplicity and sincerity which constitute the true modesty of nature. As an analysis of feeling, *Daphnis and Chloe* makes a nearer approach to the modern novel than its chief rival among Greek erotic romances, the *Æthiopica* of Heliodorus, where the attraction mainly consists in the ingenious succession of incidents.

Longus has found an incomparable translator in Amyot, bishop of Auxerre, whose French version, as revised by Paul Louis Courmer, is better known than the original. It appeared in 1559, thirty-nine years before the publication of the Greek text at Florence by Alamanni. The chief subsequent editions are those by

Jungmann (Hann., 1603), Villosio (Paris, 1778, which first gave a standard text), Courmer (Rome, 1819, the first entirely complete edition), Scirei (Leyssac, 1835), and Percebois (Paris, 1866, pronounced by M. Pons the *se plus utile et accurate*). Pons's account of the literature and bibliography of the subject, appended to his edition of Courmer's version (1878), is very useful and complete. There are English translations by Thonibay, Cruge, and Le Gai, the last with omissions. The illustrated editions, generally of Amyot's version, are very numerous, and some are very beautiful. Pradon's designs are especially celebrated.

LONS-LE-SAULNIER, capital of the department of Jura, France, is situated at a distance of 275 miles by rail from Paris, on the Vallée, a small tributary of the Saône, about 820 feet above the sea-level, at the point where the Besançon, Lyons, and Châlon-sur-Saône railways converge. It is pleasantly surrounded by vine-clad hills from 300 to 500 feet in height, consisting of lower spurs of the Jura chain. It owes its name to its salt-guts, which have been used from a very remote period; the large quantities of ashes derived from the wood burnt in the process of evaporation are extensively utilized in agriculture. Since 1839 there has been an establishment for the use of the mineral waters. The principal industry of the place is the manufacture of sparkling wines, the climate growth being the best for this purpose. There is also a foundry, in addition to printing establishments, tanneries, distilleries, brush factories, and manufactures of carpets and tapestry. About a mile to the west of the town are the salt mines of Montmorot, employing one hundred and fifty workmen; the bed of rock salt, which lies at a depth of 100 feet, and is nearly 100 feet thick, yields about 5500 tons of pure salt yearly, 885 tons of sulphate of soda, and 300 tons of chloride of potassium. Lons-le-Saulnier possesses no buildings of special interest; one of the public squares contains a statue of Lecombe, and there is a museum containing Gallo-Roman antiquities and various works of art. The library, which like the museum is in the town hall, has 20,000 volumes. The population in 1876 was 11,371.

Lons-le-Saulnier, originally a Gallic town, was fortified by the Romans, destroyed by the barbarians, and, after its rebuilt and extended, belonged for a long time during the middle ages to the powerful house of Châlon, a branch branch of that of Burgundy. It was burned in 1461 by the English, and again in 1575, when it was seized by the duke of Longueville for Louis XIII. It was definitively French in 1571. It was then that the meeting between Ney and Napoleon took place, on the return of the latter from Elba, on March 21, 1815. Rouget de Lisle, the author of the *Marseillaise* Hymn, was born at Montmorot near this town.

Encyclopædia Britannica.—VOL. XIV.

PRINCIPAL CONTENTS.

- KASHGAR C. E. D. BLACK, Home Office, London.
 KASHMIR Gen. R. MURRAY, R.E.
 KATJIBACH J. B. ATKINSON, M.A., author of "An Art-Tell."
 KEATS ALGERNON C. SWINBURNE.
 KEBBLE Principal J. C. SHARP, LL.D., author of "Culture and Religion."
 KENTUCKY J. R. PROCTOR, Geological Survey, Frankfort, Kentucky.
 KEPLER Miss A. M. CLARK.
 KHAZAN P. LYPILLION GILF, M.A., Balliol College, Oxford.
 KHIVA Major F. C. H. CLARK, R.A.
 KINDERGARTEN Rev. R. H. QUICK, M.A., author of "Essays on Educational Reformers."
 KINGS Rev. W. ROBINSON SMITH, LL.D.
 KINGSLEY C. KEOGAN PAUL, M.A., author of "William Goulton."
 KIRGHIZ A. H. KEANE, editor of "Early Tentative, Italian, and French Masters."
 KIWI ALFRED NEWTON, F.R.S., Professor of Zoology, University of Cambridge.
 KNIGHTHOOD F. DRUMMOND.
 KNOX Rev. CHARLES G. M'CHIE.
 KURDISTAN Sir H. C. RAWLINSON, K.C.D., F.R.S.
 LABOUR AND LABOUR LAWS J. E. DAVIS.
 LABRADOR Rev. M. HARVEY, St John's, Newfoundland.
 LACE A. S. COLE, South Kensington Museum, London.
 LADAK COURTNEY TROTTER, F.R.G.S.
 LA FAYETTE Hon. JOHN BIGLOW, New York.
 LA FONTAINE GEO. SAINTSBURY, M.A., late Postmaster, Merion College, Oxford.
 LAGRANGE Miss A. M. CLARK.
 LAHORE Gen. MACLAGAN, R.E.
 LAKE J. Y. BUCHANAN, F.R.S.E., late of the "Challenger" Expedition.
 LAKE DWELLINGS J. ANDERSON, LL.D., Curator, Scottish Antiquarian Society.
 LAMAIK T. W. RYAN DAVIDS, LL.D., author of "Buddhism."
 LAMARCK JOHN CRELAND, M.D., Professor of Anatomy, University of Glasgow.
 LAMARTINE GEO. SAINTSBURY.
 LAMBERT F. W. CORNISH, M.A., Eton College.
 LAMENTATIONS Rev. W. E. SMITH, LL.D.
 LAMP JAMES PATON AND A. S. MURRAY, British Museum.
 LANCASTER, HOUSE OF J. GAIRDNER, author of "History of Richard III."
 LAND
- LANDLORD AND TENANT EDWARD ROBERTSON, M.A., Professor of Roman Law, University College, London.
 LANDOR A. O. SWINBURNE.
 LANDSEER F. G. SIFFERTS, author of "Sir Edwin Landseer."
 LANFRANC Rev. J. S. BLACK, M.A.
 LANGLAND Rev. W. W. SKEAT, LL.D., Professor of Anglo-Saxon, University of Cambridge.
 LANGUEDOC WALTER BRASER, M.A.
 LAOCOON A. S. MURRAY, British Museum.
 LAO-TSEZ Rev. JOHN LEIGH, LL.D., Professor of Chinese, University of Oxford.
 LAPIDARY FRANK RUTLEY, Assistant Geologist, Geological Survey of United Kingdom.
 LAPLACE Miss A. M. CLARK.
 LAPLAND H. A. WENTNER.
 LARCH C. PIERPONT JOHNSON, author of "The Useful Plants of Great Britain."
 LARK Professor NEWTON.
 LA SALLE J. GILBERT SHEA.
 LASSALLE THOS. KIRKPATRICK, M.A.
 LATHIE C. P. B. SHENLEY, Professor of Manufacturing Art, King's College, London.
 LATIN LANGUAGE A. S. WILKINS, Professor of Latin, Owens College, Manchester.
 LATIUM E. H. BUCHANAN, author of "History of Ancient Geography."
 LAUREL Rev. GEO. HENSLER, M.A., author of "Floral Dissections."
 LAW Prof. E. ROBERTSON.
 LAW, JOHN FRANCOIS WATT, M.A.
 LAWRENCE, LORD GEO. SMITH, LL.D.
 LEAD W. DITTMAR, F.R.S., Professor of Chemistry, Anderson's College, Glasgow.
 LEATHER JAMES PATON, Curator of the Corporation Galleries of Art, Glasgow.
 LEBANON Prof. A. SOCINI, University of Tubingen, Wurtemberg.
 LEECH W. O. M'INTOSH, M.D., LL.D., F.R.S.
 LEECH, JOHN, J. M. GRAY.
 LEEDS T. W. BRID, editor of the Leeds Mercury.
 LEEUWENHOEK W. B. CARPENTIER, C.B., M.D., F.R.S.
 LEGENDRE J. W. L. GLAISHER, M.A., F.R.S., Trinity College, Cambridge.
 LEGERDEMAIN R. H. PALMER, Lord Almoner's Professor of Arabic, University of Cambridge.
 LEIBNITZ W. R. BOWLEY, M.A., author of "Jewish Christians and Judaism."
 LEIGHTON J. TAYLOR BROWN.

- LEMON. E. M. HOLMES, F.L.S., Curator of Museum, Pharmaceutical Society, London.
- LEMUR. W. H. FLOWER, LL.D., F.R.S., Professor of Comparative Anatomy, Royal College of Surgeons, London.
- LEONARDO. SIDNEY COLVIN, Slade Professor of Fine Arts, University of Cambridge.
- LEOPARDI. RICHARD GARRETT, author of "Idylls and Epigrams."
- LEPROSY. CHARLES CREIGHTON, M.A., M.D.
- LE SAGE. GEORGE SAINTSBURY.
- LESLIE, T. B. CLIFFE J. K. INGRAM, LL.D., Librarian, Trinity College, Dublin.
- LESSING. JAMES SIMS, M.A., author of "Life and Writings of Lessing."
- LEVITES. Rev. W. ROBERTSON SMITH, LL.D.
- LEWES, GEORGE HENRY. JAMES SULLY, author of "Sensation and Intuition."
- LEYDEN, JOHN. Rev. WALTER C. SMITH, D.D., author of "Olig Grange."
- LHASA. Col. HENRY YULE, C.B.
- LIBEL. ALEXANDER GIBSON, M.A., Advocate.
- LIBRARIES. H. R. TEDDER, F.S.A., Librarian, Athenaeum Club, and E. C. THOMAS, B.A., Secretary, Library Association, London.
- LIEBER. Hon. M. RUSSELL TEATON, Philadelphia.
- LIEBIG. A. CUTH BROWN, M.D., F.R.S., Professor of Chemistry, University of Edinburgh.
- LIFEBOAT. R. M. BALLANTYNE, author of "The Lifeboat."
- LIFTS. R. H. SMITH, Professor of Engineering, Mason Science College, Birmingham.
- LIGHT. P. G. TAIT, Professor of Natural Philosophy, University of Edinburgh.
- LIGHTHOUSE. THOS. STEVENSON, C.E., author of "Lighthouse Construction and Illumination."
- LIGHTING, ELECTRIC. JOHN HOPKINSON, C.E., F.R.S.
- LIGUORI. Rev. R. F. LITTLEDALE, LL.D.
- LILLE. GASTON MIESSA, Paris.
- LIMA. E. D. BUTLER, British Museum.
- LINACRE. J. F. PAYNE, M.D., St Thomas's Hospital, London.
- LINCOLN. C. H. COOTE, British Museum.
- LINCOLN, ABRAHAM. Col. J. G. NICOLAY, Supreme Court, Washington.
- LINEN. JAMES PATON.
- LINNÆUS. B. DAYTON JACKSON, Linnæan Society, London.
- LION. Prof. FLOWER.
- LIPARI ISLANDS. G. P. RODWELL, editor of "Dictionary of Science."
- LIPPI. W. M. ROBERTI, author of "Fine Art, Daily Contemporary."
- LIPSUUS. Rev. MARK PATTISON, B.D., Rector of Lincoln College, Oxford.
- LIQUOR LAWS. W. C. SMITH, LL.B., Advocate.
- LISBON. J. Y. JOHNSON, author of "Handbook to Madena."
- LITHIUM. Prof. DITTMAR.
- LITHOGRAPHY. GEO. REID, R.S.A.
- LITHUANIANS. P. A. KROPOVNIK.
- LITTLETON. KENNETH E. DUFFY, M.A., Barrister at Law.
- LITURGY. Rev. F. E. WARREN, B.D., Fellow of St John's College, Oxford.
- LIVERPOOL. Sir J. A. PIERCE, author of "Memorial of Liverpool."
- LIVERWORTS. B. CARRINGTON, M.D., author of "British Hepaticæ."
- LIVINGSTONE. J. S. KILME.
- LIVY. H. F. PHILLIPS, M.A., Classical Lecturer, Trinity College, Oxford.
- LIZARD. ADOLF GUNTHER, M.D., F.R.S., Keeper of the Zoological Department, British Museum.
- LLAMA. Prof. FLOWER.
- LOCK. Sir EDMUND BEAUFORT, Bart., LL.D., Q.C.
- LOCKE. A. C. FRANK, LL.D., Professor of Logic and Metaphysics, University of Edinburgh.
- LOCKHART. Lady BASTARD.
- LOCUST. R. M'LEACHAN, F.R.S.
- LOG. Captain H. A. MORRIS, R.N., C.B.
- LOGARITHMS. J. W. L. GLENN.
- LOGIC. R. ADAMSON, Professor of Logic and Political Economy, Owens College, Manchester.
- LOGOS. Rev. S. D. F. SALMON, D.D., Professor of Systematic Theology, Free Church College, Glasgow.
- LOLLARUS. Rev. T. M. LINDSAY, D.D., Professor of Church History, Free Church College, Glasgow.
- LOMBARD. Very Rev. R. W. CHURCH, D.D., Dean of St Paul's, London.
- LONDON. T. F. HENDERSON and H. B. WHITTAKER, Secretary of the Topographical Society, London.
- LONDONDERRY. MARQUIS OF. HENRY MORF SLEPHUS, Balliol College, Oxford.
- LONGEVITY. J. G. M'KENNEDY, M.D., Professor of the Institutes of Medicine, University of Glasgow.
- LONGFELLOW. THOMAS DAVIDSON, author of the "Philosophical System of Bonanza."
- LONGINUS. W. D. GIBBONS, LL.D., Professor of Greek, University of Aberdeen.

3979